

July 27, 2016

OFF-SITE REMEDIAL INVESTIGATION WORK PLAN

**Queens Plaza Residential Development
Brownfield Cleanup Program
Long Island City, New York
DEC Site Number: C241151A**

Prepared for

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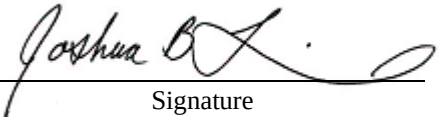
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CERTIFICATION

I, Joshua Levine, certify that I am currently a Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this Remedial Investigation 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).

Joshua B. Levine, P.E.
NYS Professional Engineer #084925

July 27, 2016
Date


Signature

1.0 INTRODUCTION

Roux Associates, Inc. (Roux Associates), on behalf of LIC Operator Co., L.P., (the Respondent), has prepared this revised Off-Site Remedial Investigation Work Plan (RIWP) to investigate the nature and extent of off-Site contamination associated with the Queens Plaza Residential Development Brownfield Cleanup Program (BCP) Site A (BCP No. C241105) and BCP Site B (BCP No. C241151). Collectively, these BCP sites, along with BCP Site C (BCP No. C241169), comprise the Site (BCP Site). This RIWP has been prepared per the requirements outlined in Administrative Consent Order (ACO) (DEC Site No. C241151A, Queens Plaza Off-Site A and B) No. 002-20150406-218A and the NYSDEC comment letter dated March 28, 2016.

The BCP Site is located in Long Island City, Queens County, New York. The BCP Site is bound by Jackson Avenue to the north, Orchard Street to the west, the Long Island Railroad Sunnyside Yard A (LIRR) to the south, and Queens Boulevard to the east. Figure 1 shows the BCP Site location.

The BCP Site is currently being remediated under the BCP, but historically, the principal activity was chemical manufacturing and storage. The BCP Site formerly consisted of a mix of asphalt-covered open areas and several 1- to 5-story commercial and industrial buildings. The former owner, West Chemical Company, manufactured soaps, disinfectants, floor waxes and other household and industrial cleaners and products. Prior to 1950, West Chemical Company manufactured a disinfectant that required storage of large quantities of a material referred to as creosote and spills of this material represent the most significant contamination of Site soil and groundwater. This material has impacted soils and formed a contaminated zone atop the bedrock and till layers at depth. Chlorinated solvents appear in soils and groundwater at some locations. Petroleum compounds have also impacted soils and groundwater, but to a much lesser extent.

Specifically, this RIWP investigates conditions to the east, north, and west of the BCP Site. An investigation of the LIRR Sunnyside Yard A property located south of BCP Site was submitted under separate cover.

Several investigations have been conducted on the Site since 1988. These investigations focused primarily on the BCP Site; therefore, there is limited data from which to evaluate potential

impacts beyond the BCP Site. Additional environmental data is needed to assess the off-Site impacts and complete an off-Site exposure assessment. Soil borings and monitoring wells will be installed to the east, north, and west of the BCP Site to evaluate the extent of off-Site impacts originating from historical operations at the Site. This RIWP includes an investigation plan that will gather the information necessary to understand off-Site potential health and environmental impacts, identify possible remedial alternatives, and prepare a Feasibility Study, if warranted.

1.1 Project Team Contact Information

Roux Associates' Principal-In-Charge for this off-Site work will be Joshua Levine. Mr. Levine is based at Roux Associates' Islandia, New York headquarters office and can be reached at 631-232-2600. Jeff Wills will be the Project Manager, and will be responsible for day-to-day management of the project, including preparation of work plans, and scoping and directing field activities.

At this time, the following subcontractors have been selected for this project:

- Drilling: Aquifer Drilling and Testing, Inc., Mineola, New York
- Analytical: Alpha Analytical, Westborough, Massachusetts

Other subcontracted services have not yet been selected. This information will be provided to NYSDEC following contractor selection.

2.0 SITE DESCRIPTION AND BACKGROUND

2.1 BCP Site Location

The BCP Site, which is currently undergoing remediation and development, was formerly identified on the New York City Tax Map as Block 264, Lots 1, 1R, 14, 17 and Block 263, Lots 1, 9 in Long Island City, Queens County, New York, which has been consolidated as Block 264, Lots 1 and 17 and Block 263, Lot 9. The BCP Site is a 2.7-acre, irregularly shaped parcel that contains three BCP parcels: BCP Site A, BCP Site B, and BCP Site C. Combined, the three sites comprise the Queens Plaza Residential Development. (BCP Site A and BCP Site B comprise the Site with regard to the ACO). Figure 1 shows the BCP Site in relation to the general area.

The Site is located in an area designated as M1-6/R10 within the Long Island City Special Purpose District assigned by the Department of City Planning. The Long Island City Special Purpose District is a particular zoning provision to promote development and transformation of historical industrial/manufacturing areas into mixed use commercial and residential spaces.

2.2 BCP Site History

West Chemical Company occupied the BCP Site from early 1900s until 1977 and manufactured and stored a variety of commercial and household disinfectants, soaps, floor waxes, insecticides, and paper product dispensing machines. Among the materials stored in above-ground tanks was a material referred to as creosote, a flammable material then used as the active ingredient in the manufacture of disinfectants, one of West Chemical's main product lines.

In the 1950s, a fire began on the BCP Site A property. In an effort to contain the blaze, the New York City Fire Department (FDNY) reportedly cut down a tank filled with the aforementioned material. The tank ruptured and the contents ran over the ground and infiltrated the underlying soils. This release is believed to be the principal cause of soil and groundwater impacts and is the most likely source of potential off-Site impacts.

2.3 Vicinity Characteristics and Nearby Public Area of Concern

The properties surrounding the BCP Site are currently primarily used for light manufacturing and/or commercial purposes, with sporadic residential use, and transportation. To the south lies the LIRR Yard. Jackson Avenue is north of the BCP Site. Across Jackson Avenue, to the north,

is a commercial redevelopment, Two Gotham Center. West of the BCP Site are warehouse buildings with light manufacturing and parking lots. East of the BCP Site lies Queens Boulevard and the New York City Transit (NYCT) No. 7 elevated subway line. Across Queens Boulevard is a vacant lot and a commercial property formerly used as a gasoline station. Orchard Street fronts the BCP Site on the west.

A NYCT electrical switching substation occupies the property in the middle of the BCP Site along Jackson Avenue. The area along Jackson Avenue was historically residential buildings with commercial/retail uses on the ground floor until the subway was built in the early 1930s.

The nearest schools are St. Patrick's School, Newcomer's High School, and the Academy of American Studies, which are over 1,800 feet (ft) northwest of the BCP Site. Two churches are approximately 1,000 ft west of the BCP Site and the New York Foundling Hospital lies more than 2,000 ft southwest of the BCP Site. The NYCT subway line No. 7 passes by the BCP Site along the east over Queens Boulevard. An abandoned subway tunnel transects the southwest corner of the intersection of Jackson Avenue and Orchard Street, through the northwest corner of the BCP Site; this structure connects to the active subway tunnel under Jackson Avenue.

2.4 BCP Site Geology, Hydrogeology & Subsurface Characteristics

The BCP Site is on gently sloping land with a surface elevation of approximately +20 ft (North American Vertical Datum 88 [NAVD88]) along Jackson Avenue and +11 ft NAVD88 along the border with LIRR. The generalized subsurface profile consists of fill overlying silty sand and glacial till, with bedrock below the till. A lens of clay sandwiched between till and bedrock exists near the western side of the Site.

Surface soils consist of a fill layer approximately 5 to 9 ft in thickness. This fill is a mixture of fine to medium sand, with some silt and gravel and traces of brick, cinders, concrete, cobbles, and wood. The fill is underlain by silty sand and glacial till deposits followed by a layer of fine sand with intermittent seams of silt and clay. Thicker layers of varied silt and clay are present within this sand unit in some locations. The sand layer varies in thickness from approximately 5 ft beginning at approximately 12 to 20 ft below grade (ft-bg) (approximately -0.4 ft to -9 ft NAVD88) and extending to the top of bedrock, approximately 9 to 25 ft-bg (approximately -

2.37 ft to -12.4 ft NAVD88). Based on soil boring data from previous investigations, bedrock at the Site is gneiss.

Groundwater occurs within the unconsolidated geologic materials covering the BCP Site. The upper surface is marked by the groundwater table, which fluctuates seasonally in response to precipitation. Depth to the groundwater table ranges from 2 to 14 ft-bg but is typically 6 to 11 ft-bg over most of the BCP Site. The groundwater table elevation ranges from approximately 7.6 ft to 11.6 ft NAVD88 over most of the BCP Site. A northeast-oriented groundwater divide occupies a large portion of the BCP Site. Groundwater north of the divide generally flows to the northwest while groundwater south of the divide generally flows to the southeast.

There are no surface water bodies on the BCP Site or on the surrounding properties. The closest surface water body is the Dutch Kill arising from Newtown Creek, located approximately 1,600 ft south of the Site, and the East River approximately 4,200 ft to the west.

2.5 Previous Investigations

Ten previous environmental site investigations beginning in 1988 consisted of varying levels of soil and groundwater investigation, non-aqueous phase liquid (NAPL) product level studies, and collection of soil gas data on and outside BCP Site A and BCP Site B. Most investigations focused on evaluating on-Site conditions. The sampling event by SCS Engineers in April 2013 collected soil and groundwater data in off-Site locations however; the data collected from this sampling event will only be used as a screening tool and not in the decision making process. Previous investigations and sampling events included the following:

- *Queens Plaza Site B Investigation*, AKRF, 1988
- *Outlet City Soil and Groundwater Sampling Results*, AKRF, 1990
- *Outlet City Property, Supplemental Site B Assessment/Remedial Investigation*, AKRF, 1998
- *Soil and Groundwater Sampling and Analysis*, ELM, 2001
- *Site Investigation*, AKRF, 2002
- *Additional Remedial Investigation Report (Draft)*, Fleming-Lee Shue, Inc., February 2007 (and updated draft revision February 2010)

- *Lot 14 Remedial Investigation Report*, NYCOER, Fleming-Lee Shue, Inc., August 2007
- Fleming-Lee Shue, Inc., *Draft Queens Plaza Residential Site B Remedial Investigation Report*, June 2015
- *Tax Lot 14 Remedial Investigation Report*, Fleming-Lee Shue, Inc. and Roux Associates Inc., November 2015.
- *Orchard Street Sidewalk Off-Site Soil Sampling Results*, Roux Associates, Inc. March and June 2016.

2.5.1 BCP Site Soil Contamination

The ten previous investigations found that BCP Site soil contamination originated predominantly from spills of a material referred to as creosote and to a lesser extent from petroleum-based spills. The sources of these spills are primarily on BCP Site A. This material impacted both shallow soils in the form of a smear zone and the deeper soils in the form of residual Dense Non-Aqueous Phase Liquid (DNAPL)-saturated zone. The material migrated through soil and over the bedrock surface to where it entered the basement of former Building 4. The material covered the former Building 4 floor and some portion of the basement walls. The heaviest BCP Site impacts were on the southern portion of BCP Site A and the western portion of BCP Site B, near the spill caused by the NYFD tank rupture and where manufacturing/chemical processing and storage predominated. Impacts to the east of the former West Street were much less than those near the spill source on BCP Site A, although some creosote-related compounds, chlorinated volatile organic compounds (CVOs), and petroleum impacts were found.

2.5.2 Off-Site Soil Contamination

The concentrations of key compounds¹ beyond the BCP Site—on Orchard Street, Jackson Avenue, and Queens Boulevard are summarized in the following sections. These data are primarily from the SCS Engineers (SCS) April 2013 sampling event as well as sampling events in Tax Lot 14 conducted by Fleming-Lee Shue (FLS) and Roux Associates. SCS installed a number of monitoring wells and collected soil and groundwater samples on Orchard Street and across Jackson Avenue in April 2013. Tables 1 through 4 present the 2013 off-Site sampling results.

¹ Key compounds are those with the highest concentrations, compounds typical of the principal contaminants, and/or most frequently found.

In Addition, Roux Associates collected a total of four soil samples from off-Site capture/bedrock wells RC-14/CW-5 and CW-3A, on the eastern side of Orchard Street sidewalk, on March 25, 2016 and June 11, 2016, respectively. RC-14/CW-5 and CW-3A soils were continuously screened via a PID and were advanced 24 feet and 34 feet, respectively, into bedrock. Tables 5 through 10 present the 2016 off-Site soil sampling results. Soil boring logs for RC-14/CW-5 and CW-3A as well as all other soil borings completed to date on Orchard Street, are provided in Appendix C.

Volatile Organic Compounds

SCS collected 12 soil samples from three borings installed along Orchard Street and Jackson Avenue. Two soil borings were advanced along the west side of Orchard Street and one across Jackson Avenue, near the corner of Jackson Avenue and 42nd Road. The soil borings were advanced to near the top of bedrock.

Benzene, toluene, ethylbenzene, total xylenes, tetrachloroethylene, and trichloroethene concentrations ranged from non-detect to 77 micrograms per kilogram ($\mu\text{g}/\text{kg}$). Half of the results for these compounds were less than 0.2 $\mu\text{g}/\text{kg}$ and most of these were below detection limits. No VOCs were detected in any of the soil samples at concentrations exceeding the Part 375 Unrestricted Use Soil Cleanup Objectives (UUSCOs).

The March/June 2016 results indicated eight VOCs, including 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 1,4-dichlorobenzene, acetone, ethylbenzene, naphthalene, toluene and xylenes (total), were detected in soil above UUSCOs at concentrations ranging from 110 $\mu\text{g}/\text{kg}$ to 1,800,000 $\mu\text{g}/\text{kg}$ but below Part 375 Restricted Residential Use Soil Cleanup Objective (RRSCO) with the exception of 1,2,4-trimethylbenzene and naphthalene.

Semivolatile Organic Compounds

Analytical results for the three borings and 12 soil samples indicate low levels of SVOCs. Results for naphthalene, 2-methylnaphthalene, 4-methylphenol, benzo(a)pyrene, acenaphthene, fluoranthene, pyrene, and phenol ranged from non-detect to 8,900 $\mu\text{g}/\text{kg}$. At least 50 percent of the results for all compounds were below detection levels. Of the compounds listed, only the result for benzo(a)pyrene was above its RRSCO in one sample.

The March/June 2016 results indicated seven SVOCs, including acenaphthene, benzo(a)anthracene, chrysene, dibenzofuran, fluorene, indeno(1,2,3-cd)pyrene and naphthalene, were detected above UUSCOs at concentrations ranging from 660 µg/kg to 510,000 µg/kg but below RRSCOs with the exception of benzo(a)anthracene, indeno(1,2,3-cd)pyrene and naphthalene.

Metals

The March/June 2016 results indicated metals and PCBs were not detected in soil above UUSCOs.

Pesticides

The March/June 2016 results indicated two pesticides, including 4,4'-DDD and 4,4'-DDT, were detected in soil above UUSCOs but below RRSCOs at concentrations ranging from 3.49 µg/kg to 8.06 µg/kg.

2.5.3 Off-Site Groundwater Contamination

SCS collected seven groundwater samples from new and existing wells on Orchard Street and Jackson Avenue. SCS installed a well on the corner of 42nd Road and Jackson Avenue with a 30-foot-long well screen. No product was detected in any of the off-Site wells.

Volatile Organic Compounds

Benzene, toluene, ethylbenzene total xylenes, tetrachloroethylene, trichloroethene concentrations ranged from non-detect to 2,100 micrograms per liter (µg/L). A number of the groundwater samples had elevated dilutions. A comparison of these compounds by well, in µg/L, shows moderately elevated concentrations of VOCs off-Site, but there are some locations that are notable for non-detect results. The greatest concentrations of VOCs were detected in wells located west of the BCP Site A along Orchard Street.

Semivolatile Organic Compounds

SVOC results demonstrated elevated naphthalene concentrations in most of the wells along Orchard Street and Jackson Avenue. Other compounds associated with creosote (2-methylnaphthalene, phenol, and phenol-derived compounds) appear in some of the wells but

not all, possibly indicating that contamination from the BCP Site may not have migrated to all off-Site locations previously sampled by SCS, namely MW-1, MW-4, and OS-5. The greatest concentrations of SVOCs were found in the wells along Orchard Street, such as OS-7D, located west of BCP Site A.

2.5.4 Tax Lot 14 Remedial Investigations

Tax lot 14 is technically considered Off-Site, but it is not the subject of this Off-Site RIWP because it is subject to a different administrative order.. A Remedial Action Work Plan has been approved by NYSDEC for this property under separate cover. Provided below is a summary of the historic Off-Site investigation activities on tax lot 14. A RI was completed on tax lot 14 by Fleming-Lee Shue (FLS) in August 2007. As described in the August 2007 RIR, the RI consisted of nine soil borings and five temporary groundwater sampling points focusing on the upper soils (grade to 10 ft-bg) and groundwater only. A total of 18 soil samples were collected from nine soil borings. At each soil boring location, one soil sample was collected from the 0 to 2 ft below ground interval and a second soil sample was collected from the 4 to 6 ft below ground interval. In addition, one sample was collected from the 8 to 10 ft interval in one soil boring (GP-9).

2007 Soil Results

Based on the analytical results, low level VOCs were detected in the soil samples collected during the 2007 RI. Benzene was detected at concentrations ranging from non-detect to 3 µg/kg; toluene was detected at concentrations ranging from non-detect to 5.9 µg/kg; and ethylbenzene was detected at concentrations ranging from non-detect to 17.6 µg/kg. Total xylenes were detected at concentrations ranging from non-detect to 325 µg/kg. Total xylenes was the only VOC detected at a concentration (325 µg/kg) that slightly exceeded the Part 375 Unrestricted Use SCO (260 µg/kg) but was below the RRSCO (100,000 µg/kg). All other VOCs were below detection limits with the exception of acetone, chloroform, methylene chloride, and methyl tertiary butyl ether (MTBE). Most of these compounds were below detection limits in all but one or two results, depending on the compound. In all instances, the maximum concentration was below their respective RRSCOs.

All detected SVOCs were below the UUSCOs. All SVOCs were below detection limits with the exception of one or two SVOC sample results were above detection limits. These measured very low concentrations, ranging from 15 µg/kg to less than 450 µg/kg.

Four metals (lead, mercury, zinc and chromium) were detected in the soil at concentrations exceeding UUSCOs. Lead was detected at a maximum concentration of 249 milligrams per kilogram [mg/kg], mercury was detected at a maximum concentration of 14.5 mg/kg, zinc was detected at a maximum concentration of 216 mg/kg, and chromium was detected at a maximum concentration of 30 mg/kg. Additionally, mercury was the only metal that was detected at concentrations exceeding the RRSCOs, which was detected in 0- to 2-foot below ground interval. Soil containing detections of mercury above the UUSCOs and RRSCOs was removed in April 2015 during pre-construction Site activities.

Two pesticides, 4,4'-DDE and 4,4'-DDT were detected in shallow soil samples at concentrations exceeding the Unrestricted Use SCOs but below the RRSCOs. 4,4'-DDE was detected at a maximum of 9.2 µg/kg and 4,4'-DDT was detected at a maximum of 60 µg/kg.

2007 Groundwater Results

Groundwater samples collected during the 2007 RI were advanced 5 ft below the groundwater table using temporary direct push sampling points. Groundwater sampling results indicated that most VOCs were detected below the TOGS AWQS with the exception of chloroform and MTBE. Chloroform was detected in sample GP-1 GW at a concentration of 20.4 micrograms per liter (µg/L) (compared to 7 µg/L [TOGS AWQS]). MTBE was detected in sample GP-4 GW at a concentration of 26.7 µg/L (compared to 10 µg/L [TOGS AWQS]).

All SVOC groundwater results were below detection limits with the exception of benzo(a)anthracene, chrysene, di-n-butyl phthalate and bis(2-ethylhexyl)phthalate, which were detected at concentrations above TOGS AWQS as follows:

- benzo(a)anthracene was detected at a concentration of 0.66 µg/L in sample GP-8 GW;
- chrysene was detected at a concentration of 2.2 µg/L in GP-8 GW;
- di-n-butyl phthalate was detected at a maximum concentration of 54.4 µg/L in GP-8 GW; and

- bis(2-ethylhexyl)phthalate was detected at a maximum concentration of 62.8 µg/L in GP-7 GW.

Metals (beryllium, barium, chromium, copper, lead, and mercury) were detected in several groundwater samples at concentrations above the TOGS AWQS. Most of these results likely represent entrained sediment in the sample as opposed to dissolved concentrations. Filtered sample results for these metals were all below detection limits.

PCBs and pesticides were not detected in any of the groundwater samples collected during the 2007 RI.

In October 2014, Tax Lot 14 was investigated under the auspices of the New York City Office of Environmental Remediation (NYCOER) to augment the 2007 investigation and comply with updated NYCOER requirements. The 2014 RI scope of work consisted of the following:

- Installation of two soil borings, and collection of seven soil samples; and
- Collection of three soil vapor samples and one ambient indoor air sample.

Groundwater samples were not collected during the 2014 RI.

2014 Soil Results

In October 2014, Tax Lot 14 was investigated under the auspices of the New York City Office of Environmental Remediation (NYCOER) to augment the 2007 investigation and comply with updated NYCOER requirements. The 2014 RI scope of work consisted of the following:

- Installation of two soil borings, and collection of seven soil samples; and
- Collection of three soil vapor samples and one ambient indoor air sample.

Groundwater samples were not collected during the 2014 RI.

The 2014 RI results indicated that two VOCs, acetone and total xylenes were detected in soil samples at concentrations above UUSCOs but below the RRSCOs. Acetone was detected in sample SB-2 (13-14) at a concentration of 689 µg/kg (compared to 50 µg/kg [UUSCOs]). Total xylenes were detected in sample SB-2 (13-14) at a concentration of 1,730 µg/kg (compared to

260 µg/kg [UUSCOs]). Five SVOCs including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene were detected above UUSCOs and/or RRSCO in the shallow soil sample (0-2 ft) in SB-2 at a concentration of 1,460 µg/kg, 1,171 µg/kg, 2,010 µg/kg, 1,174 µg/kg, and 1,230 µg/kg, respectively. Naphthalene was detected in soil sample SB-2 (13-14 ft) above UUSCO (12,000 µg/kg) at a concentration of 14,300 µg/kg, which was below the RRSCO (100,000 µg/kg).

4,4'-DDT was detected in one soil sample (SB-2 [13-14]) exceeded UUSCO (3.3 µg/kg) at a concentration of 6.8 µg/kg, which was below the RRSCO (7,900 µg/kg).

Four metals (lead, mercury, chromium, and nickel) were detected in four of the seven soil samples collected during the 2014 RI at concentrations exceeding UUSCO. Lead was detected at a maximum concentration of 434 mg/kg (compared to 63 mg/kg [UUSCO]); mercury was detected at a maximum concentration of 9 mg/kg (compared to 0.18 mg/kg [UUSCO]); chromium was detected at a maximum concentration of 36.3 mg/kg (compared to 1 mg/kg [UUSCO]); and nickel was detected at a maximum concentration of 32.7 mg/kg (compared to 30 mg/kg [UUSCO]). In addition, lead also exceeded the RRSCO in sample SB-2 (0 to 2 ft.) and mercury exceeded the RRSCO in samples SB-1 (5-6) and SB-2 (0-2). No PCBs were detected in any of the soil samples collected during the 2014 RI.

The three soil vapor samples collected during the 2014 RI were compared to the compounds listed in Table 3.1, *Air Guideline Values*, in the NYSDOH Final Guidance for Evaluating Soil Vapor Intrusion dated October 2006. PCE exceeded the guidance value of 30 micrograms per cubic meter (µg/m³) for one sample, SV-2, (53 µg/m³ and 28 µg/m³ in the duplicate, yielding an average of 41 µg/m³). TCE slightly exceeded the guidance value of 5 µg/m³ in one sample, SV-1, (8.1 µg/m³). All methylene chloride soil vapor results were below the NYSDOH guidance value. VOC concentrations were all below the NYSDOH guidance values in the corresponding indoor air sample.

Several petroleum-related compounds were detected at elevated concentrations in the soil vapor samples. The maximum concentration of petroleum-related compounds, benzene, toluene, ethylbenzene, and xylenes (BTEX), was 11,890 µg/m³. Hexane was detected at a maximum

concentration of 9,830 $\mu\text{g}/\text{m}^3$. Chlorinated VOCs including 1,1-dichloroethane, cis, 1,2-dichloroethane and 1,1,1-trichloroethane were also detected in the soil vapor samples. The compound 1,1-dichloroethane was detected at a maximum concentration of 3,680 $\mu\text{g}/\text{m}^3$; cis1,2-dichloroethane was detected at a maximum concentration of 3,060 $\mu\text{g}/\text{m}^3$; and 1,1,1-trichloroethane was detected at a maximum concentration of 29,700 $\mu\text{g}/\text{m}^3$.

During this investigation stained soil was observed in a boring on the south side of Tax Lot 14 and the spill was registered with the NYSDEC Spill Hotline. NYSDEC issued a spill number (14-06913) but the spill was closed on April 13, 2015 when the analytical data found the contaminant concentrations below the NYSDEC CP-51 Petroleum Spill Soil Cleanup Criteria. Other than some minor soil removal in the upper two ft along the extreme southern side of the Site, no other remedial work was required and the Site received a “Notice to Proceed” from NYCOER on December 18, 2014.

On June 29, 2015, FLS and Roux Associates witnessed product migrating from the Site’s southern wall onto BCP Site A, during remediation of the adjacent BCP Site A. On July 2, 2015, the Respondent met with NYSDEC and was informed that Tax Lot 14 would be subject to the AOC pertaining to off-Site issues. NYSDEC subsequently decided that Tax Lot 14 would be addressed under a separate order.

FLS and Roux Associates, on behalf of LIC Operator Co., L.P., completed a remedial investigation at the Tax Lot 14 property in August 2015, which included the following scope of work:

1. Installation of five soil borings to bedrock across Tax Lot 14 property and collection of 21 soil samples for chemical analysis to evaluate soil quality and estimate contaminant mass and migration potential for Non-Aqueous Phase Liquid (NAPL). Eight of the 21 soil samples were also analyzed for bulk density;
2. Installation of two groundwater monitoring wells and collection of two groundwater samples;
3. Collection of a product sample for density and fingerprint analysis from the NAPL observed migrating from Tax Lot 14 onto the adjacent BCP Site A; and
4. Collection of a soil sample for fingerprint analysis.

2015 Environmental Findings

1. Bedrock was encountered from 13 ft-bg to 37 ft-bg and became deeper moving from south to north. The shallowest depths were along the extreme southern end of the property. Bedrock elevations range from approximately (-0.5) ft relative to NAVD88 along the southern end of the Tax Lot 14 to (-25.75 ft) relative to NAVD88 at the northern portion of Tax Lot 14. The surface elevation is approximately +10 to +12 ft relative to NAVD88.
2. Tax Lot subsurface stratigraphy consists of approximately seven ft of surface fill underlain by brown and grey fine sand and silt. The deeper sandy stratum is a compact glacial till that lies above bedrock.
3. Free-phase product was not observed in the soil samples collected or in the two monitoring wells (MW-5 and MW-6), although a sheen developed on the groundwater surface in the monitoring wells after installation. Heavily stained soils, primarily near the soil-bedrock contact, were observed at two of the five borings (SB-5 and SB-6) located along the extreme southern edge of the property.
4. The soil sampling results found few compounds above the RRSCOs. Compounds with concentrations above the RRSCOs included benzene, 1,2-dichloroethane, naphthalene, dibenzofuran, and acenaphthene, of which naphthalene was the predominant compound exceeding the RRSCOs. The compounds detected above the RRSCOs were detected in only three borings (SB-4, SB-5 and SB-6), predominately near the soil-bedrock contact. Numerous compounds were detected at concentrations above the Protection of Groundwater Soil Cleanup Objectives (PGWSCOs), which were predominantly detected in soils from nine ft-bg to the soil-bedrock contact.
5. Groundwater sample results collected from the two monitoring wells (MW-5 and MW-6) exceeded the Technical and Operation Guidance Series (TOGS) Ambient Water Quality Standards (AWQS) for many VOCs and SVOCs, and some pesticides.

The RI did not include soil vapor sampling; however two soil vapor samples (and one duplicate sample) were collected during the RI overseen by NYCOER in October 2014. Based on the analytical results, benzene was detected at concentrations ranging from 45 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) to $4,060 \mu\text{g}/\text{m}^3$; methylene chloride was detected at concentrations ranging from non-detect to $13 \mu\text{g}/\text{m}^3$; tetrachloroethene (PCE) was detected at concentrations ranging from $4.9 \mu\text{g}/\text{m}^3$ to $53 \mu\text{g}/\text{m}^3$; and trichloroethene (TCE) was detected at concentrations ranging from non-detect to $8.1 \mu\text{g}/\text{m}^3$. Total soil vapor VOCs concentrations ranged from $1,858 \mu\text{g}/\text{m}^3$ to $17,828 \mu\text{g}/\text{m}^3$.

3.0 RI WORK PLAN OBJECTIVES, SCOPE, AND RATIONALE

This section provides a description of the RI objectives, scope of work and rationale.

3.1 Objectives and Rationale to Develop Remedial Investigation Work Plan

This RIWP has been prepared to evaluate the nature and extent of soil, groundwater and soil vapor contamination, if any, in off-Site areas adjacent to the BCP Site, excluding the LIRR property. Additional RI (i.e., soil, groundwater and/or soil vapor sampling) may be necessary, following the completion of the RI scope described below, to fill in any data gaps and fully delineate the extent of soil, groundwater and soil vapor contamination.

3.2 Off-Site RI Scope

The scope of the RI is designed to collect sufficient sub-surface samples to evaluate off-Site soil, groundwater and soil vapor quality. The proposed scope of work will be as follows:

- Install a total of ten soil borings to bedrock along Orchard Street, 42nd Road, and Queens Boulevard sidewalks and collect soil samples to assess soil quality;
- Install eight groundwater monitoring wells at eight of the aforementioned soil boring locations and collect groundwater samples to assess groundwater quality; and
- Install three soil vapor monitoring points to assess soil vapor quality.

The proposed sampling locations are shown on Figure 2.

3.2.1 Soil Characterization

Ten soil borings will be installed at locations along Orchard Street, 42nd Road and Queens Boulevard sidewalks. The proposed soil boring locations are shown on Figure 2. Actual locations may vary based on field conditions (i.e., access constraints, subsurface obstructions, and/or utilities). All soil boring locations will be cleared to a minimum of five ft-bg using hand tools and/or vacuum excavator to identify any potential subsurface utilities.

Following utility clearance activities, soil boring will be advanced at each proposed location to bedrock using the Sonic drilling method. At each location, continuous soil sampling will be completed to bedrock; the depth to the top of bedrock ranges between approximately 25 ft-bg to 75 ft-bg. The soil from each soil boring will be visually inspected and screened for organic

vapors with a photoionization detector (PID). Soil lithology will be recorded according to the Unified Soils Classification System (USCS).

Soil samples will be obtained using the sonic drill rig with 3-inch-diameter, 5-foot-long core barrels. All in-ground sampling equipment will be decontaminated between each sample collection.

In general, a minimum of three soil samples per boring will be collected. Soil samples will be collected from the smallest interval possible, based on field observations, at the following locations:

- One sample will be collected from at the water table;
- One sample will be collected from immediately above the bedrock surface; and
- Additional samples will be collected from the interval(s) exhibiting the highest level of contamination, based on PID readings, visual observations of contamination (i.e., stained soils, odor, free product, etc.), and the field geologist's judgment.

Soil samples will not be homogenized prior to bottling. Soil samples will be collected for VOC analysis by obtaining 3, 5-gram aliquots of soil per each sample location using EnCore™ samplers. One 60-mL volume of soil will also be collected for each VOC sample for percent solids analysis.

Each soil sample will be properly labeled (e.g., name of boring and sample interval), sealed and placed in a chilled cooler for shipment to Alpha Analytical of Westborough, Massachusetts, which is a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program-certified laboratory, under chain of custody procedures. All soil samples will be analyzed for the full Target Compound List (TCL) volatile organic compounds (VOCs) via United States Environmental Protection Agency (USEPA) Method 8260; TCL semi-volatile organic compounds (SVOCs) via USEPA Method 8270; TCL pesticides via USEPA Method 8081; Total Analyte List (TAL) metals via USEPA Method 6010; and Total Petroleum Hydrocarbon (TPH) Gasoline Range Organics (GRO) and TPH Diesel Range Organics (DRO) via USEPA Method 8015. Samples will be analyzed on a standard turnaround time and will be

reported as Category B data deliverables, which will be used to generate a data usability summary report (DUSR).

Excess soil cuttings generated during soil boring activities will be characterized and containerized in 55 gallon DOT-approved drums, labeled, and stored in a designated on-Site storage location pending laboratory results and proper off-Site disposal.

Soil samples have been collected from excavations conducted on Orchard Street/sidewalk and Queens Boulevard for off-Site sewer/water line and electrical utility installation work and bedrock coring investigation on Orchard Street sidewalk. The locations of the Orchard Street/sidewalk and Queens Boulevard utility work soil samples are shown on Figure 2. All field findings and soil data results of the off-Site utility work soil sampling will be included in the RI Report as discussed in Section 6.0 of this RIWP.

In addition, proposed groundwater monitoring well cluster, MW-B11/MW-B11D, is proposed to be installed on Jackson Avenue sidewalk, north of BCP Site B, as part of the BCP Site B groundwater monitoring network. During MW-B11/MW-B11D installation, the soil will be screened and sampled in accordance with the procedures described above, if installed. All field findings and soil data results of the off-Site utility work soil sampling will be included in the RI Report as discussed in Section 6.0 of this RIWP.

3.2.2 Groundwater Investigation

At least eight soil borings will be converted into groundwater monitoring wells (monitoring wells). At each proposed monitoring well location, a 10-foot long, 2-inch diameter, 20-slot polyvinyl chloride (PVC) well screen will be installed immediately above bedrock. If shallow contamination is encountered in the saturated zone (i.e., greater than 10 above the top of bedrock) during soil sampling/screening activities, Roux Associates will contact the NYSDEC prior to installation of any shallow groundwater monitoring well. Placement of the well screen will be such that it will best enable comparison with groundwater originating from the BCP Site, in order to evaluate the potential for impacts originating from the BCP Site. The well screen interval will correspond to at least one soil sample.

A sand filter pack consisting of #1 Morie Sand or equivalent will be placed into the annular space between the well screen and the borehole and up to a minimum of 2 ft above the top of the well screen. A minimum 2-foot-thick bentonite seal will be installed above the sand pack and hydrated with potable water. The bentonite pellets will be given time to hydrate before filling the remainder of the well annulus with Portland cement grout using the tremie method. All monitoring wells will be completed with a flush-mounted manhole protective curb box installed at grade.

Following monitoring well installation, each well will be developed to ensure proper hydraulic connection with the aquifer and to reduce/eliminate turbidity. The wells will be developed using a submersible pump, which will be surged periodically until well yield is consistent.

All new monitoring wells will be surveyed by a New York State Licensed Surveyor for position and measuring point elevations to enable groundwater flow contouring. The top of casing elevations and ground surface elevations will be surveyed in NAVD88.

To characterize groundwater flow and quality conditions following well installation and development, the new monitoring wells will be gauged and sampled. As part of the gauging round, water-level measurements will be recorded from the newly installed wells to define groundwater flow patterns.

Following the groundwater gauging event and waiting one week after well developments, a groundwater sampling event will be completed. In addition, the capture wells for BCP Site A and B, and MW-B11/MW-B11D, if installed, will be sampled to aid in the assessment of off-Site groundwater impacts along Orchard Street and Jackson Avenue. To ensure groundwater samples collected are representative of the conditions in the surrounding aquifer, monitoring wells and capture wells will be purged prior to sample collection using low flow procedures as outlined in USEPA document titled “Low Stress (Low Flow) Purging and Sampling Procedures for the Collection of Groundwater Samples From Monitoring Wells” (USEPA, 2010). A groundwater sample will be collected from each well once the field parameters have stabilized (i.e., <10% variation for three consecutive readings).

Each sample will be properly labeled (e.g., well designation, sample data) sealed, and placed in a chilled cooler for shipment to Alpha Analytical under chain of custody procedures. All groundwater samples will be analyzed for the TCL VOCs via USEPA Method 8260; TCL SVOCs via USEPA Method 8270; TCL pesticides via USEPA Method 8081; TAL metals via USEPA Method 6010; and TPH GRO and TPH DRO via USEPA Method 8015. Samples will be analyzed on a standard turnaround time and will be reported as Category B data deliverables, which will be used to generate a DUSR. Additionally, if free-phase product is observed in any of the groundwater monitoring wells, a product sample(s) will be collected for petroleum fingerprint/forensic analysis.

Excess soil cutting and groundwater generated during well installation activities (including development and purging prior to sample collection) will be containerized in 55 gallon NYSDOT-approved drums, labeled, and stored on-Site pending laboratory results and proper off-Site disposal.

3.2.3 Soil Vapor Investigation

Three soil vapors samples will be collected to determine the nature and extent of off-Site contamination as well to perform a feasibility study. The soil vapor sample locations are shown on Figure 2. Soil vapor samples will be collected from permanent soil vapor sample points installed five ft-bg per NYSDOH requirements (*Soil Vapor Intrusion Guidance*, October 2006). At each sample location, a 0.5-inch-diameter, stainless steel sampling screen attached to Teflon-lined poly tubing will be installed at the sampling interval (i.e., five ft-bg). Coarse sand will be added to the annular space between the sampling screen and the borehole, up to 6-inches above the top of the screen; creating a 1-foot sample interval (i.e., 4-5 ft-bg). The remainder of the borehole annulus will be backfilled with Portland cement grout. The surface will be completed with a flush-mounted manhole protective curb box installed at grade.

Vapor samples will be collected in accordance with the NYSDOH *Soil Vapor Intrusion Guidance*. Vapor samples will be collected following a 24-hour equilibration period after installation, using laboratory certified 1- liter SUMMA canisters using the following procedural steps:

1. A clay seal will be placed around the sampling tubing in an effort to further minimize the infiltration of the atmospheric air present at land surface directly above the sampling point (ambient air).
2. The sampling tubing will be connected to a “T” connector three-way valve assembly, with one end of the “T” connector leading to a vacuum pump and the other end leading to a pre-evacuated summa canister with a calibrated flow controller.
3. The soil vapor sample tubing and surrounding sand pack will be purged of approximately three volumes of air using a vacuum pump set at a rate of approximately 0.2 liters per minute.
4. A tracer gas (e.g., helium) will be used to enrich the atmosphere in the immediate vicinity of the sampling location where the sampling tubing intersected the ground surface in order to test the borehole seal and verify that ambient air was not inadvertently being drawn into the sample. A plastic container (i.e., bucket), with a soft seal, will be placed over the monitoring point and the helium will be injected into the bucket during purging of the monitoring point in an effort to enrich the interior of the bucket with the tracer gas. Note that the 3-way valve used to connect the sample tubing to the equipment will also be placed under the shroud (i.e., the bucket enclosure) and included in the tracer gas verification. This will be done in an effort to ensure that the valve does not provide a means by which ambient air would enter the canister and possibly dilute the sample. Both the purge volume from the sample tubing (i.e., also the air that passed through the 3-way valve), and the helium enriched area within the bucket will be screened for the tracer gas. The gas will be measured with a MGD-2002 helium detector (by Dielectric) or equivalent, which measures the rate of helium leakage at the surface. If the screening results show that the rate of helium detected from the sampling tubing is greater than 10% of the helium detected in the enriched area (i.e., within the bucket), the seals around the sampling equipment will be reset and the sampling tubing will be purged again until the tracer gas is no longer detected at levels greater than 10% of the enriched area.
5. Following the purging and tracer gas verification steps, the valve leading to the pump will be closed, the pump turned off, and the soil vapor directed to a 1-liter summa canister for sample collection. A laboratory-supplied, calibrated flow controller set for a ½-hour sample period will be used at each location, to restrict the sample collection rate to 0.2 liters per minute or less.

All soil vapor samples will be submitted to Alpha Analytical under chain-of-custody procedures and analyzed for VOCs using USEPA Method TO-15. Samples will be analyzed on a standard turnaround time and will be reported as Category B data deliverables, which will be used to

generate a DUSR. The data collected will be used to complete a qualitative exposure assessment.

3.2.3.1 NYCT Substation Soil Vapor Intrusion Investigation

A soil vapor intrusion investigation within the New York City Transportation (NYCT) Jackson Avenue West Street Substation (Substation) may be necessary pending NYCT occupancy. Requests were made by Roux Associates to NYCT on May 11 and May 17, 2016 for occupancy information, and no response has been received from NYCT. Per the NYSDEC's off-site RIWP comment letter dated March 28, 2016, communication is ongoing to identify:

Days per week/month the Substation is occupied by NYCT personnel; and

The hours per day NYCT personnel are in the Substation, when the Substation is occupied.

Roux Associates' understanding is that the NYCT Jackson Avenue West Street Substation is not continuously occupied by NYCT personnel, but formal confirmation has not yet been received and outreach is ongoing.

3.3 Qualitative Exposure Assessment

A qualitative exposure assessment (EA) will be performed following the collection of RI data. The EA will be performed in accordance with Section 3.3(c)4 of DER-10 and the NYSDOH guidance for performing a qualitative EA (NYSDEC DER-10; Technical Guidance for Site Investigation and Remediation; Appendix 3B). The results of the qualitative EA will be provided in the RI report.

4.0 QUALITY ASSURANCE PROJECT PLAN

The following procedures will be used to ensure that samples are collected and handled in accordance with NYCDEC protocols.

Laboratory Testing

A New York State Environmental Laboratory Accreditation Program (ELAP)-certified laboratory will be used for all laboratory analysis. The laboratory will operate a Quality Assurance/Quality Control (QA/QC) program that will consist of proper laboratory practices (including the required chain-of-custody), an internal quality control program, and external quality control audits by New York State. The laboratory will be Alpha Analytical of Westborough, Massachusetts. Alpha Analytical is an ELAP-certified laboratory.

Laboratory Methods and Holding Times

Table 11 summarizes the laboratory methods, sample preservatives, minimum volume required and holding time that will be used to analyze the soil, groundwater and soil vapor samples.

Field Quality Assurance/Quality Control

Field duplicate samples will be collected for soil, groundwater and soil vapor samples at a rate of one duplicate sample per 20 field samples.

Field blank samples will be collected for soil and groundwater samples at a rate of one field blank sample per 20 field samples.

Trip blank samples will be collected at a rate of one trip blank per cooler with groundwater samples for VOCs.

Field Decontamination Procedures.

Refer to Appendix B.

Chain of Custody

To ensure the integrity of samples collected, a strict chain of custody record must be maintained on each sample. This begins after sampling with the entry in the sampler's field log book of the sampling details:

- Date and time of sampling
- Sample location (as specific as possible)
- The unique sample number, size, and containers used
- Sample description
- Weather conditions (if applicable)
- Any additional comments

In addition, a record must be kept of the sample's progress from the sample site to the laboratory where it will be analyzed. The chain-of-custody form must include:

- The sample number
- The sampler's name
- Date and time of sampling
- Location at which the sample was taken, including the address, if possible
- A description of the sample, as best known
- Signatures of people involved in the chain of possession
- Inclusive dates of possession of each person in the chain

The chain-of-custody form must accompany the sample throughout its trip to the laboratory. If the samples must be shipped to a laboratory, most shipping agents will refuse to sign or separately carry the chain-of-custody form. In this one case, it is permissible to put the chain-of-custody form into the cooler with the sample and then seal the box. The recipient of the cooler, the laboratory's sample custodian, can then attest to the cooler's arrival still sealed and unopened. Accompanying the chain-of-custody record, or included in it, must be a request to the laboratory for sample analysis. Information required includes:

- Name of person receiving the sample
- Laboratory sample number
- Date of sample receipt

- Sample allocation
- Analysis to be performed

Finally, on arrival at the laboratory, the sample custodian must enter the sample in the laboratory's sample log book. The chain-of-custody should be kept on file at the laboratory.

Data Usability Summary Report

All soil, groundwater, and soil vapor analytical results will undergo a third party review and will be validated in accordance with NYSDEC Division of Environmental Remediation DER-10, Technical Guidance for Site Investigation and Remediation Appendix 2B – *Guidance for Data Deliverables and Development of Data Usability Summary Reports* (DUSR). The analytical results will be evaluated to determine whether the data meet NYSDEC data quality requirements. A third party, as defined in DER-10, will evaluate the data and prepare the DUSRs.

5.0 HEALTH AND SAFETY

An Off-Site specific Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP) have been prepared for the Site and are provided in Appendix B. Decontamination plans and details can be found in Section 12.0 of the HASP (Appendix B).

The Property Owner and associated parties preparing the remedial documents submitted to the State, and parties performing this work are responsible for the safe performance of all invasive work, and for the integrity and safety of structures that may be affected by the intrusive activities (such as utilities, sidewalks).

6.0 REPORTING AND SCHEDULE

Following the completion of RI activities, including additional RI activities, if warranted, a RI Report will be prepared and will include a description of the procedures followed and the results, including data summary tables and maps showing the extent of impacts to soil and groundwater as well as soil boring and monitoring well construction logs. The RI Report will include all data developed during all RI activities, including off-Site utility excavation soil sampling, and will meet the technical requirements of NYSDEC DER-10; Technical Guidance for Site Investigation and Remediation. All RI analyses will be performed in accordance with the NYSDEC Analytical Services Protocol (ASP), using USEPA SW 846 methods. The laboratory selected to analyze the field samples collected during the RI shall maintain a NYSDOH ELAP certification for each of the analyses listed in Section 3.0.

All laboratory data are to be reported in NYSDEC ASP Category B deliverables and will be delivered to NYSDEC in electronic data deliverable (EDD) format as described on NYSDEC's website (<http://www.dec.ny.gov/chemical/62440.html>). A DUSR will be prepared meeting the requirements in Section 2.2(a)1.ii and Appendix 2B of DER-10 for all data packages generated for the RI.

Hazardous wastes and other contaminated media, if any, generated during RI will be stored, transported, and disposed in full compliance with applicable local, state, and federal regulations. A table of the construction details for monitoring wells that have been built on-Site will be submitted. This will include date of construction, geologic interval screened, and current status (e.g., available for sampling, destroyed, intact, needs development, etc.).

Copies of the transport manifests of hazardous and nonhazardous investigative waste will be provided to the NYSDEC Project Manager.

Feasibility Study

A Feasibility Study will be prepared that develops and evaluates potential remediation options based on the results of the RI and additional RI, if warranted. The Feasibility Study will be prepared in accordance with all applicable rules and regulations including DER-10 and 6 NYCRR Part 375. The Feasibility Study will include a summary of the nature and extent of

contamination, site specific remedial goals and objectives, a comprehensive evaluation of each alternative and a final recommendation. Development of remedial alternatives will include the identification and screening of applicable technologies. Each alternative will be evaluated with respect to the following criteria:

- Overall protectiveness of public health and environment
- Standards, criteria, and guidance
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume of contamination
- Short-term impacts and effectiveness
- Implementability
- Cost effectiveness
- Land use
- Community acceptance

The estimated schedule for the RI is provided below.

SCHEDULE	
Reports/Work Plans	Date
Remedial Investigation Work Plan Submittal	July 2016
NYSDEC Review/Approval of Remedial Investigation Work Plan	August 2016
Submit Drilling Plans to MTA for Approval	August 2016
Remedial Investigation Field Work	September 2016
Remedial Investigation Report and Feasibility Study Submittal to NYSDEC	November 2016

Off-Site Remedial Investigation Work Plan
Queens Plaza Residential Development
Long Island City, New York

TABLES

1. Summary of Key Volatile Organic Compounds in Soil (2013)
2. Summary of Key Semivolatile Organic Compounds in Soil (2013)
3. Summary of Volatile Organic Compounds in Off-Site Groundwater (2013)
4. Summary of Semivolatile Organic Compounds in Off-Site Groundwater (2013)
5. Summary of Volatile Organic Compounds in Soil (2016)
6. Summary of Semivolatile Organic Compounds in Soil (2016)
7. Summary of Metals in Soil (2016)
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9. Summary of Pesticides in Soil (2016)
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11. Analytical Methods and Holding Times

**Table 1. Summary of Key Volatile Organic Compounds in Soil (SCS Engineers)
Queens Plaza Residential Development, Off-Site BCP Site B, C241151**

Compound	Unrestricted SCOs	Restricted Residential	NDs	Min	p50	p90	Max
	(µg/kg)	SCOs (µg/kg)					
Benzene	60	4,800	21/26	0.11	0.44	53	53
Toluene	700	100,000	16/26	0.11	0.7	101	133
Ethylbenzene	1,000	41,000	18/26	0.13	3.85	163	163
Xylene Total	260	100,000	19/26	0.58	23	667	667
BTEX	--	--	15/26	0.12	8	220	963
Methylene Chloride	50	100,000	26-Sep	0.11	0.47	8.9	49
PCE	1,300	19,000	23/26	0.1	0.59	0.64	0.64
TCE	470	19,000	24/26	0.1	0.27	0.44	0.44
Total VOCs	100,000	100,000	26-Feb	0.65	20.91	3,003	20,756*

SCOs - 6 NYCRR Part 375 Environmental Remediation Program Soil Cleanup Objectives for Unrestricted Use (Table 375-6.8 [a]) and Restricted Residential Use (Table 375-6.8 [b]).

µg/kg - Micrograms per kilogram

BTEX - benzene, toluene, ethylbenzene and xylene (total)

NDs - Number of non-detects among samples (non-detects / no. of samples), min (minimum), p50 (median) (50 percent of results), p90 (90 percent of results), max (maximum). Statistics based on detected results only.

* The total SVOC maximum concentration was altered from the SCS Engineers 2013 data. The result excludes values below detection limits (the minimum detection limit is omitted from the total).

**Table 2. Summary of Key Semivolatile Organic Compounds in Soil (SCS Engineers)
Queens Plaza Residential Development, Off-Site BCP Site B, C241151**

Compound	Unrestricted	Restricted Residential	NDs	Min	p50	p90	Max
	SCOs	SCOs					
Naphthalene	12,000	100,000	14/24	79	360	18,266	27,000
2-Methylnaphthalene	--	--	15/24	60	240	46,000	46,000
Benzo(a)pyrene	1,000	1,000	21/24	370	789	3,800	3,800
Benz(a)anthracene	1,000	1,000	19/24	44	390	4,100	4,100
Acenaphthene	20,000	100,000	16/24	42	1,296	10,000	10,000
Dibenzofuran	7,000	59,000	16/24	60	1,307	11,000	11,000
Fluorene	30,000	100,000	16/24	60	1,755	7,200	7,200
2,4-Dimethylphenol	--	--	17/24	120	340	5,911	5,911
2-Methylphenol	330	100,000	21/24	588	824	989	989
4-Methylphenol	330	100,000	18/24	95	1,146	3,708	3,708
Phenol	330	100,000	21/24	410	603	744	744
4-Nitrophenol	--	--	23/24	320	320	320	320
SVOC Total	--	--	24-Jun	0.5	1,729	56,070	113,460*

SCOs - 6 NYCRR Part 375 Environmental Remediation Program Soil Cleanup Objectives for Unrestricted Use (Table 375-6.8 [a]) and Restricted Residential Use (Table 375-6.8 [b]).

NDs - Number of non-detects among samples (non-detects / no. of samples), min (minimum), p50 (median), p90 (90 percent of results), max (maximum). Statistics based on detected results only.

* - The total VOC maximum concentration was altered from the SCS Engineers 2013 data. The result excludes values below detection limits (the minimum detection limit is omitted from the total).

**Table 3. Summary of Volatile Organic Compounds in Off-Site Groundwater (SCS Engineers)
Queens Plaza Residential Development, Off-Site BCP Site B, C241151**

Sample ID	Location	Benzene (µg/L)	Toluene (µg/L)	Ethylbenzene (µg/L)	Total Xylenes (µg/L)	BTEX (µg/L)	1,1-DCA (µg/L)	1,2-DCA (µg/L)	PCE (µg/L)	TCE (µg/L)	MeCl ₂ (µg/L)	Total VOC (µg/L)
MW-1	Jackson Ave. & 42 nd Rd.	230	1,800	340	1,580	3,950	20	300	12	39	ND	5,840
MW-2	Orchard St. & Jackson Ave.	240	160	86	199	685	6.7	54	0.35	ND	58	872
MW-4	Jackson Ave.	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MW-6	Orchard St.	1,200	710	180	580	2,670	38	280	ND	0.88	390	3,602
OS-5	Orchard St.	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
OS-7D	Orchard St.	1,000	2,100	260	1,090	4,450	4.3	140	ND	ND	1,300	7,168*
NYSDEC TOGS 1.1.1 Criterion:		1	5	5	5	--	5	0.6	5	5	5	--

ND - Not detected

NYSDEC TOGS 1.1.1 - New York State Department of Environmental Conservation- Division of Water Technical and Operational Guidance Series (1.1.1)

Ambient Water Quality Standards and Guidance Values, Groundwater Effluent Limitations

* - The total VOC maximum concentration was altered from the SCS Engineers 2013 data. The result excludes values below detection limits (the minimum detection limit is omitted from the total).

µg/L - Micrograms per liter

**Table 4. Summary of Semivolatile Organic Compounds in Off-Site Groundwater (SCS Engineers)
Queens Plaza Residential Development, Off-Site BCP Site B, C241151**

Sample	Location	2-											SVOC Total*
		Naphthalene (µg/L)	Methylnaphthalene (µg/L)	Benzo(a)pyrene (µg/L)	Benzo(a)anthracene (µg/L)	Acenaphthene (µg/L)	Dibenzofuran (µg/L)	Flourene (µg/L)	Phenol (µg/L)	2-Methylphenol (µg/L)	4-Methylphenol (µg/L)	2,4-Dimethylphenol (µg/L)	
MW-1	Jackson Ave. & 42 nd Rd.	3,700	ND	ND	ND	ND	ND	4.6	ND	ND	ND	ND	3,706
MW-2	Orchard St. & Jackson Ave.	620	180	ND	ND	37	21	ND	ND	93	ND	1,200	2,151
MW-4	Jackson Ave.	3,400	ND	ND	ND	ND	ND	ND	160	ND	ND	ND	3,560
MW-6	Orchard St.	3,400	720	ND	ND	99	ND	ND	160	860	ND	7,800	13,039
OS-5	Orchard St.	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
OS-7D	Orchard St.	3,700	660	ND	ND	ND	ND	ND	ND	3,700	11,000	22,000	41,060
NYSDEC TOGS 1.1.1 (µg/L):		10	--	ND	--	20	--	50	1	1	1	1	--

ND – Not detected

NYSDEC TOGS 1.1.1– New York State Department of Environmental Conservation- Division of Water Technical and Operational Guidance Series (1.1.1)

Ambient Water Quality Standards and Guidance Values, Groundwater Effluent Limitations

* The total SVOC maximum concentration was altered from the SCS Engineers 2013 data. The result excludes values below detection limits (the minimum detection limit is omitted from the total).

µg/L - Micrograms per liter

Table 5. Summary of Volatile Organic Compounds in Soil, Queens Plaza Residential Development - OFFSITE, Long Island City, New York

Parameter (Concentrations in µg/kg)	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Sample Designation: Sample Date: Sample Depth (ft bls):	CW-3A 6/11/2016 17 - 18	CW-3A 6/11/2016 22 - 23	RC-14 3/25/2016 7.5 - 8.5	RC-14 3/25/2016 12 - 13
1,1,1,2-Tetrachloroethane	--	--	--		51 U	4600 UD	520 UD	140 UD
1,1,1-Trichloroethane	680	100000	680		51 U	4600 UD	520 UD	140 UD
1,1,2,2-Tetrachloroethane	--	--	--		51 U	4600 UD	520 UD	140 UD
1,1,2-Trichloroethane	--	--	--		76 U	7000 UD	780 UD	200 UD
1,1-Dichloroethane	270	26000	270		76 U	7000 UD	780 UD	200 UD
1,1-Dichloroethene	330	100000	330		51 U	4600 UD	520 UD	140 UD
1,1-Dichloropropene	--	--	--		250 U	23000 UD	2600 UD	680 UD
1,2,3-Trichlorobenzene	--	--	--		250 U	23000 UD	2600 UD	680 UD
1,2,3-Trichloropropane	--	--	--		510 U	46000 UD	5200 UD	1400 UD
1,2,4,5-Tetramethylbenzene	--	--	--		100 J	15000 JD	9400 D	260 JD
1,2,4-Trichlorobenzene	--	--	--		250 U	23000 UD	2600 UD	680 UD
1,2,4-Trimethylbenzene	3600	52000	3600		240 J	67000 D	39000 D	940 D
1,2-Dibromoethane	--	--	--		200 U	18000 UD	2100 UD	540 UD
1,2-Dichlorobenzene	1100	100000	1100		250 U	23000 UD	2600 UD	680 UD
1,2-Dichloroethane	20	3100	20		51 U	4600 UD	520 UD	140 UD
1,2-Dichloroethene (total)	--	--	--		51 U	4600 UD	520 UD	140 UD
1,2-Dichloropropane	--	--	--		180 U	16000 UD	1800 UD	470 UD
1,3,5-Trimethylbenzene	8400	52000	8400		87 J	24000 D	11000 D	300 JD
1,3-Dichlorobenzene	2400	49000	2400		250 U	23000 UD	2600 UD	680 UD
1,3-Dichloropropane	--	--	--		250 U	23000 UD	2600 UD	680 UD
1,3-Dichloropropene	--	--	--		51 U	4600 UD	520 UD	140 UD
1,4-Dichlorobenzene	1800	13000	1800		250 U	3400 JD	2600 UD	680 UD
1,4-Diethylbenzene	--	--	--		200 U	18000 UD	23000 D	540 D
1,4-Dioxane	100	13000	100		5100 U	460000 UD	52000 UD	14000 UD
2,2-Dichloropropane	--	--	--		250 U	23000 UD	2600 UD	680 UD
2-Butanone (MEK)	120	100000	120		510 U	46000 UD	5200 UD	1400 UD
2-Hexanone	--	--	--		510 U	46000 UD	5200 UD	1400 UD
4-Ethyltoluene	--	--	--		150 J	41000 D	20000 D	590 D
4-Methyl-2-pentanone (MIBK)	--	--	--		510 U	46000 UD	5200 UD	1400 UD
Acetone	50	100000	50		110 J	6400 JD	5200 UD	1400 UD
Acrylonitrile	--	--	--		510 U	46000 UD	5200 UD	1400 UD
Benzene	60	4800	60		51 U	4600 UD	520 UD	140 UD

Table 5. Summary of Volatile Organic Compounds in Soil, Queens Plaza Residential Development - OFFSITE, Long Island City, New York

Parameter (Concentrations in µg/kg)	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Sample Designation: Sample Date: Sample Depth (ft bls):	CW-3A 6/11/2016 17 - 18	CW-3A 6/11/2016 22 - 23	RC-14 3/25/2016 7.5 - 8.5	RC-14 3/25/2016 12 - 13
Bromobenzene	--	--	--		250 U	23000 UD	2600 UD	680 UD
Bromochloromethane	--	--	--		250 U	23000 UD	2600 UD	680 UD
Bromodichloromethane	--	--	--		51 U	4600 UD	520 UD	140 UD
Bromoform	--	--	--		200 U	18000 UD	2100 UD	540 UD
Bromomethane	--	--	--		100 U	9300 UD	1000 UD	270 UD
Carbon disulfide	--	--	--		86 J	15000 JD	5200 UD	1400 UD
Carbon tetrachloride	760	2400	760		51 U	4600 UD	520 UD	140 UD
Chlorobenzene	1100	100000	1100		51 U	4600 UD	520 UD	140 UD
Chloroethane	--	--	--		100 U	9300 UD	1000 UD	270 UD
Chloroform	370	49000	370		76 U	7000 UD	780 UD	200 UD
Chloromethane	--	--	--		250 U	23000 UD	2600 UD	680 UD
cis-1,2-Dichloroethene	250	100000	250		51 U	4600 UD	520 UD	140 UD
cis-1,3-Dichloropropene	--	--	--		51 U	4600 UD	520 UD	140 UD
Cyclohexane	--	--	--		1000 U	93000 UD	10000 UD	2700 UD
Dibromochloromethane	--	--	--		51 U	4600 UD	520 UD	140 UD
Dibromochloropropane	--	--	--		250 U	23000 UD	2600 UD	680 UD
Dibromomethane	--	--	--		510 U	46000 UD	5200 UD	1400 UD
Dichlorodifluoromethane	--	--	--		510 U	46000 UD	5200 UD	1400 UD
Diethyl Ether	--	--	--		250 U	23000 UD	2600 UD	680 UD
Ethylbenzene	1000	41000	1000		24 J	21000 D	4300 D	140 D
Freon 113	--	--	--		1000 U	93000 UD	10000 UD	2700 UD
Hexachlorobutadiene	--	--	--		250 U	23000 UD	2600 UD	680 UD
Isopropylbenzene	--	--	--		17 J	4100 JD	2800 D	85 JD
m+p-Xylene	--	--	--		43 J	56000 D	7700 D	260 JD
Methyl acetate	--	--	--		1000 U	93000 UD	10000 UD	2700 UD
Methylcyclohexane	--	--	--		200 U	18000 UD	130 JD	540 UD
Methylene chloride	50	100000	50		510 U	46000 UD	5200 UD	1400 UD
MTBE	930	100000	930		100 U	9300 UD	1000 UD	270 UD
Naphthalene	12000	100000	12000		6000	1800000 D	880000 D	30000 D
n-Butylbenzene	12000	100000	12000		11 J	1500 JD	1600 D	44 JD
n-Propylbenzene	3900	100000	3900		15 J	3100 JD	1700 D	49 JD
o-Chlorotoluene	--	--	--		250 U	23000 UD	2600 UD	680 UD

Table 5. Summary of Volatile Organic Compounds in Soil, Queens Plaza Residential Development - OFFSITE, Long Island City, New York

Parameter (Concentrations in µg/kg)	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Sample Designation: Sample Date: Sample Depth (ft bls):	CW-3A 6/11/2016 17 - 18	CW-3A 6/11/2016 22 - 23	RC-14 3/25/2016 7.5 - 8.5	RC-14 3/25/2016 12 - 13
o-Xylene	--	--	--		24 J	26000 D	4600 D	130 JD
p-Chlorotoluene	--	--	--		250 U	23000 UD	2600 UD	680 UD
p-Isopropyltoluene	--	--	--		210	29000 D	25000 D	560 D
sec-Butylbenzene	11000	100000	11000		51 U	4600 UD	620 D	140 UD
Styrene	--	--	--		100 U	8800 JD	1000 UD	270 UD
tert-Butylbenzene	5900	100000	5900		250 U	23000 UD	2600 UD	680 UD
Tetrachloroethene	1300	19000	1300		51 U	4600 UD	520 UD	140 UD
Toluene	700	100000	700		76 U	7500 D	140 JD	200 UD
trans-1,2-Dichloroethene	190	100000	190		76 U	7000 UD	780 UD	200 UD
trans-1,3-Dichloropropene	--	--	--		51 U	4600 UD	520 UD	140 UD
trans-1,4-Dichloro-2-butene	--	--	--		250 U	23000 UD	2600 UD	680 UD
Trichloroethene	470	21000	470		51 U	4600 UD	520 UD	140 UD
Trichlorofluoromethane	--	--	--		250 U	23000 UD	2600 UD	680 UD
Vinyl acetate	--	--	--		510 U	46000 UD	5200 UD	1400 UD
Vinyl chloride	20	900	20		100 U	9300 UD	1000 UD	270 UD
Xylenes (total)	260	100000	1600		67 J	82000 D	12000 D	390 JD

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

NA - Compound was not analyzed by laboratory

D - A secondary analysis after dilution due to exceedance
of the calibration range in the original sample

µg/kg - Micrograms per kilogram

ft bls - Feet below land surface

NYSDEC - New York State Department of Environmental Conservation

SCO - Soil Cleanup Objectives

-- No SCO available

Bold data indicates that parameter was detected above the NYSDEC Part 375 Unrestricted Use SCO

Shaded data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO

Boxed data indicates that parameter was detected above the NYSDEC Part 375 Protection of Groundwater SCO

Table 6. Summary of Semivolatile Organic Compounds in Soil, Queens Plaza Residential Development - OFFSITE, Long Island City, New York

Parameter (Concentrations in µg/kg)	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Sample Designation: Sample Date: Sample Depth (ft bls):	CW-3A 6/11/2016 17 - 18	CW-3A 6/11/2016 22 - 23	RC-14 3/25/2016 7.5 - 8.5	RC-14 3/25/2016 12 - 13
1,1'-Biphenyl	--	--	--		420	44000 D	48000 D	1800
1,2,4,5-Tetrachlorobenzene	--	--	--		180 U	9100 UD	1800 UD	180 U
1,2,4-Trichlorobenzene	--	--	--		180 U	9100 UD	1800 UD	180 U
2,3,4,6-Tetrachlorophenol	--	--	--		180 U	9100 UD	1800 UD	180 U
2,4,5-Trichlorophenol	--	--	--		180 U	9100 UD	1800 UD	180 U
2,4,6-Trichlorophenol	--	--	--		110 U	5400 UD	1100 UD	110 U
2,4-Dichlorophenol	--	--	--		160 U	8200 UD	1700 UD	170 U
2,4-Dimethylphenol	--	--	--		180 U	9100 UD	1800 UD	180 U
2,4-Dinitrophenol	--	--	--		870 U	44000 UD	8900 UD	880 U
2,4-Dinitrotoluene	--	--	--		180 U	9100 UD	1800 UD	180 U
2,6-Dinitrotoluene	--	--	--		180 U	9100 UD	1800 UD	180 U
2-Chloronaphthalene	--	--	--		180 U	9100 UD	1800 UD	180 U
2-Chlorophenol	--	--	--		180 U	9100 UD	1800 UD	180 U
2-Methylnaphthalene	--	--	--		2700	270000 D	420000 D	13000 D
2-Methylphenol	330	100000	330		180 U	9100 UD	1800 UD	180 U
2-Nitroaniline	--	--	--		180 U	9100 UD	1800 UD	180 U
2-Nitrophenol	--	--	--		390 U	20000 UD	4000 UD	400 U
3&4-Methylphenol	330	100000	330		260 U	13000 UD	2700 UD	260 U
3,3'-Dichlorobenzidine	--	--	--		180 U	9100 UD	1800 UD	180 U
3-Nitroaniline	--	--	--		180 U	9100 UD	1800 UD	180 U
4,6-Dinitro-2-methylphenol	--	--	--		470 U	24000 UD	4800 UD	480 U
4-Bromophenyl phenyl ether	--	--	--		180 U	9100 UD	1800 UD	180 U
4-Chloro-3-methylphenol	--	--	--		180 U	9100 UD	1800 UD	180 U
4-Chloroaniline	--	--	--		180 U	9100 UD	1800 UD	180 U
4-Chlorophenyl phenyl ether	--	--	--		180 U	9100 UD	1800 UD	180 U
4-Nitroaniline	--	--	--		180 U	9100 UD	1800 UD	180 U
4-Nitrophenol	--	--	--		250 U	13000 UD	2600 UD	260 U
Acenaphthene	20000	100000	98000		570	46000 D	66000 D	2700
Acenaphthylene	100000	100000	107000		140 U	1500 JD	1500 UD	110 J
Acetophenone	--	--	--		180 U	9100 UD	1800 UD	68 J
Anthracene	100000	100000	1000000		110 U	4900 JD	17000 D	710

Table 6. Summary of Semivolatile Organic Compounds in Soil, Queens Plaza Residential Development - OFFSITE, Long Island City, New York

Parameter (Concentrations in µg/kg)	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Sample Designation: Sample Date: Sample Depth (ft bls):	CW-3A 6/11/2016 17 - 18	CW-3A 6/11/2016 22 - 23	RC-14 3/25/2016 7.5 - 8.5	RC-14 3/25/2016 12 - 13
Atrazine	--	--	--		140 U	7200 UD	1500 UD	150 U
Benzaldehyde	--	--	--		240 U	12000 UD	2400 UD	240 U
Benzo[a]anthracene	1000	1000	1000		110 U	5400 UD	1500 D	75 J
Benzo[a]pyrene	1000	1000	22000		140 U	7200 UD	800 JD	150 U
Benzo[b]fluoranthene	1000	1000	1700		110 U	5400 UD	640 JD	40 J
Benzo[g,h,i]perylene	100000	100000	1000000		140 U	7200 UD	1500 UD	150 U
Benzo[k]fluoranthene	800	3900	1700		110 U	5400 UD	1100 UD	110 U
Benzoic Acid	--	--	--		590 U	29000 UD	6000 UD	600 U
Benzyl Alcohol	--	--	--		180 U	9100 UD	1800 UD	180 U
Bis(2-chloroethoxy)methane	--	--	--		200 U	9800 UD	2000 UD	200 U
Bis(2-chloroethyl) ether	--	--	--		160 U	8200 UD	1700 UD	170 U
bis(2-Chloroisopropyl)ether	--	--	--		220 U	11000 UD	2200 UD	220 U
Bis(2-ethylhexyl) phthalate	--	--	--		180 U	4800 JD	1800 UD	180 U
Butylbenzyl phthalate	--	--	--		180 U	9100 UD	1800 UD	180 U
Caprolactam	--	--	--		180 U	9100 UD	1800 UD	180 U
Carbazole	--	--	--		24 J	1200 JD	2400 D	870
Chrysene	1000	3900	1000		110 U	5400 UD	1200 D	72 J
Dibenzo[a,h]anthracene	330	330	1000000		110 U	5400 UD	1100 UD	110 U
Dibenzofuran	7000	59000	210000		520	41000 D	55000 D	2400
Diethyl phthalate	--	--	--		180 U	9100 UD	1800 UD	180 U
Dimethyl phthalate	--	--	--		180 U	9100 UD	1800 UD	180 U
Di-n-butyl phthalate	--	--	--		180 U	9100 UD	1800 UD	180 U
Di-n-octyl phthalate	--	--	--		180 U	9100 UD	1800 UD	180 U
Fluoranthene	100000	100000	1000000		110 U	3000 JD	12000 D	510
Fluorene	30000	100000	386000		300	24000 D	48000 D	2200
Hexachlorobenzene	330	1200	3200		110 U	5400 UD	1100 UD	110 U
Hexachlorobutadiene	--	--	--		180 U	9100 UD	1800 UD	180 U
Hexachlorocyclopentadiene	--	--	--		520 U	26000 UD	5300 UD	530 U
Hexachloroethane	--	--	--		140 U	7200 UD	1500 UD	150 U
Indeno[1,2,3-cd]pyrene	500	500	8200		140 U	7200 UD	660 JD	150 U
Isophorone	--	--	--		160 U	8200 UD	1700 UD	170 U

Table 6. Summary of Semivolatile Organic Compounds in Soil, Queens Plaza Residential Development - OFFSITE, Long Island City, New York

Parameter (Concentrations in µg/kg)	NYSDEC	NYSDEC	NYSDEC	Sample Designation: Sample Date: Sample Depth (ft bls):	CW-3A	CW-3A	RC-14	RC-14
	Part 375	Part 375	Part 375		6/11/2016	6/11/2016	3/25/2016	3/25/2016
	Unrestricted	Restricted	Protection of					
	Use SCO	Residential SCO	Groundwater SCO					
Naphthalene	12000	100000	12000		2400	320000 D	510000 D	20000 D
Nitrobenzene	--	--	--		160 U	8200 UD	1700 UD	170 U
n-Nitrosodi-n-propylamine	--	--	--		180 U	9100 UD	1800 UD	180 U
n-Nitrosodiphenylamine	--	--	--		140 U	7200 UD	1500 UD	150 U
Pentachlorophenol	800	6700	800		140 U	7200 UD	1500 UD	150 U
Phenanthrene	100000	100000	1000000		230	16000 D	51000 D	2200
Phenol	330	100000	330		180 U	9100 UD	1800 UD	180 U
Pyrene	100000	100000	1000000		30 J	2400 JD	8800 D	390

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

NA - Compound was not analyzed by laboratory

D - A secondary analysis after dilution due to exceedance
of the calibration range in the original sample

µg/kg - Micrograms per kilogram

ft bls - Feet below land surface

NYSDEC - New York State Department of Environmental Conservation

SCO - Soil Cleanup Objectives

-- No SCO available

Bold data indicates that parameter was detected above the NYSDEC Part 375 Unrestricted Use SCO

Shaded data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO

Boxed data indicates that parameter was detected above the NYSDEC Part 375 Protection of Groundwater SCO

Table 7. Summary of Metals in Soil, Queens Plaza Residential Development - OFFSITE, Long Island City, New York

Parameter (Concentrations in mg/kg)	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Sample Designation: Sample Date: Sample Depth (ft bls):	CW-3A 6/11/2016 17 - 18	CW-3A 6/11/2016 22 - 23	RC-14 3/25/2016 7.5 - 8.5	RC-14 3/25/2016 12 - 13
Aluminum	--	--	--		2500	5200	7800	5000
Antimony	--	--	--		4.4 U	4.2 U	4.3 U	4.4 U
Arsenic	13	16	16		0.60 J	0.64 J	1.6	1.8
Barium	350	400	820		18	46	40	28
Beryllium	7.2	72	47		0.44 U	0.14 J	0.25 J	0.20 J
Cadmium	2.5	4.3	7.5		0.88 U	0.85 U	0.87 U	0.88 U
Calcium	--	--	--		960	1400	2100	2300
Chromium	30	180	--		9.2	15	20	12
Cobalt	--	--	--		3.3	11	5.6	5.1
Copper	50	270	1720		9.4	24	14	16
Iron	--	--	--		6800	19000	13000	9000
Lead	63	400	450		3.0 J	4.6	2.3 J	2.4 J
Magnesium	--	--	--		1400	2900	2300	1600
Manganese	1600	2000	2000		110	290	230	150
Mercury	0.18	0.81	0.73		0.07 U	0.07 U	0.02 J	0.08 U
Nickel	30	310	130		7.3	18	12	11
Potassium	--	--	--		530	2300	1100	730
Selenium	3.9	180	4		1.8 U	1.7 U	0.43 J	0.27 J
Silver	2	180	8.3		0.88 U	0.85 U	0.87 U	0.88 U
Sodium	--	--	--		170 J	140 J	80 J	160 J
Thallium	--	--	--		1.8 U	1.7 U	1.7 U	1.8 U
Vanadium	--	--	--		9.3	27	24	15
Zinc	109	10000	2480		14	38	24	19

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

NA - Compound was not analyzed by laboratory

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of the calibration range in the original sample

µg/kg - Micrograms per kilogram

ft bls - Feet below land surface

NYSDEC - New York State Department of Environmental Conservation

SCO - Soil Cleanup Objectives

-- No SCO available

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Boxed data indicates that parameter was detected above the NYSDEC Part 375 Protection of Groundwater SCO

Table 8. Summary of Polychlorinated Biphenyls in Soil, Queens Plaza Residential Development - OFFSITE, Long Island City, New York

Parameter (Concentrations in µg/kg)	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Sample Designation: Sample Date: Sample Depth (ft bls):	CW-3A 6/11/2016 17 - 18	CW-3A 6/11/2016 22 - 23
Aroclor-1016	--	--	--		35.1 U	35.7 U
Aroclor-1221	--	--	--		35.1 U	35.7 U
Aroclor-1232	--	--	--		35.1 U	35.7 U
Aroclor-1242	--	--	--		35.1 U	35.7 U
Aroclor-1248	--	--	--		35.1 U	35.7 U
Aroclor-1254	--	--	--		35.1 U	35.7 U
Aroclor-1260	--	--	--		35.1 U	35.7 U
Aroclor-1262	--	--	--		35.1 U	35.7 U
Aroclor-1268	--	--	--		35.1 U	35.7 U
PCBs, Total	100	1000	3200		35.1 U	35.7 U

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

NA - Compound was not analyzed by laboratory

D - A secondary analysis after dilution due to exceedance
of the calibration range in the original sample

µg/kg - Micrograms per kilogram

ft bls - Feet below land surface

NYSDEC - New York State Department of Environmental Conservation

SCO - Soil Cleanup Objectives

-- No SCO available

Bold data indicates that parameter was detected above the NYSDEC Part 375 Unrestricted Use SCO

Shaded data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO

Boxed data indicates that parameter was detected above the NYSDEC Part 375 Protection of Groundwater SCO

Table 9. Summary of Pesticides in Soil, Queens Plaza Residential Development - OFFSITE, Long Island City, New York

Parameter (Concentrations in µg/kg)	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Sample Designation: Sample Date: Sample Depth (ft bls):	CW-3A 6/11/2016 17 - 18	CW-3A 6/11/2016 22 - 23	RC-14 3/25/2016 7.5 - 8.5	RC-14 3/25/2016 12 - 13
4,4'-DDD	3.3	13000	14000		3.49	35.3	1.75 U	1.77 U
4,4'-DDE	3.3	8900	17000		1.71 U	1.66 U	1.75 U	1.77 U
4,4'-DDT	3.3	7900	136000		3.20 U	8.06	6.02	3.32 U
Aldrin	5	97	190		1.71 U	1.66 U	1.75 U	1.77 U
alpha-BHC	20	480	20		0.711 U	0.691 U	0.728 U	0.738 U
alpha-Chlordane	94	4200	2900		0.716 J	5.06	2.18 U	2.21 U
beta-BHC	36	360	90		1.71 U	1.66 U	1.75 U	1.77 U
Chlordane	--	--	--		12.6 JPI	134 P	14.2 U	14.4 U
delta-BHC	40	100000	250		1.71 U	1.66 U	1.75 U	1.77 U
Dieldrin	5	200	100		1.07 U	1.22	1.09 U	1.11 U
Endosulfan I	2400	24000	102000		1.71 U	1.66 U	1.75 U	1.77 U
Endosulfan II	2400	24000	102000		1.71 U	4.06	1.75 U	1.77 U
Endosulfan sulfate	2400	24000	1000000		0.711 U	0.691 U	0.728 U	0.738 U
Endrin aldehyde	--	--	--		2.13 U	2.07 U	2.18 U	2.21 U
Endrin ketone	--	--	--		1.71 U	1.66 U	1.75 U	1.77 U
Endrin	14	11000	60		0.711 U	0.691 U	0.728 U	0.738 U
gamma-BHC (Lindane)	100	1300	100		0.711 U	0.691 U	0.728 U	0.738 U
gamma-Chlordane	--	--	--		0.625 JPI	3.21 PI	2.18 U	2.21 U
Heptachlor epoxide	--	--	--		3.20 U	3.11 U	3.28 U	3.32 U
Heptachlor	42	2100	380		0.854 U	0.829 U	0.873 U	0.885 U
Methoxychlor	--	--	--		3.20 U	3.11 U	3.28 U	3.32 U
Toxaphene	--	--	--		32.0 U	31.1 U	32.8 U	33.2 U

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

NA - Compound was not analyzed by laboratory

D - A secondary analysis after dilution due to exceedance
of the calibration range in the original sample

µg/kg - Micrograms per kilogram

ft bls - Feet below land surface

NYSDEC - New York State Department of Environmental Conservation

SCO - Soil Cleanup Objectives

-- No SCO available

Bold data indicates that parameter was detected above the NYSDEC Part 375 Unrestricted Use SCO

Shaded data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO

Boxed data indicates that parameter was detected above the NYSDEC Part 375 Protection of Groundwater SCO

Table 10. Summary of Petroleum Hydrocarbons in Soil, Queens Plaza Residential Development - OFFSITE, Long Island City, New York

Parameter (Concentrations in µg/kg)	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential SCO	NYSDEC Part 375 Protection of Groundwater SCO	Sample Designation:	CW-3A	CW-3A	RC-14	RC-14
				Sample Date:	6/11/2016	6/11/2016	3/25/2016	3/25/2016
				Sample Depth (ft bls):	17 - 18	22 - 23	7.5 - 8.5	12 - 13
DIESEL RANGE ORGANICS	--	--	--		31000 J	2900000 D	9000000 D	600000 D
GASOLINE RANGE ORGANICS	--	--	--		9000	2300000 D	890000 D	32000 D

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

NA - Compound was not analyzed by laboratory

D - A secondary analysis after dilution due to exceedance
of the calibration range in the original sample

µg/kg - Micrograms per kilogram

ft bls - Feet below land surface

NYSDEC - New York State Department of Environmental Conservation

SCO - Soil Cleanup Objectives

-- No SCO available

Bold data indicates that parameter was detected above the NYSDEC Part 375 Unrestricted Use SCO

Shaded data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO

Boxed data indicates that parameter was detected above the NYSDEC Part 375 Protection of Groundwater SCO

Table 11. Analytical Methods and Holding Times
Offsite Properties, Queens Plaza Residential Development, Long Island City, New York

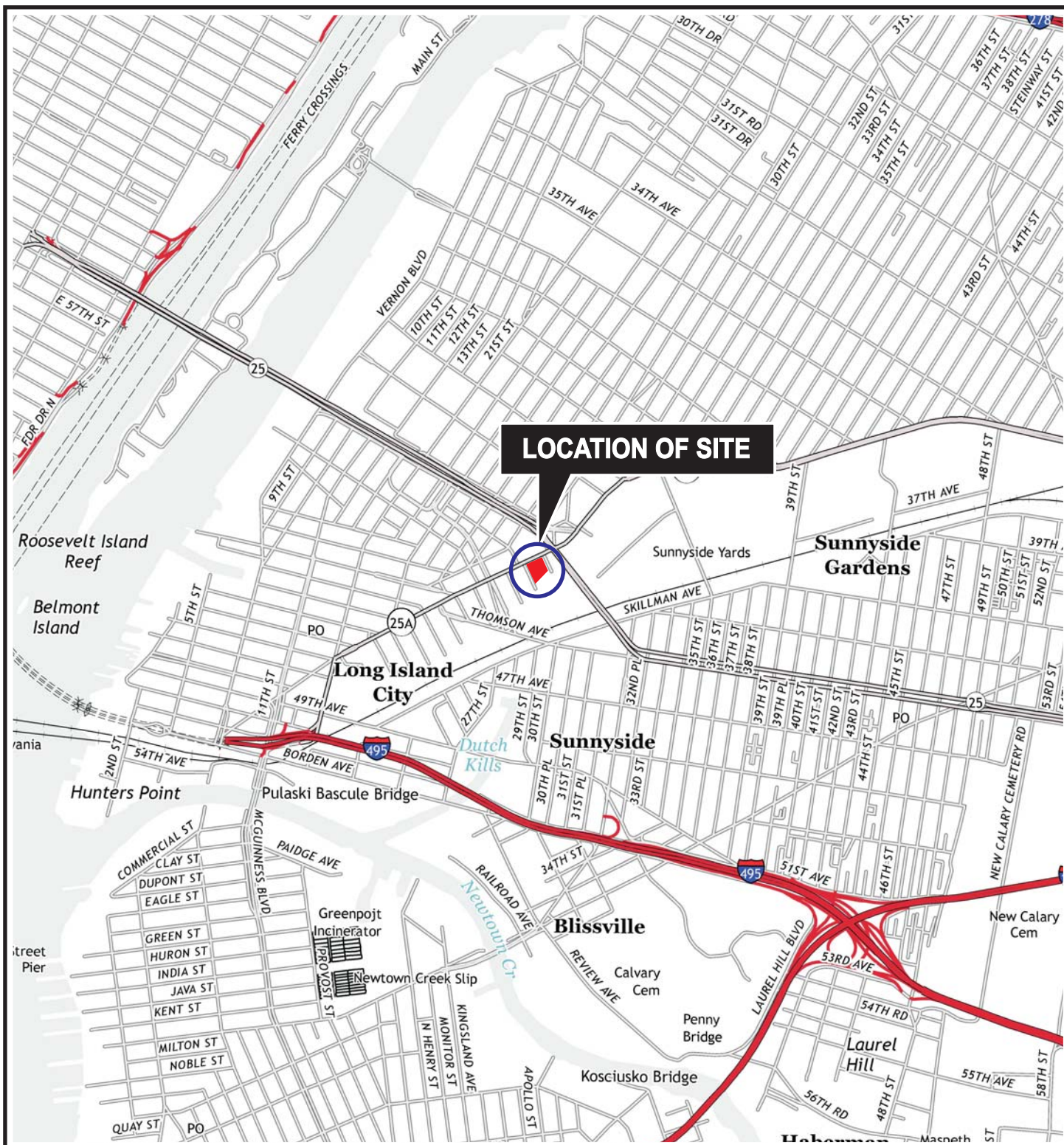
Matrix	Quantity (approx.)	Analysis	Method	Preservative	Volume/Container	Holding Time
Soil	30	TCL VOCs	USEPA 8260	None	3 x Encore	48 Hours for preservation by Method 5035A; 14 Days for Analysis
	30	TCL SVOCs	USEPA 8270	None	1 x 300 mL glass	14 Days Extraction; 40 Days Analysis
	30	TCL Pesticides	USEPA 8081	None	1 x 300 mL glass	14 Days Extraction; 40 Days Analysis
	30	TAL Metals	USEPA 6010 / 7000	None	1 x 300 mL glass	14 Days Extraction; 40 Days Analysis
	30	TCL PCBs	USEPA 8082	None	1 x 300 mL glass	15 Days Extraction; 40 Days Analysis
	30	TPH-GRO	USEPA 8015	None	1 x 150 mL glass	7 Days Extraction; 14 Days Analysis
	30	TPH DRO	USEPA 8015	None	1 x 300 mL glass	7 Days Extraction; 14 Days Analysis
Groundwater	12	TCL VOCs	USEPA 8260	HCl	3 x 40 mL vial	14 Days
	12	TCL SVOCs	USEPA 8270	None	2 x 1000 mL amber	7 Days Extraction; 40 Days Analysis
	12	TCL Pesticides	USEPA 8081	None	2 x 1000 mL amber	7 Days Extraction; 40 Days Analysis
	12	TAL Metals-total	USEPA 6010 / 7000	HNO ₃	500 mL plastic	6 Months
	12	TCL PCBs	USEPA 8082	None	2 x 1000 mL amber	14 days
	12	TPH-GRO	USEPA 8015	pH<2 with HCl; Cool to 40 C	3 x 40 mL vial	14 days
	12	TPH-DRO	USEPA 8015	None	3, 40 mL vial	14 days
Soil Vapor	4	VOCs	USEPA TO-15	None	1 x 1 mL Summa Canister	28 Days

TCL - Target compound list
 VOC - Volatile organic compounds
 SVOC - Semivolatile organic compounds
 TPH - Total petroleum hydrocarbon
 GRO - Gas range organics
 DRO - Diesel range organics
 USEPA - United States Environmental Protection Agency

Off-Site Remedial Investigation Work Plan
Queens Plaza Residential Development
Long Island City, New York

FIGURES

1. Site Location
2. Proposed Off-Site Sample Locations



QUADRANGLE LOCATION



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



0 2000'

FILE:

SITE LOCATION MAP

OFFSITE
QUEENS PLAZA RESIDENTIAL DEVELOPMENT

Prepared for:

LIC OPERATOR CO., L.P.



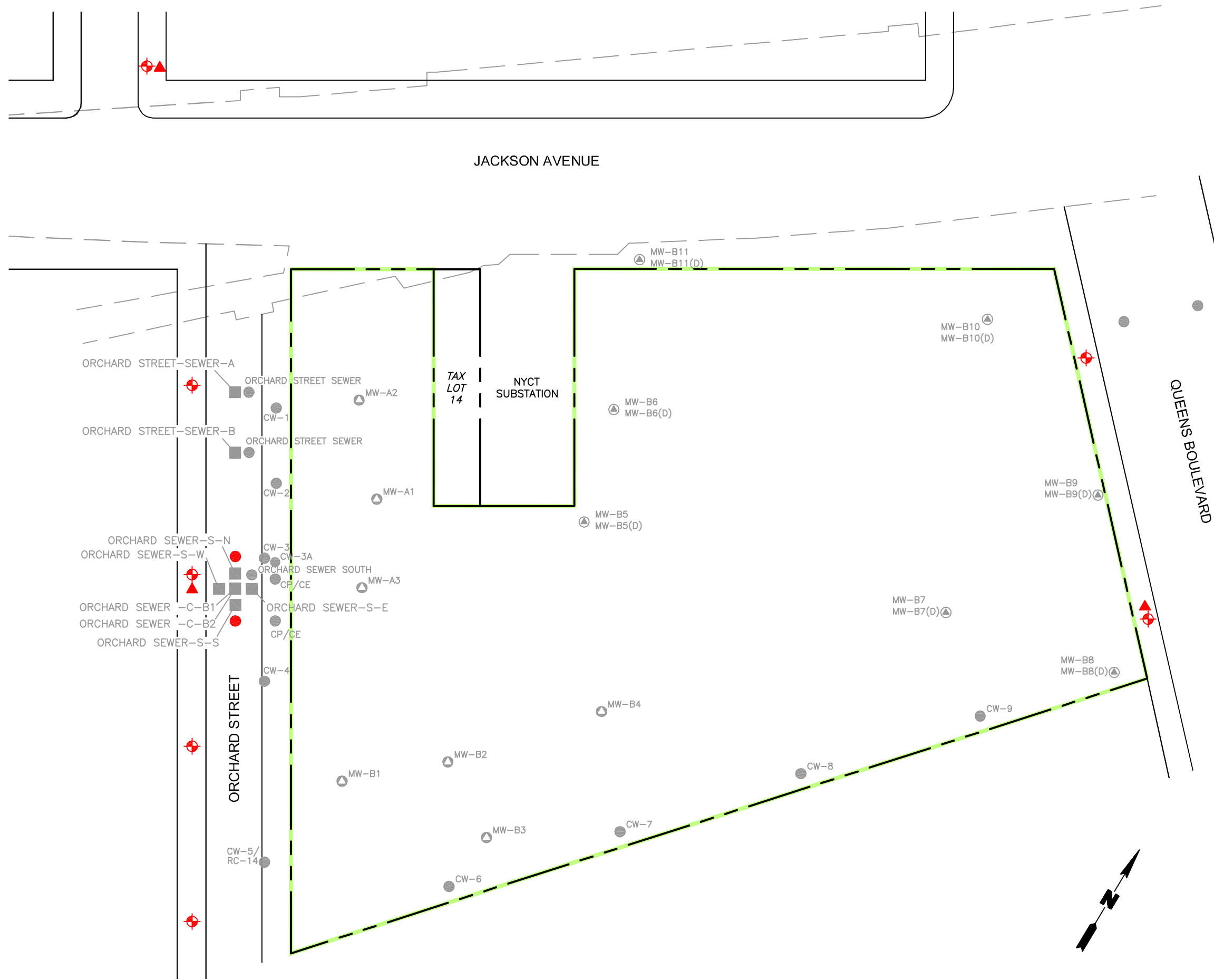
ROUX ASSOCIATES, INC.
Environmental Consulting
& Management

Compiled by: G.N.	Date: 01FEB16
Prepared by: G.M.	Scale: AS SHOWN
Project Mgr.: D.B.	Project No.: 2409.0003Y002
File: 2409.0003Y110.01.CDR	

FIGURE

1

V:\CAD\PROJECTS\2409\0003Y\110\2409.0003Y110.02.DWG

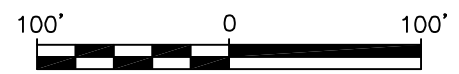


LEGEND

- QUEENS PLAZA RESIDENTIAL DEVELOPMENT (QPRD) BCP BOUNDARY
- NEW YORK CITY TRANSIT SUBWAY LINE BOUNDARY
- BCP BROWNFIELD CLEANUP PROGRAM
- QPRD MONITORING WELL LOCATION AND DESIGNATION
- QPRD NESTED DUAL MONITORING WELL LOCATION AND DESIGNATION
- QPRD CAPTURE WELL LOCATION AND DESIGNATION
- PROPOSED OFFSITE SOIL BORING LOCATION
- PROPOSED OFFSITE SOIL BORING/MONITORING WELL LOCATION
- PROPOSED OFFSITE SOIL VAPOR MONITORING POINT LOCATION
- PRIOR ORCHARD STREET DISCRETE SOIL SAMPLE LOCATION
- PRIOR ORCHARD STREET/SIDEWALK CHARACTERIZATION SOIL SAMPLE LOCATION

SOURCE

FLEMING-LEE SHUE "PROPOSED CAPTURE WELL AND MONITORING WELL LAYOUT", DATED 1/19/2016.



Title:

PROPOSED OFFSITE SAMPLE LOCATIONS

OFFSITE
QUEENS PLAZA RESIDENTIAL DEVELOPMENT

Prepared For:

LIC OPERATOR, CO., L.P.

 ROUX ASSOCIATES, INC. <i>Environmental Consulting & Management</i>	Compiled by: J.W.	Date: 01FEB16	FIGURE 2
	Prepared by: G.M.	Scale: AS SHOWN	
	Project Mgr: J.W.	Project: 2409.0003Y002	
	File: 2409.0003Y110.02.DWG		

Off-Site Remedial Investigation Work Plan
Queens Plaza Residential Development
Long Island City, New York

APPENDICES

- A. Roux Associates' Standard Operating Procedures
- B. Health and Safety Plan
- C. Soil Boring Logs

Off-Site Remedial Investigation Work Plan
Queens Plaza Residential Development
Long Island City, New York

APPENDIX A

Roux Associates'
Standard Operating Procedures

STANDARD OPERATING PROCEDURE 4.4
FOR SAMPLING GROUND-WATER MONITORING
WELLS FOR DISSOLVED CONSTITUENTS

Page 1 of 7

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for the sampling of ground-water monitoring wells for dissolved constituents. As part of the SOP for the sampling of ground-water monitoring wells, sample collection equipment and devices must be considered, and equipment decontamination and pre-sampling procedures (e.g., measuring water levels, sounding wells, and purging wells) must be implemented. Sampling objectives must be firmly established in the work plan before considering the above.

Valid water-chemistry data are integral to a hydrogeologic investigation that characterizes ground-water quality conditions. Water-quality data are used to evaluate both current and historic aquifer chemistry conditions, as well as to estimate future conditions (e.g., trends, migration pathways). Water-quality data can be used to construct ground-water quality maps to illustrate chemical conditions within the flow system, to generate water-quality plots to depict conditions with time and trends, and to perform statistical analyses to quantify data variability, trends, and cleanup levels.

2.0 EQUIPMENT AND MATERIALS

2.1 In order to sample ground water from monitoring wells, specific equipment and materials are required. The equipment and materials list may include, but not necessarily be limited to, the following:

- a. Bailers (Teflon™ or stainless steel).
- b. Pumps (centrifugal, peristaltic, bladder, electric submersible, bilge, hand-operated diaphragm, etc.).
- c. Gas-displacement device(s).
- d. Air-lift device(s).
- e. Teflon™ tape, electrical tape.
- f. Appropriate discharge hose.
- g. Appropriate discharge tubing (e.g., polypropylene, teflon, etc.) if using a peristaltic pump.
- h. Appropriate compressed gas if using bladder-type or gas-displacement device.

STANDARD OPERATING PROCEDURE 4.4
FOR SAMPLING GROUND-WATER MONITORING
WELLS FOR DISSOLVED CONSTITUENTS

Page 2 of 7

- i. Portable generator and gasoline or alternate power supply if using an electric submersible pump.
- j. Non-absorbent cord (e.g., polypropylene, etc.).
- k. Plastic sheeting.
- l. Tape measure (stainless steel, steel, fiberglass) with 0.01-foot measurement increments and chalk (blue carpenter's).
- m. Electronic water-level indicators (e.g., m-scope, etc.) or electric water-level/product level indicators.
- n. Non-phosphate, laboratory-grade detergent.
- o. Distilled/Deionized water.
- p. Potable water.
- q. Paper towels, clean rags.
- r. Roux Associates' field forms (e.g., daily log, well inspection checklist, sampling, etc.) and field notebook.
- s. Well location and site map.
- t. Well keys.
- u. Stop watch, digital watch with second increments, or watch with a second hand.
- v. Water Well Handbook.
- w. Calculator.
- x. Black pen and water-proof marker.
- y. Tools (e.g., pipe wrenches, screwdrivers, hammer, pliers, flashlight, pen knife, etc.).
- z. Appropriate health and safety equipment, as specified in the site health and safety plan (HASP).
- aa. pH meter(s) and buffers.
- bb. Conductivity meter(s) and standards.
- cc. Thermometer(s).

- dd. Extra batteries (meters, thermometers, flashlight).
- ee. Filtration apparatus, filters, pre-filters.
- ff. Plasticware (e.g., premeasured buckets, beakers, flasks, funnels).
- gg. Disposable gloves.
- hh. Water jugs.
- ii. Laboratory-supplied sample containers with labels.
- jj. Cooler(s).
- kk. Ice (wet, blue packs).
- ll. Masking, duct, and packing tape.
- mm. Chain-of-custody form(s) and custody seal(s).
- nn. Site sampling and analysis plan (SAP).
- oo. Site health and safety plan (HASP).
- pp. Packing material (e.g., bubble wrap)
- qq. "Zip-lock" plastic bags.
- rr. Overnight (express) mail forms.

3.0 DECONTAMINATION

- 3.1 Make sure all equipment is decontaminated and cleaned before use (refer to the SOP for Decontamination of Field Equipment for detailed decontamination methods, summaries for bailers and pumps are provided below). Use new, clean materials when decontamination is not appropriate (e.g., non-absorbent cord, disposable gloves). Document, and initial and date the decontamination procedures on the appropriate field form and in the field notebook.
 - a. Decontaminate a bailer by: 1) wearing disposable gloves, 2) disassembling (if appropriate) and scrubbing in a non-phosphate, laboratory-grade detergent and distilled/deionized water solution, and 3) rinsing first with potable water and then distilled/deionized water.
 - b. Decontaminate a pump by: 1) wearing disposable gloves, 2) flushing the pump and discharge hose (if not disposable) first with a non-phosphate, laboratory-grade detergent and potable water solution in an appropriate

container (clean bucket, garbage can, or 55-gallon drum) and then with distilled/deionized water or potable water, and 3) wiping pump-related equipment (e.g., electrical lines, cables, discharge hose) first with a clean cloth and detergent solution and then rinsing or wiping with a clean cloth and distilled/deionized water or potable water.

- 3.2 Note that the decontamination procedures for bailers and pumps are the minimum that must be performed. Check the work plan to determine if chemicals specified by individual state regulatory agencies must also be used for decontamination procedures (e.g., hexane, nitric acid, acetone, isopropanol, etc.).

4.0 CALIBRATION OF FIELD ANALYSIS EQUIPMENT

Calibrate field analysis equipment before use (e.g., thermometers, pH and conductivity meters, etc.). Refer to the specific SOP for field analysis for each respective piece of equipment. Document, and initial and date the calibration procedures on the appropriate field form, in the field notebook, and in the calibration log book.

5.0 PROCEDURE

- 5.1 Document, and initial and date well identification, pre-sampling information, and problems encountered on the appropriate field form and in the field notebook as needed.
- 5.2 Inspect the protective casing of the well and the well casing, and note any items of concern such as a missing lock, or bent or damaged casing(s).
- 5.3 Place plastic sheeting around the well to protect sampling equipment from potential cross contamination.
- 5.4 Remove the well cap or plug and, if necessary, clean the top of the well off with a clean rag. Place the cap or plug on the plastic sheeting. If the well is not vented, allow several minutes for the water level in the well to equilibrate. If fumes or gases are present, then diagnose these with the proper safety equipment. Never inhale the vapors.
- 5.5 Measure the depth to water (DTW) from the measuring point (MP) on the well using a steel tape and chalk or an electronic sounding device (m-scope). Refer to the specific SOPs for details regarding the use of a steel tape or a m-scope for measuring water levels. Calculate the water-level elevation. Document, and initial and date the information on the appropriate field form and in the field notebook.
- 5.6 Measuring the total depth of the well from the MP with a weighted steel tape. Calculate and record the volume of standing water in the well casing on the appropriate field form and in the field notebook.

- 5.7 Decontaminate the equipment used to measure the water level and sound the well with a non-phosphate, laboratory-grade detergent solution followed by a distilled/deionized water rinse.
- 5.8 Purge the well prior to sampling (refer to the SOP for Purging a Well). The well should be pumped or bailed to remove the volume of water specified in the work plan. Usually three to five casing volumes are removed if the recharge rate is adequate to accomplish this within a reasonable amount of time.

If the formation cannot produce enough water to sustain purging, then one of two options must be followed. These include: 1) pumping or bailing the well dry, or 2) pumping or bailing the well to "near-dry" conditions (i.e., leaving some water in the well). The option employed must be specified in the work plan and be in accordance with regulatory requirements.

If the well is purged dry, then all the standing water has been removed and upon recovery the well is ready for sampling. However, depending on the rate of recovery and the time needed to complete the sampling round, one of the following procedures may have to be implemented: 1) the well may have to be sampled over a period of more than one day; 2) the well may not yield enough water to collect a complete suite of samples and only select (most important) samples will be collected; or 3) the well may not recover which will preclude sampling. Regardless of the option that must be followed, the sampling procedure must be fully documented. When preparing to conduct a sampling round, review drilling, development and previous sampling information (if available) to identify low-yielding wells in order to purge them first, and potentially allow time for the well to recover for sampling.

- 5.9 Record the physical appearance of the water (i.e., color, turbidity, odor, etc.) on the appropriate field form and in the field notebook, as it is purged. Note any changes that occur during purging.
- 5.10 If a bailer is used to collect the sample, then:
- a. Flush the decontaminated bailer three times with distilled/deionized water.
 - b. Tie the non-absorbent cord (polypropylene) to the bailer with a secure knot and then tie the free end of the bailer cord to the protective casing or, if possible, some nearby structure to prevent losing the bailer and cord down the well.
 - c. Lower the bailer slowly down the well and into the water column to minimize disturbance of the water surface. If a bottom-filling bailer is used, then do not submerge the top of the bailer; however, if a top-filling bailer is used, then submerge the bailer several feet below the water surface.

- d. Remove and properly discard one bailer volume from the well to rinse the bailer with well water before sampling. Again, lower the bailer slowly down the well to the appropriate depth depending on the bailer type (as discussed above in 5.11 c). When removing the bailer from the well, do not allow the bailer cord to rest on the ground but coil it on the protective plastic sheeting placed around the well. Certain regulatory agencies require that the first bailer volume collected be utilized for the samples.
- 5.11 If a pump is used to collect the sample, then use the same pump used to purge the well and, if need be, reduce the discharge rate to facilitate filling sample containers and to avoid problems that can occur while filling sample containers (as listed in Number 5.14, below). Alternately, the purge pump may be removed and a thoroughly decontaminated bailer can be used to collect the sample.
- 5.12 Remove each appropriate container's cap only when ready to fill each with the water sample, and then replace and secure the cap immediately.
- 5.13 Fill each appropriate, pre-labeled sample container carefully and cautiously to prevent: 1) agitating or creating turbulence; 2) breaking the container; 3) entry of, or contact with, any other medium; and 4) spilling/splashing the sample and exposing the sampling team to contaminated water. Immediately place the filled sample container in a ice-filled (wet ice or blue pack) cooler for storage. If wet ice is used it is recommended that it be repackaged in zip-lock bags to help keep the cooler dry and the sample labels secure. Check the work plan as to whether wet ice or blue packs are specified for cooling the samples because certain regulatory agencies may specify the use of one and not the other.
- 5.14 "Top-off" containers for volatile organic compounds (VOCs) and tightly seal with Teflon™-lined septums held in place by open-top screw caps to prevent volatilization. Ensure that there are no bubbles by turning the container upside down and tapping it gently.
- 5.15 Filter water samples (Procedure 4.6) collected for dissolved metals analysis prior to preservation to remove the suspended sediment from the sample. If water samples are to be collected for total metals analysis, then collect a second set of samples without field filtering.

In the event that the regulatory agency(ies) want unfiltered samples for metals analysis, a second set of filtered samples should also be collected. Because unfiltered samples are indications of total metals (dissolved and suspended) they are not representative of aquifer conditions because ground water does not transport sediment (except in some rare cases). Thus, the results for dissolved metals in ground water should be based on filtered samples even if both filtered and unfiltered sets are presented in a report.

STANDARD OPERATING PROCEDURE 4.4
FOR SAMPLING GROUND-WATER MONITORING
WELLS FOR DISSOLVED CONSTITUENTS

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- 5.16 Add any necessary preservative(s) to the appropriate container(s) prior to, or after (preferred), the collection of the sample, unless the appropriate preservative(s) have already been added by the laboratory before shipment.
- 5.17 Collect quality control (QC) samples as required in the work plan to monitor sampling and laboratory performance. Refer to the SOP for Collection of Quality Control Samples.
- 5.18 Conduct field analyses after sample collection is complete by measuring and recording the temperature, conductivity, pH, etc. (as called for in the work plan). Note and record the "final" physical appearance of the water (after purging and sampling) on an appropriate field form and in the field notebook.
- 5.19 Wipe the well cap with a clean rag, replace the well cap and protective cover (if present). Lock the protective cover.
- 5.20 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," placed in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory.
- 5.21 Decontaminate bailers, hoses, and pumps as discussed in the decontamination SOP. Wrap decontaminated equipment with a suitable material (e.g., clean plastic bag or aluminum foil). Discard cords, rags, gloves, etc. in a manner consistent with site conditions.
- 5.22 Complete all necessary field forms, field notebook entries, and the chain-of-custody forms. Retain one copy of each chain-of-custody form. Secure the cooler with sufficient packing tape and a custody seal.
- 5.23 Samples collected from Monday through Friday will be delivered within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Consult the work plan to determine if any of the analytes require a shorter delivery time.

END OF PROCEDURE

STANDARD OPERATING PROCEDURE 5.1
FOR COLLECTION OF SOIL SAMPLES
FOR LABORATORY ANALYSIS

Page 1 of 3

Date: May 5, 2000

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish guidelines for the collection of soil samples for laboratory analysis. This SOP is applicable to soil samples collected from split-spoon samplers during drilling, hand auger samples, grab samples from stockpiled soils, surface samples, test pit samples, etc.

2.0 CONSIDERATIONS

Soil samples may be collected in either a random or biased manner. Random samples can be based on a grid system or statistical methodology. Biased samples can be collected in areas of visible impact or suspected source areas. Soil samples can be collected at the surface, shallow subsurface, or at depth. When samples are collected at depth the water content should be noted, since generally "soil sampling" is restricted to the unsaturated zone. Equipment selection will be determined by the depth of the sample to be collected. A thorough description of the sampling locations and proposed methods of sample collection should be included in the work plan.

Commonly, surface sampling refers to the collection of samples at a 0 to 6 inch depth interval. Certain regulatory agencies may define the depth interval of a surface sample differently, and this must be defined in the work plan. Collection of surface soil samples is most efficiently accomplished with the use of a stainless steel trowel or scoop. For samples at greater depths a decontaminated bucket auger or power auger may be needed to advance the hole to the point of sample collection. Another clean bucket auger should then be used to collect the sample. To collect samples at depths of greater than approximately six feet the use of a drill rig and split spoon samples will usually be necessary. In some situations, sample locations are accessed with the use of a backhoe.

3.0 MATERIALS/EQUIPMENT

- a. A work plan which outlines soil sampling requirements.
- b. Field notebook, field form(s), maps, chain-of-custody forms, and custody seals.
- c. Decontamination supplies (including: non-phosphate, laboratory grade detergent, buckets, brushes, potable water, distilled water, regulatory-required reagents, aluminum foil, plastic sheeting, etc.).
- d. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).
- e. Stainless steel spoons or spatulas.
- f. Disposable sampling gloves.

- g. Laboratory-supplied sample containers with labels.
- h. Cooler with blue or wet ice.
- i. Plastic sheeting.
- j. Black pen and indelible marker.
- k. Zip-lock bags and packing material.
- l. Tape measure.
- m. Paper towels or clean rags.
- n. Masking and packing tape.
- o. Overnight (express) mail forms.

4.0 DECONTAMINATION

All reusable sampling equipment will be thoroughly cleaned according to the decontamination SOP. Where possible, thoroughly pre-cleaned and wrapped sampling equipment should be used and dedicated to individual sampling locations. Disposable items such as sampling gloves, aluminum foil, and plastic sheeting will be changed after each use and discarded in an appropriate manner.

5.0 PROCEDURE

- 5.1 Prior to collecting soil samples, ensure that all sampling equipment has been thoroughly cleaned according to the decontamination SOP. If samples are to be collected at depth, then the boring must be advanced with thoroughly cleaned equipment to the desired sampling horizon and a different thoroughly cleaned sampler must be used to collect the sample.
- 5.2 Using disposable gloves and a pre-cleaned, stainless steel spatula or spoon, extract the soil sample from the sampler, measure the recovery, and separate the wash from the true sample. Where allowed by regulatory agency(ies), disposable plastic spoons may be used.
- 5.3 Place the sample in a laboratory-supplied, pre-cleaned sample container. This should be done as quickly as possible and this is especially important when sampling for volatile organic compounds (VOCs). Samples to be analyzed for VOCs must be collected prior to other constituents.
- 5.4 The sample container will be labeled with appropriate information such as, client name, site location, sample identification (location, depth, etc.), date and time of collection, and sampler's initials.

STANDARD OPERATING PROCEDURE 5.1
FOR COLLECTION OF SOIL SAMPLES
FOR LABORATORY ANALYSIS

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- 5.5 Using the remaining portion of soil from the sampler, log the sample in detail and record sediment characteristics (color, odor, moisture, texture, density, consistency, organic content, layering, grain size, etc.).
- 5.6 If soil samples are to be composited in the field, then equal portions from selected locations will be placed on a clean plastic sheet and homogenized. Alternately, several samples may be submitted to the laboratory for compositing by weight. The method used is dependent upon regulatory requirements. Specific compositing procedures shall be approved by the appropriate regulatory agency and described in the work plan. Samples to be analyzed for VOCs will not be composited unless required by a regulatory agency.
- 5.7 After the sample has been collected, labeled, and logged in detail, it is placed in a zip-lock bag and stored in a cooler at 4°C.
- 5.8 A chain-of-custody form is completed for all samples collected. One copy is retained and two are sent with the samples in a zip-lock bag to the laboratory. A custody seal is placed on the cooler prior to shipment.
- 5.9 Samples collected from Monday to Friday are to be delivered to the laboratory within 24 hours of collection. If Saturday delivery is unavailable, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if any analytes require a shorter delivery time.
- 5.10 The field notebook and appropriate forms should include, but not be limited to the following: client name, site location, sample location, sample depth, sample identification, date and time collected, sampler's name, method of sample collection, number and type of containers, geologic description of material, description of decontamination procedures, etc. A site map should be prepared with exact measurements to each sample location in case follow-up sampling is necessary.
- 5.11 All reusable sampling equipment must be thoroughly cleaned in accordance with the decontamination SOP. Following the final decontamination (after all samples are collected) the sampling equipment is wrapped in aluminum foil. Discard any gloves, foil, plastic, etc. in an appropriate manner that is consistent with site conditions.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for sample handling which will allow consistent and accurate results. Valid chemistry data are integral to investigations that characterize media-quality conditions. Thus, this SOP is designed to ensure that once samples are collected, they are preserved, packed and delivered in a manner which will maintain sample integrity to as great an extent as possible. The procedures outlined are applicable to most sampling events and any required modifications must be clearly described in the work plan.

2.0 CONSIDERATIONS

Sample containers, sampling equipment decontamination, quality assurance/quality control (QA/QC), sample preservation, and sample handling are all components of this SOP.

2.1 Sample Containers

Prior to collection of a sample, considerations must be given to the type of container that will be used to store and transport the sample. The type and number of containers selected is usually based on factors such as sample matrix, potential contaminants to be encountered, analytical methods requested, and the laboratory's internal quality assurance requirements. In most cases, the overriding considerations will be the analytical methodology, or the state or federal regulatory requirements because these regulations generally encompass the other factors. The sample container selected is usually based on some combination of the following criteria:

a. Reactivity of Container Material with Sample

Choosing the proper composition of sample containers will help to ensure that the chemical and physical integrity of the sample is maintained. For sampling potentially hazardous material, glass is the recommended container type because it is chemically inert to most substances. Plastic containers are not recommended for most hazardous wastes because the potential exists for contaminants to adsorb to the surface of the plastic or for the plasticizer to leach into the sample.

In some instances, however, the sample characteristics or analytes of interest may dictate that plastic containers be used instead of glass. Because some metals species will adhere to the sides of the glass containers in an aqueous matrix, plastic bottles (e.g., nalgene) must be used for samples collected for metals analysis. A separate, plastic

container should accompany glass containers if metals analysis is to be performed along with other analyses. Likewise, other sample characteristics may dictate that glass cannot be used. For example, in the case of a strong alkali waste or hydrofluoric solution, plastic containers may be more suitable because glass containers may be etched by these compounds and create adsorptive sites on the container's surface.

b. Volume of the Container

The volume of sample to be collected will be dictated by the analysis being performed and the sample matrix. The laboratory must supply bottles of sufficient volume to perform the required analysis. In most cases, the methodology dictates the volume of sample material required to complete the analysis. However, individual laboratories may provide larger volume containers for various analytes to ensure sufficient quantities for duplicates or other QC checks.

To facilitate transfer of the sample from the sampler into the container and to minimize spillage and sample disturbance, wide-mouth containers are recommended. Aqueous volatile organic samples must be placed into 40-milliliter (ml) glass vials with polytetrafluoroethylene (PTFE) (e.g., TeflonTM) septums. Non-aqueous volatile organic samples should be collected in the same type of vials or in 4-ounce (oz) wide-mouth jars provided by the laboratory. These jars should have PTFE-lined screw caps.

c. Color of Container

Whenever possible, amber glass containers should be used to prevent photodegradation of the sample, except when samples are being collected for metals analysis. If amber containers are not available, then containers holding samples should be protected from light (i.e., place in cooler with ice immediately after filling).

d. Container Closures

Container closures must screw on and off the containers and form a leak-proof seal. Container caps must not be removed until the container is ready to be filled with the sample, and the container cap must be replaced (securely) immediately after filling it. Closures should be constructed of a material which is inert with respect to the sampled material, such as PTFE (e.g., TeflonTM). Alternately, the closure may be separated from the sample by a closure liner that is inert to the sample material such as PTFE sheeting. If soil or sediment samples are being collected, the threads of the container must be wiped clean with a dedicated paper towel or cloth so the cap can be threaded properly.

e. Decontamination of Sample Containers

Sample containers must be laboratory cleaned by the laboratory performing the analysis. The cleaning procedure is dictated by the specific analysis to be performed on the sample. Sample containers must be carefully examined to ensure that all containers appear clean. Do not mistake the preservative as unwanted residue. The bottles should not be field cleaned. If there is any question regarding the integrity of the bottle, then the laboratory must be contacted immediately and the bottle(s) replaced.

f. Sample Bottle Storage and Transport

No matter where the sample bottles are, whether at the laboratory waiting to be packed for shipment or in the field waiting to be filled with sample, care must be taken to avoid contamination. Sample shuttles or coolers, and sample bottles must be stored and transported in clean environments. Sample bottles and clean sampling equipment must never be stored near solvents, gasoline, or other equipment that is a potential source of cross-contamination. When under chain of custody, sample bottles must be secured in locked vehicles, and custody sealed in shuttles or in the presence of authorized personnel. Information which documents that proper storage and transport procedures have been followed must be included in the field notebook and on appropriate field forms.

2.2 Decontamination of Sampling Equipment

Proper decontamination of all re-usable sampling equipment is critical for all sampling episodes. The SOP for Decontamination of Field Equipment and SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for decontamination of various types of equipment.

2.3 Quality Assurance/Quality Control Samples

QA/QC samples are intended to provide control over the proper collection and tracking of environmental measurements, and subsequent review, interpretation and validation of generated analytical data. The SOPs for Collection of Quality Control Samples, for Evaluation and Validation of Data, and for Field Record Keeping and Quality Assurance/Quality Control must be referred to for detailed guidance regarding these respective procedures. SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for QA/QC procedures.

2.4 Sample Preservation Requirements

Certain analytical methodologies for specific analytes require chemical additives in order to stabilize and maintain sample integrity. Generally, this is accomplished under the following two scenarios:

- a. Sample bottles are preserved at the laboratory prior to shipment into the field.
- b. Preservatives are added in the field immediately after the samples are collected.

Many laboratories provide pre-preserved bottles as a matter of convenience and to help ensure that samples will be preserved immediately upon collection. A problem associated with this method arises if not enough sample could be collected, resulting in too much preservative in the sample. More commonly encountered problems with this method include the possibility of insufficient preservative provided to achieve the desired pH level or the need for additional preservation due to chemical reactions caused by the addition of sample liquids to pre-preserved bottles. The use of pre-preserved bottles is acceptable; however, field sampling teams must always be prepared to add additional preservatives to samples if the aforementioned situations occur. Furthermore, care must be exercised not to overfill sample bottles containing preservatives to prevent the sample and preservative from spilling and therefore diluting the preservative (i.e., not having enough preservative for the volume of sample).

When samples are preserved after collection, special care must be taken. The transportation and handling of concentrated acids in the field requires additional preparation and adherence to appropriate preservation procedures. All preservation acids used in the field should be trace-metal or higher-grade.

2.5 Sample Handling

After the proper sample bottles have been received under chain-of-custody, properly decontaminated equipment has been used to collect the sample, and appropriate preservatives have been added to maintain sample integrity, the final step for the field personnel is checking the sample bottles prior to proper packing and delivery of the samples to the laboratory.

All samples should be organized and the labels checked for accuracy. The caps should be checked for tightness and any 40-ml volatile organic compound (VOC) bottles must be checked for bubbles. Each sample bottle must be placed in an individual "zip-lock" bag to protect the label, and placed on ice. The bottles must be carefully packed to prevent breakage during transport. When several bottles have been collected for an individual sample, they should not be placed adjacent to each other in the cooler to prevent possible breakage of all bottles for a given sample. If there are any samples which are known or suspected to be highly

contaminated, these should be placed in an individual cooler under separate chain-of-custody to prevent possible cross contamination. Sufficient ice (wet or blue packs) should be placed in the cooler to maintain the temperature at 4 degrees Celsius (°C) until delivery at the laboratory. Consult the work plan to determine if a particular ice is specified as the preservation for transportation (e.g., the United States Environmental Protection Agency does not like the use of blue packs because they claim that the samples will not hold at 4°C). If additional coolers are required, then they should be purchased. The chain-of-custody form should be properly completed, placed in a "zip-lock" bag, and placed in the cooler. One copy must be maintained for the project files. The cooler should be sealed with packing tape and a custody seal. The custody seal number should be noted in the field book. Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time. If overnight mail is utilized, then the shipping bill must be maintained for the files and the laboratory must be called the following day to confirm receipt.

3.0 EQUIPMENT AND MATERIALS

- 3.1 General equipment and materials may include, but not necessarily be limited to, the following:
- a. Sample bottles of proper size and type with labels.
 - b. Cooler with ice (wet or blue pack).
 - c. Field notebook, appropriate field form(s), chain-of-custody form(s), custody seals.
 - d. Black pen and indelible marker.
 - e. Packing tape, "bubble wrap," and "zip-lock" bags.
 - f. Overnight (express) mail forms and laboratory address.
 - g. Health and safety plan (HASP).
 - h. Work plan/scope of work.
 - i. Pertinent SOPs for specified tasks and their respective equipment and materials.
- 3.2 Preservatives for specific samples/analytes as specified by the laboratory. Preservatives must be stored in secure, spillproof glass containers with their content, concentration, and date of preparation and expiration clearly labeled.

- 3.3 Miscellaneous equipment and materials including, but not necessarily limited to, the following:
- a. Graduated pipettes.
 - b. Pipette bulbs.
 - c. Litmus paper.
 - d. Glass stirring rods.
 - e. Protective goggles.
 - f. Disposable gloves.
 - g. Lab apron.
 - h. First aid kit.
 - i. Portable eye wash station.
 - j. Water supply for immediate flushing of spillage, if appropriate.
 - k. Shovel and container for immediate containerization of spillage-impacted soils, if appropriate.

4.0 PROCEDURE

- 4.1 Examine all bottles and verify that they are clean and of the proper type, number, and volume for the sampling to be conducted.
- 4.2 Label bottles carefully and clearly with project name and number, site location, sample identification, date, time, and the sampler's initials using an indelible marker.
- 4.3 Collect samples in the proper manner (refer to specific sampling SOPs).
- 4.4 Conduct preservation activities as required after each sample has been collected. Field preservation must be done immediately and must not be done later than 30 minutes after sample collection.
- 4.5 Conduct QC sampling, as required.
- 4.6 Seal each container carefully and place in an individual "zip lock" bag.
- 4.7 Organize and carefully pack all samples in the cooler immediately after collection (e.g., bubble wrap). Insulate samples so that breakage will not occur.

- 4.8 Complete and place the chain-of-custody form in the cooler after all samples have been collected. Maintain one copy for the project file. If the cooler is to be transferred several times prior to shipment or delivery to the laboratory, it may be easier to tape the chain-of-custody to the exterior of the sealed cooler. When exceptionally hazardous samples are known or suspected to be present, this should be identified on the chain-of-custody as a courtesy to the laboratory personnel.
- 4.9 Add additional ice as necessary to ensure that it will last until receipt by the laboratory.
- 4.10 Seal the cooler with packing tape and a custody seal. Record the number of the custody seal in the field notebook and on the field form. If there are any exceptionally hazardous samples, then shipping regulations should be examined to ensure that the sample containers and coolers are in compliance and properly labeled.
- 4.11 Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time.
- 4.12 Maintain the shipping bill for the project files if overnight mail is utilized and call the laboratory the following day to confirm receipt.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for decontamination of all field equipment potentially exposed to contamination during drilling, and soil and water sampling. The objective of decontamination is to ensure that all drilling, and soil-sampling and water-sampling equipment is decontaminated (free of potential contaminants): 1) prior to being brought onsite to avoid the introduction of potential contaminants to the site; 2) between drilling and sampling events/activities onsite to eliminate the potential for cross-contamination between boreholes and/or wells; and 3) prior to the removal of equipment from the site to prevent the transportation of potentially contaminated equipment offsite.

In considering decontamination procedures, state and federal regulatory agency requirements must be considered because of potential variability between state and federal requirements and because of variability in the requirements of individual states. Decontamination procedures must be in compliance with state and/or federal protocols in order that regulatory agency(ies) scrutiny of the procedures and data collected do not result in non acceptance (invalidation) of the work undertaken and data collected.

2.0 PROCEDURE FOR DRILLING EQUIPMENT

The following is a minimum decontamination procedure for drilling equipment. Drilling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

- 2.1 The rig and all associated equipment should be properly decontaminated by the contractor before arriving at the test site.
- 2.2 The augers, drilling casings, rods, samplers, tools, rig, and any piece of equipment that can come in contact (directly or indirectly) with the soil, will be steam cleaned onsite prior to set up for drilling to ensure proper decontamination.
- 2.3 The same steam cleaning procedures will be followed between boreholes (at a fixed on-site location[s], if appropriate) and before leaving the site at the end of the study.
- 2.4 All on-site steam cleaning (decontamination) activities will be monitored and documented by a member(s) of the staff of Roux Associates, Inc.
- 2.5 If drilling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat drilling equipment, then special decontamination procedures may have to be utilized before steam cleaning (e.g., hexane scrub and wash).

- 2.6 Containment of decontamination fluids may be necessary (e.g., rinseate from steam cleaning) or will be required (e.g., hexane), and disposal must be in accordance with state and/or federal procedures.

3.0 PROCEDURE FOR SOIL-SAMPLING EQUIPMENT

The following is a minimum decontamination procedure for soil-sampling equipment (e.g., split spoons, stainless-steel spatulas). Soil-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

- 3.1 Wear disposable gloves while cleaning equipment to avoid cross-contamination and change gloves as needed.
- 3.2 Steam clean the sampler or rinse with potable water. If soil-sampling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat sampling equipment, then special decontamination procedures may have to be utilized before steam cleaning and washing in detergent solution (e.g., hexane scrub and wash).
- 3.3 Prepare a non-phosphate, laboratory-grade detergent solution and distilled or potable water in a clean bucket.
- 3.4 Disassemble the sampler, as necessary and immerse all parts and other sampling equipment in the solution.
- 3.5 Scrub all equipment in the bucket with a brush to remove any adhering particles.
- 3.6 Rinse all equipment with copious amounts of potable water followed by distilled or deionized water.
- 3.7 Place clean equipment on a clean plastic sheet (e.g., polyethylene)
- 3.8 Reassemble the cleaned sampler, as necessary.
- 3.9 Transfer the sampler to the driller (or helper) making sure that this individual is also wearing clean gloves, or wrap the equipment with a suitable material (e.g., plastic bag, aluminum foil).

As part of the decontamination procedure for soil-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

4.0 PROCEDURE FOR WATER-SAMPLING EQUIPMENT

The following is a decontamination procedure for water-sampling equipment (e.g., bailers, pumps). Water-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

4.1 Decontamination procedures for bailers follow:

- a. Wear disposable gloves while cleaning bailer to avoid cross-contamination and change gloves as needed.
- b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a bucket.
- c. Disassemble bailer (if applicable) and discard cord in an appropriate manner, and scrub each part of the bailer with a brush and solution.
- d. Rinse with potable water and reassemble bailer.
- e. Rinse with copious amounts of distilled or deionized water.
- f. Air dry.
- g. Wrap equipment with a suitable material (e.g., clean plastic bag, aluminum foil).
- h. Rinse bailer at least three times with distilled or deionized water before use.

4.2 Decontamination procedures for pumps follow:

- a. Wear disposable gloves while cleaning pump to avoid cross-contamination and change gloves as needed.
- b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a clean bucket, clean garbage can, or clean 55-gallon drum.
- c. Flush the pump and discharge hose (if not disposable) with the detergent solution, and discard disposable tubing and/or cord in an appropriate manner.
- d. Flush the pump and discharge hose (if not disposable) with potable water.
- e. Place the pump on clear plastic sheeting.
- f. Wipe any pump-related equipment (e.g., electrical lines, cables, discharge hose) that entered the well with a clean cloth and detergent solution, and rinse or wipe with a clean cloth and potable water.

- g. Air dry.
- h. Wrap equipment with a suitable material (e.g., clean plastic bag).

As part of the decontamination procedure for water-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

Off-Site Remedial Investigation Work Plan
Queens Plaza Residential Development
Long Island City, New York

APPENDIX B

Health and Safety Plan

July 18, 2016

HEALTH AND SAFETY PLAN

**Offsite Properties
Queens Plaza Residential Development
28-10 Jackson Avenue
Long Island City, New York**

Prepared for

**LIC Operator Co., L.P.
% Tishman Speyer
45 Rockefeller Plaza
New York, New York 10111**

ROUX ASSOCIATES, INC.

Environmental Consulting & Management



209 Shafter Street, Islandia, New York 11749 ♦ 631-232-2600

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- G. Roux Heavy Equipment Exclusion Zone Policy
- H. ACORD[®] Automobile Loss Notice Form
- I. Roux Peer Observation Form
- J. All One Health Responsibilities Form

1.0 INTRODUCTION

This site-specific Health and Safety Plan (HASP) has been prepared in accordance with 29 CFR 1910.120 Occupational Safety and Health Act (OSHA) Hazardous Waste Operations and Roux Associates, Inc. (Roux Associates) Standard Operating Procedures (SOPs). It addresses all the activities described below that are associated with the Offsite areas (Site), located immediately north, east and west of the New York State Brownfield Cleanup Program Queens Plaza Residential Development (BCP Site) located at 28-10 Jackson Avenue, Long Island City, New York (Figure 1) and will be implemented by the designated Site Health and Safety Officer (SHSO) during Site work. When activities are to be conducted which are not specifically addressed by this HASP, appropriate SOPs and Job Safety Analyses (JSAs) will be reviewed to determine the appropriate work approach and associated levels of health and safety required. If a JSA for the specific activity does not exist, one will be prepared by the field work team, reviewed for completeness by the Project Manager, and implemented as required by the JSA (see Section 6.3 and Appendix A).

Compliance with this HASP is required for all Roux Associates personnel and subcontractors contracted directly by Roux Associates. Assistance in implementing this HASP can be obtained from the Roux Associates Office Health and Safety Manager (OHSM). The content of this HASP may undergo revision based upon additional information made available. Any changes proposed to this HASP must be reviewed and approved by the OHSM or his/her designee.

Prior to performing work each task should be evaluated to determine the appropriate procedures that need to be followed.

		<u>Office:</u>	<u>Cell:</u>
1. Project Principal:	Joshua Levine	(631) 232-2600	(516) 250-0372
2. Project Manager/SSO:	Jeff Wills	(631) 232-2600	(516) 637-0213
3. Office Health and Safety Manager:	Joseph Gavin	(631) 232-2600	(516) 754-6671
4. Corporate Health & Safety Manager:	Joseph Gentile	(856) 423-8800	(610) 844-6911
5. Office Manager:	Brian Morrissey	(631) 232-2600	(631) 921-6355

Upon entering the Site, all visitors are required to sign in with the SHSO. All visitors entering the Contamination Reduction Zone (CRZ) (defined in Section 7.1.2) or the Exclusion Zone (EZ)

(defined in Section 7.1.1) will be required to read and comply with the provisions of this HASP. Visitors will also be required to comply with all applicable OSHA requirements. In the event that a visitor does not adhere to the provisions of this HASP, the visitor will be required to leave the Site.

Scope of Work:

The proposed scope of work will vary depending on the planned work activities and includes, but not limited to, the following tasks:

- Advancement of soil borings/soil sampling;
- Soil vapor monitoring point installation/sampling;
- Monitoring well installation/sampling/development and surveying; and
- Offsite transportation and disposal of investigation derived waste (soil/purge water). Transportation shall be performed in accordance with the New York State Department of Transportation (NYSDOT) regulations.

Any change in scope will require a revision of this HASP to address any new hazards. Detailed scopes of work for these activities are discussed in the Off-Site Remedial Investigation Work Plan.

Emergency Information

Multiple emergency services may be obtained by calling 911. More specific numbers for local services are listed below but should not be used until after 911 is alerted.

Emergency Medical Service	911
<u>Police</u> : New York City Police Department	911
Fire: New York Fire Department	911
<u>Hospital</u> : Mount Sinai Hospital	718-932-1000
National Response Center	800-424-8802
Poison Control Center	800-222-1222
CHEMTREC	800-262-8200
Center for Disease Control	800-311-3435
USEPA (Region I)	212-637-5000
NYSDEC Emergency Spill Response	800-457-7362

Urgent Care Clinic 877-900-2308
(For non-emergency medical services)

Environmental Emergency

(e.g., release or spill)

Type	Name	Telephone Numbers
Corporate Health and Safety Manager	Joseph Gentile	(856) 832-3768 (Office) (610) 844-6911 (Cell)
Office Health and Safety Manager	Joseph Gavin	(631) 232-2600 (Office) (516) 754-6671 (Cell)
Site Health and Safety Officer	Richard Crockett	(631) 232-2600 (Office) (928) 221-2531 (Cell)
Project Manager	Jeff Wills	(631) 630-2366 (Office) (516) 637-0213 (Cell)

2.0 PERSONNEL DESIGNATIONS

Project Manager/Site Manager

The Project Manager/Site Manager (PM/SM) is responsible for coordination of subcontractors and tasks related to accomplishment of the scope of work. The PM/SM is responsible for committing to a goal of ZERO environmental, health and safety incidents. The PM/SM is also responsible for making certain that personnel receive and are aware of the provisions of this HASP, are instructed in the work practices necessary to ensure safety and are familiar with planned procedures for dealing with emergencies. The PM/SM assures that personnel are aware of the potential hazards associated with site operations and correcting any work practices or conditions that may result in injury or exposure to hazardous substances. The SM ensures that at least one person on site, prior to assignment, is trained and certified by the American Red Cross or equivalent and is responsible for rendering first aid. These individuals will be identified by job function and will be recertified per the certifying agency's time schedule. Blood borne Pathogens training will be conducted concurrently and will be provided annually. Potential exposure to blood borne pathogens will be determined without regard for personal protective equipment. When rendering first aid or CPR universal precautions will be observed. Labels and signs will be used to serve as warnings of infectious materials. Employees will also have a copy of the site-specific exposure control plan. The use of PPE/PPC provides for work practice controls. This PPE/PPC will be provided at no cost to employees. Where PPE is provided to minimize exposure to lead, gloves, hats, vented goggles, shoes or disposable shoe covers are provided. Protective clothing shall be in clean and dry condition at least weekly. Protective clothing shall be cleaned, laundered, properly disposed and repaired or replaced as necessary. Any blood soaked bandages, etc., will be placed in leak proof bags for handling, storage and transport. After contact with blood or other potentially infectious material, all equipment and surfaces shall be cleaned and decontaminated. Hepatitis B vaccine is made available to all employees that have occupational exposure to BBP at no cost. The PM/SM assures that all field personnel are in compliance with the hazardous waste worker health and safety training and medical surveillance requirements of 29 CFR 1910.120 and all other applicable regulations. The PM/SM for this project is Jeff Wills.

Corporate Health and Safety Manager

The Corporate Health and Safety Manager (CHSM) is responsible for assuring that the appropriate monitoring and safety equipment and other resources necessary to perform Site activities safely

are addressed in the HASP. The CHSM provides consultation to Site personnel on all questions related to health and safety. The CHSM also provides HAZWOPER training based on his extensive industrial experience and technical background (i.e., CIH). The CHSM for Roux Associates is Mr. Joseph Gentile.

Site Health and Safety Officer

The Site Health and Safety Officer (SHSO) will be present onsite during the conduct of all field operations, will be responsible for all health and safety activities, and has the authority to make all health and safety related decisions. The SHSO ensures that all personnel working onsite are qualified according to applicable Environmental Protection Agency, Occupational Safety and Health Association (OSHA) and state requirements. The determination of hazard concentrations will be made by the SHSO in consultation with the CHSM. The SHSO has stop-work authorization which he or she will execute upon determination of an imminent safety hazard, emergency situations, or other potentially dangerous situation, such as detrimental weather conditions. Authorization to proceed with work will be issued by the SHSO or CHSM in consultation with the PM/SM after such action. The SHSO or PM/SM will initiate and execute all contact with emergency facilities and personnel when this action is appropriate. The SHSO will also monitor decontamination procedures to determine their effectiveness. When such procedures are found to be ineffective, appropriate steps shall be taken to correct any deficiencies. The SHSO for this site is Richard Crockett. An assistant SHSO may be designated by the SHSO if required but must be pre-qualified and approved by the CHSM.

Office Health and Safety Manager

The New York Office Health and Safety Manager (OHSM) is responsible for providing support, as needed, to the Project and serves as back-up to the Site Health and Safety Officer. The OHSM assures that field personnel assigned to the project receive a health and safety orientation and are provided with the necessary personal protective equipment and clothing. The OHSM may periodically perform field audits, participate in field assessments and prepare information to be used for safety communication. The OHSM for this project is Joseph Gavin.

Project Personnel

Project personnel will be responsible for: complying with this HASP; taking all reasonable precautions to prevent injury to themselves and to their fellow employees; performing only those tasks that they believe they can do safely; immediately reporting any accidents and/or unsafe conditions to the SHSO; notifying the PM/SM and the SHSO of any special medical problems (e.g., allergies) and making certain that all on-Site personnel are aware of any such problems.

3.0 BCP SITE DESCRIPTION AND SURROUNDING PROPERTY

Descriptions of the BCP Site and surrounding property usage are included in the following sections. The location of the BCP Site is presented in Figure 1.

3.1 BCP Property Location and Description

The BCP Site is located in Long Island City, Queens County, New York and encompasses a trapezoid-shaped parcel (Figure 1). The BCP Site is bound by Jackson Avenue on the north. On the west, the BCP Site abuts Orchard Street. The eastern side of the BCP Site abuts Queens Boulevard and the southern boundary fronts the Long Island Railroad (LIRR) Sunnyside Yard property. West Street, a 5-story Apartment building and a New York City transit (NYCT) Substation are outside the BCP Site. The BCP Site is currently under development. The BCP Site topography slopes gently to the south. The pre-construction surface elevation ranged from approximately 12 ft. Queens Borough Datum (QBD) to 16 ft. QBD. The depth to bedrock is variable beneath the BCP Site; it is shallow near the middle of the western side of the property and deepens to the north, south, and east.

The Site is in an area designated as M1-5/R9 within the Long Island City Special Purpose District assigned by the Department of City Planning. The Long Island City Special Purpose District is a special zoning provision to promote the development and transformation of historical industrial/manufacturing areas into mixed use commercial and residential spaces.

The Site was occupied by the West Chemical Company (West Chemical) from the early 1900s until 1977. West Chemical manufactured a variety of commercial and household disinfectants, soaps, floor waxes, insecticides, and paper product dispensing machines. West Chemical stored a variety of other materials on-Site during its tenancy, including muriatic (hydrochloric) acid, alcohol, rosin, fats, and oils. These materials were used in the manufacture of hand creams, cleaning products (floor waxes and cleaners), and vending machine products. The manufacture of a disinfectant “Coronoleum” (CN+) prior to 1950 resulted in the storage of large quantities of creosote on the western side of the property.

3.1.1 Previous Investigation Findings

Previous BCP Site investigations identified the following three historic instances of creosote contamination:

- Leaks in the bottoms of several aboveground storage tanks (ASTs). These are believed to all be removed.
- In 1950, the New York City Fire Department (FDNY) deliberately released the contents of a 5,000-gallon AST of creosote to the ground during a fire as an explosion prevention measure.
- Former West Chemical personnel identified that creosote was historically delivered to the plant by means of a rail siding and the creosote was pumped into a fill line and delivered to storage tanks.

The following summarizes the history of petroleum bulk storage on the BCP Site:

- Two, 500-gallon, gasoline underground storage tanks (USTs) were identified and were removed in 2003. They were located near the parking area that lies along Orchard Street.
- Four heating oil USTs were installed between 1947 and 1948. These USTs were originally used to store No. 6 fuel oil and later converted to No. 4 fuel oil. In 1990, the USTs were closed-in-place and a natural gas-fired heating system was installed. These are located in the western part of Building 10.
- Twenty-two aboveground storage tanks (ASTs) were identified on the Site in the 1940s and 1950s. The ASTs ranged in capacity from 3,000 to 24,000 gallons, with a total tank volume of 260,575 gallons. These have been removed.
- Forty-five process/storage vaults and kettles filled with unknown liquid were encountered in Buildings 2B, 3A, and Buildings 3A and 3B, and 10. The composition of the liquid and quantity, if any, is unknown for all of the units, but water mixed with soap and/or lye is suspected in at least one unit.

Seven previous environmental investigations, beginning in 1988, consisted of varying levels of soil and groundwater investigation, Non-Aqueous Phase Liquid (NAPL) product-level studies, and collection of soil gas data across the Site. Previous investigations included the following studies:

1. *Queens Plaza Site B Investigation*, AKRF, 1988
2. *Outlet City Soil and Groundwater Sampling Results*, AKRF, 1990
3. *Outlet City Property, Supplemental Site B Assessment/Remedial Investigation*, AKRF, 1998

4. *Soil and Groundwater Sampling and Analysis*, ELM, 2001
5. *Site Investigation*, AKRF, 2002
6. *Additional Remedial Investigation Report (Draft)*, Fleming-Lee Shue, Inc., February 2007
(and updated draft revision February 2010)
7. *Site Characterization Investigation Data Summary*, SCS Engineers, July 12, 2013.

4.0 HAZARD ASSESSMENT

4.1 Chemical Hazards

Soil and groundwater contaminants that may be encountered during drilling and sampling activities include both organic and inorganic compounds. Based on historic use of the BCP Site, compounds such as creosote, volatile organic compounds (VOCs), Polycyclic Aromatic Hydrocarbons (PAHs), polychlorinated biphenyls (PBCs) and metals may be present in soil and/or groundwater. The toxicological, physical, and chemical properties of potential contaminants are presented in Table 1. Material Safety Data Sheets (MSDSs) / Safety Data Sheets (SDS) for chemical products found at the BCP Site are provided in Appendix B where they are available for review by project personnel during field operations.

4.1.1 Carbon Monoxide Hazards

Carbon monoxide (CO) is a colorless, odorless, and toxic gas, which is predominately produced by incomplete combustion of carbon-containing materials. Incomplete combustion occurs when insufficient oxygen is used in the fuel (hydrocarbon) burning process. Common sources of CO may include: motor vehicle exhausts, fuel burning¹, furnaces, coal burning power plants, small gasoline engines including electric generators, demolition equipment, chain saws, lawn mowers and power washers, marine engines, fuel powered forklifts, propane or kerosene-powered heaters, and fuel burning water heaters.

Exposure to CO impedes the blood's ability to carry oxygen to body tissues and vital organs. When CO is inhaled, it combines with hemoglobin (an iron-protein component of red blood cells), producing carboxyhemoglobin, which greatly diminishes hemoglobin's oxygen-carrying capacity. **Hemoglobin's binding affinity for CO is 300 times greater than its affinity for oxygen.** As a result, small amounts of CO can dramatically reduce hemoglobin's ability to transport oxygen.

Common symptoms of CO exposure are headache, nausea, rapid breathing (i.e., shortness of breath), weakness, exhaustion, dizziness, and confusion (i.e., light headedness). Hypoxia (severe oxygen deficiency) due to acute CO poisoning may result in reversible neurological effects, or it

¹ Fuel burning may include natural gas, propane, fuel oil, kerosene, gasoline, coal, or other carbon-based items.

may result in long-term (and possibly delayed) irreversible neurological (brain damage) or cardiological (heart damage) effects.

CO exposure can be dangerous during pregnancy for both the mother and the developing fetus. Please contact CDC-INFO (800-232-4636) if you have any questions regarding CO exposure during pregnancy.

At work sites where carbon-containing fuels are used, such as in internal combustion engines and generators, the exhausts from these units can contain significant concentrations of CO. In situations where the exhausts create exposure to CO, the exhausts of these units should be extended via appropriate hoses/piping to well ventilated exterior areas (i.e., outside and downwind of structures). Where the concentrations of CO exceed the following “action levels”, notify the Project Manager and immediately implement the corresponding actions to mitigate exposure.

Action Levels Table (CO)

Carbon Monoxide (CO) Action Levels²	
Concentration of CO in Air	Action
< 25 ppm	Inspect exhaust system for leaks or other sources of CO. Monitor initially and every 15 minutes during use of CO-generating equipment.
25 – 50 ppm	Ventilate area. Monitor continuously and record measurements. Contact PM.
> 50 ppm	Stop work activities. Ventilate area.

4.2 Physical Hazards

A variety of physical hazards may be present during Site activities. These hazards are similar to those associated with any investigation/construction-type project. These physical hazards are due to motor vehicle and heavy equipment operation and hazardous walking and working surfaces. A hard hat and reflective vest/clothing must be worn at all times while working on-Site. Workers

² Based upon The American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) of 25 ppm as an 8-hour time-weighted average (TWA) [ACGIH 2014 TLVs® and BEIs®] and OSHA’s Permissible Exposure Limit (PEL) of 50 ppm as an 8-hour TWA concentration [29 CFR Table Z-1].

must also be aware of electrical hazards, such as overhead or subsurface power lines, while performing their assigned tasks. These hazards are not unique and are generally familiar to most field personnel. Additional task-specific requirements may be covered during safety briefings.

4.2.1 Flammability/Explosive Hazards

A variety of highly flammable/explosive materials are potentially stored at the Site. Prior to performing activities near potentially flammable/explosive materials, all applicable sections of this HASP specific to these areas need to be thoroughly understood and adhered to. Any questions or concerns should be directed to the SHSO.

4.3 Biological Hazards

Biological hazards include exposure to poison ivy/oak, the possibility of disease carrying insects (i.e., ticks) and a variety of wild animals (i.e., coyotes, raccoons, etc.).

4.3.1 Insect Stings

Stings from insects are often painful, may cause swelling, and can be fatal if a severe allergic reaction, such as anaphylactic shock, occurs. If a sting occurs, the stinger should be scraped out of the skin, opposite of the sting direction. The area should be washed with soap and water, followed by an ice pack. Personnel allergic to bee and/or wasp stings shall alert their PM, SHSO and coworkers immediately, and provide/self-administer medicine and antidotes to treat allergic reactions immediately as prescribed by their personal physician, or if the victim has a history of allergic reaction, he/she should be taken to the designated hospital.

4.3.2 Tick Injury Prevention Program

Ticks may carry Lyme disease, Rocky Mountain spotted fever or other diseases. As such, Roux Associates has instituted a program to prevent tick bites and to provide prompt, adequate and appropriate notifications and treatment in the event of a work-related tick bite. This SOP applies to all Roux Associates employees and their subcontractors and is additionally addressed by applicable JSAs.

4.3.3 Project Planning

Pre-planning is the first step in tick avoidance. Where possible, plan the work to avoid tick-infested areas.

- Avoid brushy, overgrown grassy and wooded habitats, particularly in spring and early summer when nymphal-stage ticks feed.
- Remove leaves, tall grass and brush from areas surrounding work areas (to include residential Sites), thereby reducing tick, deer and rodent habitat.
- Consider having a licensed applicator apply tick-toxic chemicals (e.g., Damminix, Dursban, Sevin, etc.) to surrounding work or residential areas to suppress the tick population.
- Consider performing work during dormant (sub-freezing) seasons; or not during maximum season (spring and early summer) unless it is not practical or rescheduling may introduce other hazards.

4.3.4 Tick Injury Prevention Measures

Where avoidance of tick habitat or clearing of the area is not possible, follow Roux Associates' Tick Prevention SOP which includes the use of PPE and other measures to avoid tick bites. These include:

- Using Permethrin on clothes to kill ticks on contact;
- Wearing light-colored clothing so that ticks can be more easily seen and removed before attachment occurs;
- Wearing long-sleeved shirts and tucking in (or taping) pant legs into socks or boots to prevent ticks from reaching the skin;
- Wearing high boots or closed shoes that cover the entire foot;
- Wearing a hat; and
- Spraying insect repellents containing n,n-diethylm-toluamide (DEET) on exposed skin, excluding the face, in accordance with United States Environmental Protection Agency (USEPA) guidelines.

Tick prevention measures as described above must be implemented prior to entering a potentially tick-infested area. This usually means that the PPE needs to be in place and properly worn before stepping off of a paved or concrete area onto a grassy or wooded area. Pant legs need to be tucked into socks. Where Tyvek is used, the pant legs need to be taped at the ankles.

Insect repellent should be applied in accordance with the manufacturer's instructions. In the event of sensitive ecosystems ensure that the application does not need to be applied at a certain distance from the habitat.

The PPE needs to remain on with the tucking or taping of pant legs, all closures fastened, etc., until leaving the potentially tick-infested area. Upon leaving the area, remove the PPE and bag it to prevent ticks from traveling and subsequently attaching themselves to your skin.

Workers are to inspect themselves and co-workers frequently to see if any ticks are on their clothing and remove them as soon as they are identified. If an embedded tick is found, it should be promptly removed with tweezers. This should be done by grasping the tick firmly and as close to the skin as possible. Then, with a steady motion, pull the tick's body away from the skin. Cleanse the area with an antiseptic. DO NOT use petroleum jelly, a hot match, nail polish or other products to remove the tick. **Preserve the tick for analysis (i.e., by placing in a zip lock bag, envelope, or jar). The tick will be analyzed to determine if it contains the bacteria capable of causing Lyme disease.** After returning home, it is also important to do another thorough examination while showering as a further check that no ticks were missed in previous inspections. Also, it is recommended that any work clothes be washed and dried at high temperatures.

4.3.5 Responding to Known or Suspected Tick Bites

Any discovery of a tick embedded in the skin where the tick contact may have occurred at work will require (in addition to project management) immediate contact of the Office Manager, OHSM, and CHSM.

Medical practitioners consulted by Roux Associates recommend not administering an antibiotic until AFTER symptoms such as rash, flu-like symptoms, fever, joint or muscle aches, nausea or vomiting develop which could take a few days. Therefore, for tick bites determined to be work related, **antibiotics should not be prescribed or administered until AFTER the results of the tick testing are reviewed and until after any characteristic symptoms develop.**

4.3.6 Tick Incident Investigation and Reporting

Investigation and reporting of a work-related tick bite will follow established incident investigation and reporting procedures. The Roux Associates Health & Safety Lessons Learned (H&SLL) / Accident Report Forms (ARF) will be used for documenting incidents as appropriate, and are provided in Appendix C.

4.3.7 Animals and Animal Wastes

There is potential for various wildlife to reside within the structures, including, but not limited to pigeons, bats, mice, rats, squirrels, raccoons, stray dogs, and feral cats. Certain animals can represent significant sources (vectors) of disease transmission. Precautions to avoid or minimize potential contact with (biting) animals (such as some of the above listed) or animal waste and/or dead animals should be considered prior to all field activities. Rats, squirrels, raccoons, feral cats, and other wild animals can inflict painful bites which can also cause disease (as in the case of rabid animals). Site personnel should avoid contact with any of the above.

If contact occurs, be sure to clean the area thoroughly with soap and water as soon as possible. If a bite occurs, the area should be cleaned thoroughly immediately with soap and water and medical attention should be sought.

4.3.8 Blood-Borne Pathogens

The majority of the occupational tasks on-Site will not involve a significant risk of exposure to blood, blood components, or body fluids. The highest risk of acquiring any blood borne pathogen for employees on-Site will be following an injury. When administering first aid care, there are potential hazards associated with blood borne pathogens that cause diseases such as Human Immunodeficiency Virus (HIV), Hepatitis B (HBV), Hepatitis A (HAV), Hepatitis C (HCV), or the Herpes Simplex Virus (HSV). An employee who has not received the appropriate certification and blood borne pathogens training should never perform first aid and/or cardiopulmonary resuscitation (CPR).

In order to minimize any potential pathogen exposure, all employees should use the hand washing facilities on a regular basis. The decontamination area will provide an adequate supply of water,

soap, and single use towels for hand washing. Additionally, the following universal precautions should be followed to prevent further potential risk:

- Direct skin or mucous membrane contact with blood should be avoided.
- Open skin cuts or sores should be covered to prevent contamination from infectious agents.
- Body parts should be washed immediately after contact with blood or body fluids that might contain blood, even when gloves or other barriers have been used.
- Gloves and disposable materials used to clean spilled blood shall be properly disposed of in an approved hazardous waste container.
- First aid responders shall wear latex or thin mil nitrile gloves when performing any procedure risking contact with blood or body substances.
- Safety glasses will be worn to protect the eyes from splashing or aerosolization of body fluids.
- A CPR mask will be worn when performing CPR to avoid mouth-to-mouth contact.
- Cut-resistant work gloves will be worn to minimize the risk of injury to the hands and finger when working on all equipment with sharp or rough edges.
- Broken glass or possible contaminated material shall be avoided with unprotected hands.

4.3.9 Mold

A collection of moisture inside on-Site structures may lead to the growth of mold within the structures.

Although mold affects individuals differently and to different degrees, the following are some of the most common adverse health effects:

- Respiratory problems – wheezing, difficulty breathing;
- Nasal and sinus congestion;
- Eyes – burning, watery, reddened, blurry vision, light sensitivity;
- Dry, hacking cough;
- Sore throat;
- Nose and throat irritation;
- Shortness of breath and lung disease;
- Chronic fatigue;

- Skin irritation;
- Central nervous system (headaches, loss of memory, and mood changes);
- Aches and pains;
- Fever;
- Headaches;
- Diarrhea; and
- Immune suppression.

Decisions about removing individuals from an affected area must be based on the results of a medical evaluation, and be made on a case-by-case basis.

Workers that discover the visible presence of mold in excess of ten square feet need to notify the SHSO for consultation. If a worker smells mold and feels that he/she is experiencing symptoms of exposure, he/she should retreat and report the symptoms to the SHSO.

4.3.10 Other Biohazards

Other biological hazards include mosquitoes which generally live in the vicinity of brush, trees, and stagnant water. Some areas have mosquitoes that carry viruses (for example, West Nile virus, or Eastern Equine Encephalitis). Another category of biohazards include plants such as poison ivy, poison oak, and poison sumac. If exposed to these plants, personnel will wash skin thoroughly with soap and water or post-contact cleansers.

4.4 Heat/Cold Stress

Heat and cold stress are potential hazards associated with heavy physical activity and/or the use of personal protective equipment in hot or cold weather environments. Heat and Cold stress are discussed in Sections 9.13 and 9.14. Protection against sun exposure by wearing a sun screen, hat, and long-sleeved shirts must be implemented when warranted in addition to frequent and proactive hydration of workers.

4.5 Noise

Noise is associated with the operation of heavy equipment, power tools, pumps, and generators. Personnel with 8-hour time weighted average (TWA) exposures exceeding 85 decibels (dB) must

be included in a hearing conservation program in accordance with 29 CFR 1910.95. High noise operations will be evaluated by the SHSO. Noise exposure will be controlled through the use of hearing protection such as ear plugs or ear muffs or by maintaining set-backs from high-noise equipment as warranted.

4.6 Hazards Caused by Roux's Work

Roux Associates will advise the Client of any unique hazards presented by its work or of any hazards found by Roux during the course of its work for the Client.

- Heavy equipment and motor vehicle traffic- Workers shall wear fluorescent, reflective Class 3 vests or high visibility outerwear in high traffic areas and utilize traffic cones, barricades and caution tape to protect work areas, as necessary;
- Slip, trip, fall hazards associated with uneven terrain, obstacles, and slippery or icy surfaces- General housekeeping will be performed to reduce slip, trip and fall hazards;
- Sharp edges, broken glass, exposed nails, rusty metal (wear leather or ANSI Level 2 cut-resistant gloves);
- Pinch points (wear leather or ANSI Level 2 cut-resistant gloves);
- Overhead hazards (wear hard hats as applicable); and
- Flying objects and airborne particulate hazards (Wear safety glasses, goggles, or face shields when appropriate).

4.7 Electrical Hazards

Portable pumps, generators, and other power tools require proper grounding and/or a ground fault circuit interrupter (GFCI) before operation. Personnel should never attempt to move an operating pump or generator.

5.0 TRAINING REQUIREMENTS

5.1 Basic Training

All 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 onsite per OSHA (29 CFR 1920.120(e)). Initial and annual training will include the locations of and proper use of safety equipment such as portable fire extinguishers. American Red Cross basic first aid and adult CPR will be offered to employees approximately every two years. Training records will be maintained by the SHSO onsite and as described in Section 6.4. OSHA HAZWOPER training will be provided annually and is limited to first responder awareness level only. Where training is required by a specific health or safety standard, this will be conducted initially and annually and will include the information summarized in the Toxicological Table, Table 1 of this HASP.

5.2 Site-Specific Training

Training will be provided by the SHSO and PM/SM that specifically addresses the activities, procedures, monitoring and equipment to be utilized by site personnel and visitors. The training will include site and facility layout, hazards, emergency services at the site, and will detail all provisions contained within this HASP. Where a facility is subject to OSHA's Process Safety Management (PSM) Standard, 29 CFR 1910.119, employees will be trained in the purpose of PSM, namely, to prevent or minimize consequences of catastrophic releases of toxic, flammable or explosive chemicals. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity. Site-specific training will be documented and kept as part of the project records.

Where employees may be exposed to lead, employees shall be informed of 29 CFR 1910.1025 and 29 CFR 1926.62, Appendices A and B. All affected employees are required to attend initial and annual training programs. The employees will be informed of the specific nature of the operations which could result in exposure to lead above the action level, the purpose, proper selection, fitting, use, and limitation of respirators, engineering controls, purpose and a description of the medical surveillance program and medical removal program.

5.3 Safety Briefings

Project personnel will be given briefings by the SHSO, the PM and/or the Client's Project Engineer on an as-needed basis to further assist them in conducting their activities safely. Safety briefings will be provided each morning and when new operations are to be conducted; changes in work practices must be implemented due to new information made available and before work is begun at each onsite work area. Safety briefings will include a discussion of anticipated hazards, review Job Safety Analyses for tasks to be implemented, pertinent Loss, Lessons Learned, Peer Observation finding, and safety violations. These include not following Client rules or procedures, not following established safe work practices, and lack or improper use of personal protective equipment/clothing, etc. On-site safety briefings will be documented daily on the forms included as Appendix D (Health and Safety Briefing/Meeting Log and Daily Site Safety Checklist), and will be kept by the SHSO as part of the project records. In addition, when activities are to be conducted which are not specifically addressed by this HASP, appropriate JSAs will be reviewed to determine the appropriate levels of health and safety required. If a JSA for the specific activity does not exist, one will be prepared by the field work team, reviewed for completeness by the Project Manager, and implemented as required by the work scope. Copies of the completed JSA forms for various tasks are included in Appendix A. Modifications to JSAs will be documented on these forms and maintained in the project file. Observed safety violations will be addressed by coaching and mentoring of personnel.

5.4 Record Keeping Requirements

All record keeping requirements mandated by OSHA (29 CFR 1910.120) will be strictly followed. Specifically, all current personnel training records, medical fit for duty papers, and respirator fit test forms will be required before work can begin and maintained onsite during the length of the project. These records along with injury/incident reports, medical examination records and exposure monitoring records will become a permanent part of the project records. Each subcontractor will maintain the above-mentioned records for his employees.

Medical and exposure records maintained per 29 CFR 1910.1020 will be maintained for at least the duration of employment plus 30 years. Training records will be maintained for 3 years from the date of training.

Medical and exposure records shall be made available upon request to employees, and to the Assistant Secretary or the Director (OSHA) for examination and copying. Medical records must have written consent of employee before being released. Transfer of records will be in compliance with 29 CFR 1910.1020 (h).

6.0 ZONES, PROTECTION, AND COMMUNICATIONS

6.1 Site Zones

A three zone approach to site operations to control the potential spread of contamination will be employed. The three zones are:

- The Exclusion Zone;
- The Contamination Reduction Zone; and
- The Support Zone.

The establishment of work zones will ensure that: personnel are properly protected against the potential hazards in the area where they are working; work activities and potential contamination are limited to the specific areas; and personnel can be easily located and evacuated in an emergency.

The establishment of work zones and the levels of protection required within the zones will be determined on a case-by-case basis. The SHSO, PM and the Client's Project Engineer will determine the need for work zones, and based upon Site-specific knowledge and data, determine the levels of protection within the established zones. The following sections provide general specifications for the three work zones.

6.1.1 Exclusion Zone

The area(s) which contain, or are suspected to contain, hazardous materials or activities will be considered the Exclusion Zone (EZ). The SHSO may establish more than one restricted area within the EZ when different levels of protection may be employed or different hazards exist. Signs will be posted in and around areas required to be posted by a specific health or safety standard. No personnel are allowed in the EZ without:

- The proper personal protective equipment;
- Medical authorization per Section 8.4;
- A need to be in the zone; and
- Training certification.

During excavation, drilling and sampling activities, the Exclusion Zone is defined as the excavation and a 10-foot radius around the excavation boundary, or drilling or sampling locations. For the purposes of this project, the Exclusion Zone(s) will be delineated once the work sites have been determined.

6.1.2 Contamination Reduction Zone

A Contamination Reduction Zone (CRZ) will be established between the Exclusion Zone and the Support Zone. The CRZ will contain the contamination reduction corridor (CRC) and is designed to reduce the probability that the uncontaminated clean areas will become contaminated or affected by other site hazards. It is the area where decontamination of personnel and equipment takes place and serves to limit the physical transfer of hazardous substances into clean areas. Decontamination shall be performed in geographical areas that minimize the exposure of uncontaminated employees or equipment to contaminated employees or equipment. The CRZ is to be used for general site entry and egress including access for heavy equipment for investigation activities. The CRZ will also contain safety and emergency equipment (see Section 7.2.3). No personnel are allowed in the CRZ without:

- The proper personal protective equipment;
- Medical authorization per Section 8.4;
- A need to be in the zone; and
- Training certification.

Unauthorized employees shall not remove protective clothing or equipment from change rooms.

6.1.3 Support Zone

The Support Zone (SZ) is considered the uncontaminated area and will be separated from the CRZ by the "Contamination Control Line". The SZ will contain the support facility that will provide for team communications and emergency response. Appropriate sanitary facilities and safety and support equipment will be located in this zone. The majority of site operations as well as site access of authorized persons will be controlled from this location. The support facility will be located up-wind of site operations, if possible, and may be used as a potential evacuation point. No potentially contaminated personnel or materials are allowed in this zone.

6.1.4 Buddy System

Select field activities conducted in contaminated, hazardous, and remote areas of the Site may require the use of the buddy system. Instances when the buddy system should be employed include, but are not limited to activities performed in wetland areas (i.e., surface-water sampling, etc.), excavation activities, drilling activities and confined space entry (permit required and non-permit required). Prior to commencing with field tasks in a potentially hazardous area, the need for using the buddy system should be evaluated. If required, a buddy should be able to:

- Provide his/her partner with assistance;
- Observe his/her partner for signs of chemical or heat/cold exposure;
- Periodically check the integrity of his/her partner's protective clothing; and
- Notify the SHSO or others if emergency help is needed.

6.2 Personal Protection

This section describes the levels of protection that will be required by on-Site personnel during Site activities.

6.2.1 General

The level of protection to be worn by field personnel and visitors will be defined and controlled by the SHSO, the PM and the Client's Project Engineer. Where more than one hazard is indicated, further definition shall be provided by review of Site hazards, conditions, and operational requirements and by monitoring at the particular operation being conducted.

Intrusive activities (i.e., drilling, excavation activities, etc.) include any Site activity which will, or potentially will, result in exposure(s) to hazardous or toxic chemicals or physical agents at or above the permissible exposure limit (PEL), or to flammable or oxygen-deficient atmospheres. Prior to commencing with any field activity, the potential for such conditions should be evaluated to determine air monitoring requirements. General procedures for air monitoring are described below.

During intrusive activities, continuous monitoring will be performed using the photoionization detector (PID) and Dräger or Sensidyne tubes for initial and periodic real-time measurements of

benzene. Personnel monitoring utilizing activated charcoal tubes may also be performed in areas where high benzene concentrations were present during previous investigations. If personal monitoring is needed, it will only be undertaken under the direction and direct supervision of the CHSM.

The use of Dräger or Sensidyne tubes for benzene will allow the SHSO to make an immediate decision on the adequacy of protection against this compound. Should the PID or Dräger or Sensidyne tubes indicate that any detectable concentration for this constituent has been exceeded, work will cease in this area until:

- Workers have donned a full-face air-purifying respirator; or
- The concentration levels for benzene are below the Dräger or Sensidyne tube detection levels.

Based upon the results of air measurements of intrusive activities in these worst case areas, the level of personnel protection will be established for the remainder of the Site. Protection may be upgraded or downgraded by the SHSO in conjunction with the PM based upon the PID instrument and Dräger or Sensidyne tube results.

All non-intrusive activities that preclude contact with contaminated media will be performed in Level D protection without continuous monitoring, unless periodic PID monitoring indicates additional monitoring is warranted. However, initial monitoring may be necessary utilizing the PID and the Dräger or Sensidyne tubes and/or personal monitoring (charcoal tubes).

6.2.2 Respiratory Protection and Clothing

Three levels of protective equipment are discussed below including Level D, Level C, and Level B.

Level D Protection

1. Personal Protective Equipment:
 - High visibility/reflective coveralls/clothing
 - Cut Resistant gloves (or leather work gloves);
 - Boots/shoes, leather, or chemical-resistant, steel toe and shank;
 - Ice cleats⁽¹⁾;

- Boots (outer), chemical-resistant (disposable)*;
- Chemical resistant gloves – nitriles*;
- Chemical resistant clothing (e.g., Tyveks)*;
- Fire Retardant Clothing⁽²⁾*
- Safety glasses or chemical splash goggles⁽³⁾;
- Hard hat; and
- Hearing protection.

* Optional for activities except when handling petroleum product (i.e., well bailing) and materials (i.e., soil, sorbent products, etc.) exhibiting high degrees of petroleum contamination

- ⁽¹⁾ Ice Cleats to be worn with approved safety shoes when working in areas with snow/ice cover.
- ⁽²⁾ Fire retardant coveralls required in areas of hot work/areas with potential for flash (i.e., truck flammable loading rack, within tank berms)
- ⁽³⁾ Clear lenses to be worn when working in low light areas inside site buildings and outside during overcast days that may limit visibility.

2. Criteria for Selection.

- Non-intrusive activities and intrusive activities in areas where the potential airborne hazards are substantially characterized and do not pose a threat of exposure in excess of one-half the PEL.
- PID instrument (such as the MiniRAE 3000 or other comparable instrument) readings in the breathing zone are less than 5 ppm and benzene and furfural are not detectable utilizing colorimetric indicator tubes (e.g., Dräger or Sensidyne). Work functions preclude splashes, immersion, or potential for unexpected inhalation of any chemicals.

Notes: 1. Benzene and furfural may also be monitored initially and periodically in the breathing zone utilizing activated charcoal sampling devices.

- 3. Modifications of Level D will be used to increase or decrease the level of skin protection during activities that increase or preclude, respectively, the degree of contact with chemical hazards. Modifications for increased protection may include the use of chemical resistant coveralls (e.g., Tyveks) and chemical resistant gloves. Chemical resistant coveralls, gloves and boots will be used when the handling of petroleum products is required (i.e., well bailing). Any modifications of Level D will require approval of the SHSO and PM.

Protection may be upgraded or downgraded by the SHSO in conjunction with the Project Principal on the basis of action levels presented below:

Action Levels for Respiratory Protection (Total Organic Vapors)

Total Organic Vapors in Breathing Zone (ppm)⁽¹⁾	Action
≤ 5	No Action
> 5 – < 25	Cease Field Operations
≥ 25	Cease Field Operations

⁽¹⁾ Based on relative response (sensitivity of PID to total organic vapors).

PID Action Levels

If photoionization detector measurements are above 5 ppm-v but below 25 ppm-v above background for five minutes in the breathing zone, employee protection will be upgraded to Level C with the use of a full-face respirator.

If PID measurements exceed 25 ppm-v above background for five minutes in the breathing zone, work activities will cease until airborne vapor levels can be reduced to less than 25 ppm-v and are quantified or the SHSO determines alternate methods to be followed in order to proceed.

Most activities are conducted outdoors, where breathing of high vapor levels are not likely in aboveground areas. Excavations which are not to be entered are likely to have higher vapor concentrations. Where a spill occurs in a basement or other indoor area, ventilation will not be as good as outdoors and extra care shall be taken in monitoring vapor levels.

Action Levels for Oxygen Levels and Combustible Gases

COMBUSTIBLE GASES ¹	
0-2.0 – 2.0% LEL	Continue monitoring
2.0 – 5.0% LEL	Notify SHSO
5.0% LEL or greater	Potential explosion hazard Interrupt task / Evacuate Area

Action Levels for Oxygen Levels and Combustible Gases

OXYGEN ¹	
20.8% O ₂	Oxygen level normal
Greater than 22.0% O ₂ / Less than 20.0% O ₂	Oxygen enriched / deficient – notify SHSO
Greater than 23.5% O ₂ / Less than 19.5% O ₂	Oxygen enriched / deficient Interrupt task / Evacuate area

¹ Action levels are based on Environmental Protection Agency Standard Operating Safety Guides; Table 5-1, Atmospheric Hazard Action Guidelines may be further restricted based on the CIH's professional judgment and experience.

Level C Protection

1. Personal Protective Equipment:

- Full-face, air-purifying, cartridge-equipped respirator (MSHA/NIOSH specifically approved for protection from organic vapors per OSHA 1910.1028);
- Chemical-resistant clothing (coverall; hooded, two-piece chemical splash suit; chemical-resistant hood and apron; disposable chemical-resistant coveralls);
- Gloves (outer), chemical-resistant - nitriles;
- Gloves (inner), chemical-resistant - latex;
- Boots (inner), chemical-resistant, steel toe and shank;
- Boots (outer), chemical-resistant (disposable*);
- Hard hat;
- Hearing protection;
- Escape mask*.

* Optional

2. Criteria for Selection.

Meeting any of these criteria warrants use of Level C protection.

- Airborne hazards are known to be present but are unlikely to exceed protection factors provided by air-purifying respirators.
- Continuous total organic vapor readings in the breathing zone register between 5 ppm and 25 ppm on a PID (such as the MiniRAE 3000 or other comparable instrument), benzene and furfural readings utilizing colorimetric indicator tubes (e.g., Dräger or Sensidyne) are detectable but less than 5 ppm.

- Measured air concentrations of known organic vapors will be reduced by the respirator to, at, or below one-half the permissible exposure limits, and the individual and combined compound concentrations are within the service limit of the respirator cartridge.
- Atmospheric contaminant concentrations do not exceed Immediately Dangerous to Life and Health (IDLH) concentrations.
- Atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect the small area of skin left unprotected by chemical-resistant clothing.
- Job functions have been determined not to require self-contained breathing apparatus.

Notes: 1. Benzene and furfural may also be monitored initially and periodically in the breathing zone utilizing activated charcoal sampling devices.

2. Modifications of Level C will be used to increase or decrease the level of skin protection during activities that increase or preclude, respectively, the degree of contact with chemical hazards. Modifications for increased protection may include the use of chemical resistant coveralls (e.g., Tyveks) and chemical resistant gloves. Any modifications to Level C will require approval of the SHSO and PM.

Level B Protection

1. Personal Protection Equipment:

- Pressure-demand, self-contained breathing apparatus (MSHA/NIOSH approved);
- Chemical-resistant clothing (overall and long-sleeved jacket; coveralls; hooded, one or two-piece chemical-splash suit; disposable chemical-resistant coveralls);
- Gloves (outer), chemical-resistant;
- Gloves (inner), chemical-resistant;
- Boots (inner), chemical-resistant, steel toe and shank;
- Boots (outer), chemical-resistant, (disposable);
- Hard hat;
- Hearing protection; and
- Two-way radio communications (intrinsically safe).

2. Criteria for Selection

Meeting any one of these criteria warrants use of Level B protection:

- PID instrument (such as the MiniRAE 3000 or other comparable instrument) readings in the breathing zone are greater than 25 ppm and less than 500 ppm, benzene and

furfural are detectable at concentrations at or above 5 ppm utilizing colorimetric indicator tubes (e.g., Draeger or Sensidyne).

- Airborne hazards are known to be present, but are not identified or quantified.
- The type(s) and atmospheric concentration(s) of toxic substance(s) have been identified and require the highest level of respiratory protection, but a lower level of skin and eye protection. These would be atmospheres:
 - ♦ With IDLH concentrations;
 - ♦ Exceeding limits of protection afforded by a full-face, air-purifying respirator; or
 - ♦ Containing substances requiring air-supplied equipment, but substances and/or concentrations do not represent a serious skin hazard.
- The atmosphere contains less than 19.5% oxygen.
- Site operations make it highly unlikely that the small, unprotected arc of the head or neck will be contacted by splashes of extremely hazardous substances.
- If work is performed in an enclosed space where the exposure to toxics or an oxygen deficient atmosphere may be present.

6.2.3 Safety Equipment

Basic emergency and first aid equipment will be available at the Support Zone and/or the CRZ as appropriate. This shall include first aid kit, emergency eyewash, fire extinguishers, and other safety-related equipment.

Field personnel will be notified of the locations of emergency and first aid equipment prior to commencing with field activities.

Hand Tools

Where hand and power tools are used and employees are potentially exposed to the hazard of falling, flying, abrasive, or splashing objects, or are exposed to harmful dust, fumes, mists, vapors, or gases, the employees shall be provided the appropriate Personal Protective Equipment as necessary to protect them from the hazard.

Communications

Mobile Telephones – for communication with emergency support services/facilities. All Roux Associates, Inc. site personnel will be equipped with a mobile phone. Mobile communications, however, will be prohibited when the user is within the work area to avoid injuries resulting from distraction.

7.0 MONITORING PROCEDURES FOR SITE OPERATIONS

7.1 Air Quality Monitoring During Site Operations

The SHSO will monitor wind direction and temperature during monitoring and record all data in a log book. All monitoring equipment will be calibrated to the manufacturer's specifications each day prior to use and documented in Site field books.

7.2 Air Quality Monitoring During Intrusive Activities

General air monitoring will be performed in accordance with the Generic Community Air Monitoring Plan included in Appendix E during intrusive Site activities. Intrusive activities include any Site activity which will, or will possibly, result in exposure(s) to hazardous or toxic chemicals or physical agents at or above a permissible exposure limit (PEL), or to flammable or oxygen-deficient atmospheres. Prior to commencing with any field activity, the potential for such conditions should be evaluated to determine air monitoring requirements. General procedures for air monitoring are described below.

Air monitoring will be performed to establish the concentrations of volatile organic compounds during invasive activities using the following instrument(s):

- Photoionization detector;
- Colorimetric indicator tubes (e.g., Dräger or Sensidyne); and
- Activated charcoal sampling devices, if necessary.

The PID and colorimetric indicator tubes will be used to provide direct readings of organic vapor concentrations during intrusive activities to determine that personnel protection is adequate.

A combustible gas LEL/O₂ meter will be used to monitor the potential for oxygen-deficient atmospheres and for explosive concentrations of organic vapors during intrusive operations and confined space work. Monitoring will be performed according to the action levels for oxygen and combustible gases provided in Section 7.2.2.

If applicable, a hydrogen sulfide meter will be utilized to monitor the potential presence of hydrogen sulfide gas. The hydrogen sulfide meter will be used to provide direct readings of concentrations of this gas during intrusive activities. Monitoring will continue if hydrogen sulfide

concentrations are detected but do not exceed 5 ppm. Work will cease and the area will be excavated if hydrogen sulfide concentrations are 10 ppm or higher.

7.2.1 Level D Intrusive Activities

Level D intrusive activities will initially include all intrusive Site activities. These investigations/activities will begin utilizing Level D protection as described in Section 7.2.2, with upgrading as necessary to assure adequate personnel protection.

The SHSO will monitor the breathing zone with the PID in continuous operating mode and with the alarm activated. The alarm will be set at 5 ppm, which is below the permissible exposure level (PEL) for all constituents of concern, except benzene and furfural. If the PID indicates the 5 ppm concentration has been exceeded, the SHSO will order cessation of the activity and the exclusion zone cleared of all personnel until the PID indicates a reading less than 5 ppm, or until the nature of the hazard has been more thoroughly evaluated.

Colorimetric indicator tubes will be used to establish the concentration of benzene and furfural. Furfural may be detected utilizing the Sensidyne tube for Cyclohexanone (#154). The colorimetric indicator tubes may not be chemical-specific for these compounds but will be conservatively biased high and the readings will be assumed to be benzene or furfural, which will enable the SHSO to make an immediate decision on the appropriate level of protection. Benzene and furfural may also be monitored initially in the breathing zone, using activated charcoal sampling devices if approved by, and under the direct supervision of, the CHSM. If any detections of benzene and/or furfural are noted based on the colorimetric indicator tube readings, the SHSO will order cessation of the activity until: 1) the benzene and/or furfural concentrations are non-detectable by the colorimetric indicator tubes; or 2) all potentially exposed personnel have donned Level C respiratory protection as described in Section 7.2.2., and PID readings are less than 5 ppm; or 3) until the nature of the hazard has been more thoroughly evaluated and it is determined that the measured compound(s) was not benzene and/or furfural.

To confirm the adequacy of respiratory protection, personnel monitoring (short-term and full shift, as appropriate) utilizing activated charcoal sampling devices may be performed to measure the airborne concentrations of benzene and furfural and possibly other organic and inorganic

compounds (as necessary) at beginning of new activities and periodically during intrusive activities. These samples would be sent to an American Industrial Hygiene Association (AIHA) accredited laboratory for analysis using the approved National Institute of Occupational Safety and Health (NIOSH) analytical methods. If initial monitoring results exceed the applicable action level for a compound of concern, additional monitoring will be conducted every six months until two consecutive results are below the action level. Whenever air monitoring is undertaken to evaluate employee exposure, employees will be notified of the results in writing to include any corrective actions to be or that are being taken. If a corrective action program is necessary, it will be developed (and updated annually) to include engineering and work practice controls, air monitoring and a description of lead-emitting sources.

Where employees may be exposed to lead, full shift personal samples will be taken that are representative of the employees' regular, daily exposure to lead. If the initial determination or subsequent monitoring reveals employee exposure to be at or above the action level but below the permissible exposure limit the employer will repeat monitoring in accordance with 29 CFR 1910.1025 (d)(6)(ii) and (iii)/29 CFR 1926.62 (d)(6)(ii) and (iii) at least every six months. This monitoring will be continued at the required frequency until at least two consecutive measurements, taken at least 7 days apart, are below the action level at which time the monitoring may be discontinued.

Within 15 working days after the receipt of the results of any lead monitoring the employer shall notify each affected employee of these results either individually or by posting in an appropriate location that is accessible to affected employees. Whenever the results indicate that the representative employee exposure, without regard to respirators, exceeds the permissible exposure limit, the employer shall include in the written notice a statement that the permissible exposure limit was exceeded and a description of the corrective action taken or to be taken to reduce exposure to or below the permissible exposure limit.

If needed, a Site-specific compliance program for controlling lead exposure will address means of engineering and work practice controls, air monitoring, and a description of each operation in which lead is emitted. This program then would be revised and updated at least annually.

Respirators will be used during the time period necessary to install or implement engineering or work practice controls, where engineering and work practice controls are insufficient and in emergencies.

7.2.2 Level C Intrusive Activities

Level C intrusive activities will initially include only those activities which require upgrading from Level D. Level C protection will be as described in Section 7.2.2, with upgrading, as necessary, to Level B to assure adequate personnel protection. Downgrading to Level D protection will also be possible if monitoring demonstrates no inhalation hazard exists for the activity.

The SHSO will monitor the breathing zone with the PID in continuous operating mode and with the alarm activated. The alarm will be set at 5 ppm, which is below the permissible exposure level (PEL) for all constituents of concern except benzene and furfural. If the PID indicates the 5 ppm concentration has been exceeded, the SHSO will initiate measurements utilizing the colorimetric indicator tubes for benzene and furfural.

If the PID readings exceed 25 ppm total organic vapor, or the benzene and/or furfural colorimetric indicator tube readings exceed 5 ppm, the SHSO will order cessation of the activity until: 1) the PID indicates a reading less than 25 ppm, and the benzene and/or furfural concentrations are below 5 ppm based upon the colorimetric indicator tube readings, 2) all potentially exposed personnel have donned Level B respiratory protection or, 3) the nature of the hazard has been more thoroughly evaluated and it is determined that the measured concentrations do not pose a potential exposure in excess of the PEL utilizing the Level C protection.

To confirm the adequacy of respiratory protection, personnel monitoring utilizing activated charcoal sampling devices may be performed to measure the airborne concentrations of benzene and furfural and possibly other organic compounds (as necessary) at the beginning of new activities and periodically during intrusive activities. These samples would be sent to an AIHA accredited laboratory for analysis using the approved NIOSH analytical methods.

7.2.3 Level B Intrusive Activities

Level B intrusive activities will initially include only those activities that require upgrading from Level C, and only those activities required to bring work to a safe stoppage. No work is currently planned utilizing Level B protection, and this HASP will require amendment at such time as Level B work becomes necessary (except for safe work stoppage activities).

When Level B protection is utilized, the SHSO will monitor the breathing zone with the PID in continuous operating mode and with the alarm activated. The alarm will be set at 100 ppm. If the PID indicates the 100 ppm concentration is exceeded, the SHSO will order cessation of the activity until: 1) the PID readings are below 100 ppm or; 2) until the nature of the hazard has been more thoroughly evaluated and it is determined that the measured concentrations do not pose a potential exposure in excess of a PEL utilizing the Level B protection.

To confirm the adequacy of respiratory protection, personnel monitoring utilizing activated charcoal sampling devices may be performed to measure the airborne concentrations of benzene and furfural and possibly other organic compounds (as necessary) whenever Level B protection is utilized.

7.3 Air Quality Monitoring During Non-Intrusive Activities

Non-intrusive activities include any Site activity which would not reasonably be expected to result in exposure(s) to hazardous or toxic chemicals or physical agents at or above the permissible exposure limit (PEL), or to flammable or oxygen-deficient atmospheres. Based upon the current understanding of Site conditions, personnel monitoring may be performed using colorimetric indicator tubes or activated charcoal sampling devices on the first day of non-intrusive activities, and periodically thereafter, if the PID readings indicate a more accurate assessment is warranted.

7.4 Medical Surveillance Requirements

Medical surveillance specifies any special medical monitoring and examination requirements as well as stipulates that all Roux Associates personnel and subcontractors contracted directly by Roux Associates are required to pass the medical surveillance examination or equivalent for hazardous waste work required by 29 CFR 1910.120.

The examination will be taken annually, at a minimum, and upon termination of employment with the company at no cost to employees. Additional medical testing may be required by the CHSM, or CHSM in consultation with the company physician and the SHSO, if an overt exposure or accident occurs, or if other site conditions warrant further medical surveillance. For example, if there is potential exposure to lead, blood sampling and monitoring will be conducted in accordance with the OSHA lead standard. In addition temporary removal will be employed for any employee with elevated blood levels along with employee notification of blood sampling results within 5 days and incorporation of Medical Removal Protection benefits.

Medical examinations and procedures shall be performed by or under the supervision of a licensed physician. Medical surveillance is provided without cost to the employees.

Where biological monitoring is performed based on lead exposure, the blood sampling and monitoring should be conducted every 6 months until two consecutive blood samples and analyses are acceptable. The sampling and monitoring should be performed at least monthly during the removal period. Any employee with elevated blood levels should be temporarily removed. Employees should be notified in writing within five days when lead levels are not acceptable. OSHA Standard 29 CFR 1910.1025/29 CFR 1926.62 requires temporary medical removal with Medical Removal Protection benefits.

8.0 SAFETY CONSIDERATIONS FOR SITE OPERATIONS

8.1 General

In this section, non-monitoring, safety-related procedures are described. In general, all site activities should be conducted in accordance this HASP.

8.2 Site Walk-Throughs

Safety considerations during site walk-throughs are important since this activity will usually precede all other field operations. Air monitoring will be performed as indicated in Section 8.0 and will be used to assist in prescribing levels of protection for future site operations, designating site layout and identifying areas of particular hazard, if any.

8.3 Construction Activities

Activities involved with construction of remedial action treatment systems will initially be considered non-intrusive activities. However, initial and/or periodic monitoring, as described in Section 7.2 may be performed by the SHSO.

A variety of physical hazards may be present during any construction-type project. Personnel should be aware of safety issues associated with; noise, cold, hot work such as welding, cutting and burning, heavy lifting, rough terrain, heavy equipment operation, ladders, scaffolding, excavating and trenching, underground and overhead utilities, electrical hazards, and the hazards associated with hand and power tools. These hazards are not unique and are generally familiar to most construction personnel.

8.4 Operation and Maintenance Activities

Once a treatment system is brought on-line (including initial start-up and testing), any personnel involved in sampling, testing, repairs, and operation and maintenance of the system must be health and safety trained before being allowed to work on the system. Certification of compliance with 29 CFR 1910.120 must be provided to, and will be maintained by, the SHSO onsite as described in Section 6.4 of the HASP.

Once a treatment system is on-line, all remedial action treatment system activities will be performed under the requirements of the HASP.

Air monitoring will be performed to establish the general or specific concentrations of benzene and furfural and other chlorinated and non-chlorinated solvents prior to maintenance activities performed on the remedial action treatment system using the following instruments:

- photoionization detector;
- colorimetric indicator tubes; and
- activated charcoal sampling devices, if necessary.

Action levels described in Section 8.0 of the HASP will apply to all remedial action treatment system tasks.

Hearing protection is to be used when performing activities within the [INSERT LOCATIONS] and when performing activities at all soil vapor extraction/air sparge (SVE/AS) treatment systems located on site. Additionally, be sure that appropriate personal protective equipment/clothing is used when handling chemicals (i.e., polymers, coagulants, disinfecting agents, etc.) used during operation and maintenance activities.

If used, ladders will meet the following requirements:

- all rungs will be uniformly spaced or meet OSHA specifications;
- will be inspected prior to each use with defective ladders tagged and taken out of service until destroyed;
- users will maintain 3 points of contact while ascending and descending the ladder and will face the ladder at all times, will not stand on the top two rungs and will avoid carrying items in their hands; and
- side-rails shall be tied off at the top and extend a minimum of 3 feet above the upper landing.
- Extension ladders shall be placed at a 4:1 ratio:
 - will be of the correct load capacity for the task;
 - not loaded beyond that capacity; and
 - will only be used for the purpose for which they were designed.

8.5 Heavy Equipment and Traffic Safety

The SHSO will be present onsite during all invasive operations and will provide health and safety monitoring to ensure that appropriate levels of protection and safety procedures are utilized.

This Site utilizes all of the mechanical equipment used on any major construction site. Typical machinery to be found includes pumps, compressors, generators, portable lighting systems, pneumatic tools (drum openers), hydraulic drum crushers, pug mills, forklifts, trucks, dozers, and backhoes, drill rigs. It poses a serious hazard if not operated properly, or if personnel near machinery cannot be seen by equipment operators.

Roux SOP 1.13R1 outlines Roux policies and procedures regarding Heavy Equipment Exclusion Zone (HEEZ) set up and use. The objective of the Exclusion Zone Policy 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 other equipment entering the HEEZ while the equipment is in operation/moving, to ensure that Roux and Subcontractor employees are not unnecessarily exposed to the hazards of the equipment. Appendix G provides Roux Associates' Heavy Equipment Exclusion Zone SOP.

In addition, the following safety procedures relating to traffic safety must be followed while performing on-site and off-site activities.

On-Site Traffic Safety Procedures

When performing activities on, or adjacent to on-site roads, the following traffic safety procedures must be followed.

- High-visibility coveralls must be worn during Site activities as described in Section 7.2 of this HASP. If possible, the coveralls being worn should be modified via wearing of a reflective vest or with a reflective, reflective stripe(s) when working on, or adjacent to all paved and unpaved roads at the Site.
- When performing activities on, or on the shoulder of any paved roads (e.g., Site entrance and exit roads, the primary roads leading to a truck loading rack, paved areas at a truck loading rack and [INSERT ANY OTHER AREAS]), a minimum of two people must be present. One person will serve as a “traffic watchman” whose sole responsibility is to monitor traffic conditions and alert worker(s) of potential traffic hazards. The “traffic watchman” must be alert at all times and focused on traffic conditions. At no time should the “traffic watchman” engage in activities other than monitoring traffic conditions.

- When performing activities at wells, well vaults, manholes, etc., on, or adjacent to all paved and unpaved roads at the Site, the work vehicle should be positioned, to the fullest extent possible, to form a barrier between the worker(s) and oncoming traffic. In addition, each work vehicle will be equipped with a minimum of four high visibility traffic cones. All traffic cones will be placed as necessary to alert traffic of ongoing activities.
- All Client and Roux Associates subcontractors performing work at the Site must also adhere to the above safety procedures.

Off-Site Traffic Safety Procedures

When performing activities on or adjacent to off-site roads, the following traffic safety procedures must be followed.

- When performing activities on, or adjacent to off-site roads (paved and unpaved), a reflective vest or high visibility outerwear will be worn at all times.
- As described in on-site procedures, when performing activities on, or adjacent to off-site paved roads, a “traffic watchman” must be used at all times.
- The following safety procedures must be adhered to when entering and exiting these areas: the work vehicle should be driven off the road and parked on the unpaved road immediately adjacent. Additionally, use caution when entering and exiting the road, particularly when leaving vehicle to lock/unlock the gate.
- As described in on-site procedures, when performing activities on, or adjacent to off-site roads, the work vehicle should be positioned, to the fullest extent possible, to form a barrier between the worker(s) and oncoming traffic. In addition, a minimum of four 42” high traffic cones will be placed as necessary to alert traffic of ongoing activities.

8.5.1 Inspection

Each piece of potentially hazardous equipment (i.e., power tools,) will be inspected for proper and safe operation prior to its use.

- All mechanical and rigging equipment will be inspected by the operators prior to beginning this work effort, and at least daily thereafter, to ensure proper operating capability and that all guards are adequate and in place. Defective equipment must be repaired or replaced prior to continued use/operation.
- Inspect all cables, sheaves, slings, chains, hooks, and eyes prior to use.
- Secure equipment firmly or make sure it is supported.
- Be sure all power lines are inactivated, removed, or at a safe distance.
- Always use proper loading for capacity at lifting radius.

- Keep all equipment lubricated and maintained.
- Employ signal persons whenever needed.
- Make certain that signals are understood and observed.

8.6 Drilling Operations

The SHSO will be present onsite during all Roux Associates contracted, and when requested, Client contracted, drilling operations. The SHSO will provide health and safety monitoring to ensure that appropriate levels of protection and safety procedures are utilized. The proximity of chemical, water, sewer, and electrical lines will be identified before any subsurface activity or sampling is attempted. Refer to Appendix F for the Roux Associates' Subsurface Utility Clearance Procedure, which provides guidance regarding the identification of subsurface structures through exploratory test-hole advancement to target depths in order to be protective of underground utilities potentially in the borehole location and the health and safety of both onsite personnel and the public.

Proper stockpiling, containment, and disposal practices will be utilized in regard to the potential amount of waste generated during operations. The location of safety equipment and evacuation procedures will be established prior to initiation of operations according to this HASP. The use of hard hats, eye protection, ear protection, hand protection, and steel-toed boots will be required during all drilling operations.

8.7 Excavation and Backfill Operations

The SHSO will be present onsite during all Roux Associates contracted excavation and backfill operations and will provide health and safety monitoring to ensure that appropriate levels of protection and safety procedures are utilized. The proximity of chemical, water, sewer, and electrical lines will be identified by the Client's Project Engineer before any subsurface activity or sampling is attempted.

The following safe work practices will be followed during this task:

- The proximity of chemical, water, sewer and electrical lines will be identified by a facility representative prior to any subsurface activity beginning.

- Roux's subsurface protocol or the Client's protocol will be used, whichever is more stringent.
- While excavating, stay out of the reach of the backhoe arm's swing by standing at the end of the excavation, not near the sides (sides have the potential to cave in).

Maximum Allowable Slopes

Soil or Rock Type	Maximum Allowable Slopes (H:V)¹ for Excavations less than 20 Feet Deep³
Stable Rock	Vertical (90°)
Type A ²	$\frac{3}{4} : 1$ (53°)
Type B	1 : 1 (45°)
Type C	$1\frac{1}{2} : 1$ (34°)

OSHA (29 CFR 1926.652, Subpart P, Appendices A and B)

Notes:

- ¹ Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
- ² A short term maximum allowable slope of 1/2H : 1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H : 1V (53°).
- ³ Sloping or benching for excavations greater than 20 feet deep shall be designed by a Registered Professional Engineer.

Proper stockpiling, containment, and disposal practices will be utilized in regard to the potential amount of waste generated during operations. The location of safety equipment and evacuation procedures will be established prior to initiation of operations according to this HASP. The use of hard hats, eye protection, ear protection, hand protection and steel-toed boots will be required during excavation or other heavy equipment operations.

8.8 Overhead/Underground Power Lines

The positioning or operation of heavy equipment in the vicinity of utility services will not be initiated until the activities have been coordinated with the SHSO and PM/SM. Operation of equipment adjacent to or under overhead power lines, in such a manner that encroaches on authorized clearances, will not take place unless one of the following are satisfied:

- Power has been shut off and positive steps are taken to prevent the lines from being energized;
- The equipment does not have the ability to move laterally or horizontally within the minimum clearance specified in the table below, from energized power lines;
- The equipment has been positioned and blocked to allow no part, including cables, to come within the minimum clearance specified in the table below; or
- Excavation operations are not initiated within 25 feet of the verified position of underground power lines.

Minimum Required Clearances for Energized Overhead Power Lines

Nominal System Voltage of Power Line (K V)	Minimum Required Clearance (feet)
0-50	10
51-100	12
101-200	15
201-300	20
301-500	25
501-750	35
751-1000	45

1 kilovolt (KV) = 1,000 volts

8.9 Heavy Equipment Decontamination

If a steam cleaner will be utilized to decontaminate equipment, personnel should exercise caution as the high pressure steam can cause severe burns. Protective gloves, face shields, hard hats, steel-toed boots, and Tyvek suits or rain gear will be worn when using steam cleaners.

8.10 Hot/Cold Work

Roux Associates shall not perform welding unless specific clearance and a hot work permit have been obtained from the OHSO. Any contractors performing welding must adhere to the Hot Work Procedures and the procedures outlined below.

Welding equipment shall be chosen for safe application to the work and shall be installed properly. Employees designated to operate welding equipment shall be properly instructed and qualified to operate it. Mechanical ventilation shall be provided when welding or cutting:

- Where there is less than 10,000 cubic feet of air per welder;
- Where the overhead height is less than 16 feet; and
- Where required by Client practices and procedures (e.g., Confined Space Permitting).

Proper shielding and eye protection shall be used to prevent exposure of personnel to welding hazards. Proper precautions (isolating welding and cutting, removing fire hazards from vicinity, etc.) for fire prevention shall be taken in areas where welding or other "hot work" is being done. All welding operations and other "hot work" shall be scheduled and performed in accordance with the Client's permitting system. The SHSO will be responsible for securing these permits.

8.10.1 Welding in Confined Spaces

All welding and cutting operations carried out in confined spaces shall be adequately ventilated to prevent the accumulation of toxic materials or possible oxygen deficiency and shall be performed in compliance with the Client's and Roux Associates' Confined Space Entry Procedures (Appendices E and I). In general, oxygen shall never be used for ventilation. In such circumstances where it is impossible to provide ventilation, OSHA requires airline respirators or hose masks approved by the National Institute for Occupational Safety and Health (NIOSH) for this purpose to be utilized. In areas immediately dangerous to life, NIOSH approved powered air purifying respirators (PAPR) or self-contained breathing apparatus (SCBA) shall be used. These exposures and tasks are not to be performed by Roux employees. If the work requires welding in confined spaces, this will only be performed by a qualified welder who is Confined Space Entry Trained (for permit-required entries) and provided with procedures and PPE that satisfy OSHA 29 CFR 1910.134.

8.11 Asbestos

Asbestos may be present at the site as pipe wrap, as part of the pipe material itself (asbestos-cement pipe), or as part of other building materials (e.g., in floor tiles and roofing). Asbestos shall be abated by a licensed abatement contractor according to all applicable laws and standards. Personnel should be aware of the presence of asbestos and avoid contact with friable material. Asbestos-cement pipe can emit airborne fibers if the materials are cut or sawed, or if they are damaged during demolition operations. Handling of these non-friable materials shall be limited to activities that will not generate airborne fibers.

8.12 Heat Stress

Heat stress is a significant potential hazard and can be associated with heavy physical activity and/or the use of personal protective equipment/clothing in hot weather environments.

Heat cramps are brought on by prolonged exposure to heat. As an individual sweats, water and salts are lost by the body resulting in painful muscle cramps. The signs and symptoms of heat stress are as follows:

- Severe muscle cramps, usually in the legs and abdomen;
- Exhaustion, often to the point of collapse; and
- Dizziness or periods of faintness.

First aid treatment includes shade, rest and fluid replacement. Normally, the individual should recover within one-half hour. If the individual is not better within 30 minutes and the body temperature has not decreased, the individual should be transported to an occupational health clinic or hospital for medical attention.

Heat exhaustion may occur in a healthy individual who has been exposed to excessive heat while working or exercising. The circulatory system of the individual fails as blood collects near the skin in an effort to rid the body of excess heat. The signs and symptoms of heat exhaustion are as follows:

- Rapid and shallow breathing;
- Weak pulse;

- Cold and clammy skin with heavy perspiration;
- Skin appears pale;
- Fatigue and weakness;
- Dizziness; and
- Elevated body temperature.

First aid treatment includes cooling the victim, elevating the feet, and replacing fluids. If the individual is not better within 30 minutes and the body temperature has not decreased, the individual should be transported to an occupational health clinic or hospital for medical attention. A Long Island City vicinity map with the location of Mt Sinai Hospital of Queens and CityMD Urgent Care of Astoria are included as Figure 2A and 3A.

Heat stroke occurs when an individual is exposed to excessive heat and stops sweating. This condition is classified as a **MEDICAL EMERGENCY** requiring immediate cooling of the victim and transport to an emergency medical facility. The signs and symptoms of heat stroke are as follows:

- Dry, hot red skin;
- Body temperature approaching or above 105 degrees F;
- Large (dilated) pupils; and
- Loss of consciousness - the individual may go into a coma.

First aid treatment requires immediate cooling and transportation to an emergency medical facility.

Heat stress is a significant hazard if any type of protective equipment (semipermeable or impermeable) which prevents evaporative cooling is worn in hot weather environments.

8.13 Cold Stress

Cold stress is a danger at low temperatures and when the wind-chill factor is low. Prevention of cold-related illnesses is a function of whole body protection. Adequate insulating clothing must be used when the air temperature is below 40°F. A work/rest regimen will be initiated when

ambient temperatures and protective clothing cause a stressful situation. In addition, reduced work periods followed by rest in a warm area may be necessary in extreme conditions. The signs and symptoms of cold stress include the following:

- Severe shivering;
- Abnormal behavior;
- Slowing;
- Weakness;
- Stumbling or repeated falling;
- Inability to walk;
- Collapse; and/or
- Unconsciousness.

First aid requires removing the victim from the cold environment, and preventing further body heat loss by covering the victim lightly with blankets. Do not cover the victim's face. If the victim is still conscious, administer hot drinks and encourage activity such as walking, wrapped in a blanket. If the victim's conditions do not improve, seek further medical attention.

8.14 Communications

Site personnel are equipped with cellular telephones. Applicable telephone and cellular phone numbers are provided in Section 1.0 (page 3) and in the colored tab section located in the back of this HASP.

- Hand Signals
To be employed by personnel required to use Level C respiratory protection. They shall be known by the entire field team before operations commence and covered during Site-specific training.

Hand Signals

SIGNAL	MEANING
Hand gripping throat	Out of air, can't breath
Grip partner's wrist	Leave area immediately
Hands on top of head	Need assistance
Thumbs up	I'm alright, okay
Thumbs down	No, negative

8.15 Additional Safe Work Practices

Refer to the SHSO for specific concerns on each individual site task. The safety rules listed below must be strictly followed:

- Inform PM/SM of planned activities and evaluate the degree of health and safety protection required for each task;
- Practice contamination avoidance, avoid any skin contact with potentially contaminated materials (i.e., surface or ground water, soil, etc.);
- Hard hat and safety eye protection will be worn when inside the exclusion zone;
- Do not carry gum, cigarettes, food drink or cosmetics of any kind into contaminated areas;
- Wash hands before handling food and drink and other activities that could cause hand-to-mouth transfer of contaminants;
- Appropriate foot, hearing, eye, head and hand protection will be worn by those directly involved in the work efforts when warranted;
- No facial hair that interferes with the face to face piece seal of respirators will be allowed;
- Personnel not involved in the operations, excavating, or monitoring activities will remain a safe distance from the equipment;
- Do not climb over/under obstacles or barricades;
- Be alert to your own physical condition;
- Watch your buddy for signs of fatigue, exposure, heat or cold stress, etc.;
- No work will be conducted without adequate light;
- Report all accidents, no matter how minor, immediately to the SHSO and the Project Engineer; and
- **KNOW YOUR HEALTH AND SAFETY PLAN.**

9.0 DECONTAMINATION PROCEDURES

9.1 Contamination Prevention

One of the most important aspects of decontamination is the prevention of contamination. Good contamination prevention should minimize worker exposure and help ensure valid sample results by precluding cross-contamination. Procedures for contamination avoidance include:

Personnel

- Do not walk through areas of obvious or known contamination;
- Do not handle or touch contaminated materials directly;
- Make sure all personal protective equipment (PPE) has no cuts, tears or other signs of deterioration prior to donning;
- Fasten all closures on suits, covering with tape, if necessary;
- Take particular care to protect any skin injuries;
- Stay upwind of airborne contaminants; and
- Do not carry cigarettes, gum, etc., into contaminated areas.

Sampling/Monitoring

- When required by the SHSO, cover instruments with clear plastic, leaving opening for sampling and exhaust ports; and
- Bag sample containers prior to the placement of sample material.

Heavy Equipment

- Care should be taken to limit the amount of contamination that comes in contact with heavy equipment;
- Excavated soils should be contained and kept away from workers; and
- Decontaminate equipment prior to moving to another work area.

9.2 Decontamination

The SHSO shall be responsible for determining appropriate decontamination methods for all Site activities. Figures 4, 5 and 6 illustrate typical decontamination procedures for Levels D, C, and B and procedures for emergency decontamination. Decontamination water should be collected,

handled, drummed, and/or containerized prior to determination of classification and appropriate disposal method (see Section 11.0).

Equipment Decontamination

Sampling equipment will be decontaminated through the following steps, if necessary:

- fresh water rinse;
- non-phosphate detergent wash;
- fresh water rinse; and
- distilled water rinse.

10.0 DISPOSAL PROCEDURES

All discarded materials, waste materials, or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard, or causing litter to be left onsite. All potentially contaminated materials should be bagged, drummed, or placed in waste wranglers, as necessary, and placed in the designated staging area as directed by the PM/SM or SHSO. Potentially contaminated waste materials that are bagged or drummed outside of the area will be labeled prior to staging.

All personal protective clothing and sorbent products contaminated with petroleum product will be stored in waste storage containers (i.e., waste wranglers) located in the hazardous waste storage area. Additionally, all petroleum products generated from product recovery activities (i.e., well bailing, etc.) will be drummed and stored within the hazardous waste storage area. All hazardous waste storage containers, tanks and drums will be labeled with the appropriate hazardous waste labels and/or placards. All contaminated materials will be disposed of in accordance with appropriate regulations. All non-contaminated materials shall be collected and bagged for appropriate disposal as normal domestic waste.

PPE & equipment shall be decontaminated, cleaned, laundered, maintained or replaced as needed to maintain their effectiveness. Employees whose non-impermeable clothing becomes wetted with hazardous substances shall immediately remove the clothing.

11.0 EMERGENCY PLAN

As a result of the hazards onsite and the conditions under which operations are conducted, the possibility of an emergency exists. An emergency plan is required by OSHA (29 CFR 1910.120) to be available for use and is included below. A copy of this plan shall be available in the Support zone at each work site.

In the event of an emergency situation, such as fire, explosion, significant release of particulates, etc., all persons in both the restricted and non-restricted areas will evacuate and assemble near the Support Zone or other safe area as identified by the Site Emergency Coordinator(s). The Site Emergency Coordinator(s) will have authority to initiate proper action if outside services are required. Under no circumstances will incoming personnel or visitors be allowed to proceed into the area once the emergency signal has been given. The SHSO or PM/SM must see that access for emergency equipment is provided and that all spark-producing apparatus has been shut down once the alarm has been sounded. Once the safety of all personnel is established, the fire department and other emergency response groups will be notified by telephone of the emergency. Then, other personnel listed in Section 12.4 shall be notified.

Note: This plan does NOT address post-emergency response operations since a specific HASP will be developed at that time as appropriate.

11.1 Site Emergency Coordinator(s)

The Site Emergency Coordinator(s) are:

- Site Manager;
- Site Health and Safety Officer; and
- Office Health and Safety Officer.

The Site Emergency Coordinator(s) shall implement this emergency plan whenever conditions at the site warrant such action. The coordinator(s) will be responsible for assuring the evacuation, emergency treatment, emergency transport of site personnel as necessary, and notification of emergency response units and the appropriate management staff.

11.2 Evacuation

Withdrawal Upwind

The work party will continually note general wind directions while onsite. Upon noting the conditions warranting movement away from the work site, the crew will move upwind a distance of approximately 100 feet or farther, as indicated by the site monitoring instruments. Donning SCBA and a lifeline, SHSO will return to the work site to determine if the condition noted was transient or persistent. If persistent, on-site personnel will be notified of the situation and the need to leave the site or don SCBA. When access to the site is restricted and escape possibly hindered, the crew may be instructed to evacuate the site rather than move upwind, especially if withdrawal upwind moves the crew away from escape routes.

Site Evacuation

Upon determination of conditions warranting site evacuation, the work party will proceed upwind of the work site and notify the SHSO and the Client's Project Engineer of site conditions. If the hazard is toxic gas, respirators will be donned. The crew will proceed to the field office to assess the situation. The advisability and type of further response action will be coordinated and carried out by the SHSO, the PM and the Client's Project Engineer. Site evacuation routes are illustrated in Figure 7.

11.3 Potential or Actual Fire or Explosion

If the potential for a fire exists or if an actual fire or explosion occurs, the following procedure will be implemented:

- Immediately evacuate the site as described above (Section 12.2);
- Notify Client's Project Engineer, SHSO and PM; and
- Notify fire and security. Call **911**

Fire Department – FDNY _____

Police Department – NYPD _____

11.4 Environmental Incident (Release or Spread of Contamination)

If possible, the spread of contamination should be controlled or stopped. The Facility Manager must be informed of the need to contact police and fire authorities to inform them of the possible or immediate need for nearby evacuation. If a significant release has occurred, the National

Response Center and other appropriate groups should be contacted by the Facility Manager or his designee. Those groups will alert National or Regional Response Teams as necessary. Following these emergency calls, the remaining personnel listed in the table below shall be notified:

Emergency Telephone Numbers

Type	Name	Telephone #
Fire Department	Fire Department	911
HazMat Emergency Response		911
Law Enforcement	Police Department	911
Hospital	Mt Sinai Hospital of Queens	(718) 932-1000
Ambulance		911
Urgent Care Center	CityMD of Astoria	(877) 900-2308
National Response Center (Release or Spill)		(800) 424-8802
Site Health and Safety Officer	Richard Crockett	(631) 232-2600 (Office) (928) 221-2531 (Cell)
Project Manager	Jeff Wills	(631) 630-2366 (Office) (516) 637-0213 (Cell)
Corporate H&S Manager	Joseph Gentile	(856) 832-3768 (Office) (610) 844-6911 (Cell)

These contacts and phone numbers will be posted in the SZ.

11.5 Personal Injury

If on-site personnel require emergency medical treatment, the following steps will be taken:

- 1) Notify the Project Manager, Principal, and/or other Roux Senior Management for Illness or Injury Case Management protocol to be initiated.
- 2) Notify the Fire Department or Ambulance service and request an ambulance or transport the victim to the hospital, as appropriate.
- 3) Decontaminate to the extent possible prior to administration of first aid or movement to emergency facilities.
- 4) First aid will be provided by emergency medical services (EMS) or by on-site personnel trained in first aid, CPR, and blood borne pathogens, if available.

- 5) The OHSM will supply medical data sheets on the victim (if a Roux Associates, Inc. employee) to appropriate medical personnel.

Accident Report Forms and Medical Services Form are provided in Appendices F, G, and H.

11.6 Overt Personnel Exposure

If an overt exposure to toxic materials should occur, the exposed person shall be treated onsite as follows:

Skin Contact:	Wash/rinse affected area thoroughly with copious amounts of soap and water; then provide appropriate medical attention. An emergency shower or drench system shall be accessible at the Site at all times. Utilizing eyewash, eyes should be rinsed for at least fifteen (15) minutes upon chemical contamination.
Inhalation:	Move to fresh air and/or, if necessary, decontaminate, and transport to the hospital.
Ingestion:	Decontaminate and transport to emergency medical facility.
Puncture Wound or Laceration:	Decontaminate and transport to emergency medical facility. SHSO will coordinate with the CHSM and the HR Director to obtain medical information on the injured if necessary.

11.7 Adverse Weather Conditions

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

- Heavy rainfall;
- High wind;
- Potential for heat stress;
- Potential for cold stress and cold-related injuries;
- Limited visibility;
- Potential for electrical storms – stop work for a minimum of 15 minutes after observing a lightning strike and for at least 15 minutes after the storm has passed;
- Potential for malfunction of H&S monitoring equipment or gear; and
- Potential for accidents.

12.0 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: Offsite Properties / Queens Plaza Residential Development

[illegible]

13.0 APPROVALS

By their signature, the undersigned certify that this HASP is approved and will be utilized at the Offsite Properties (Queens Plaza Residential Development).

Richard Crockett – Site Health and Safety Officer

Date

Joseph Gentile – Corporate Health and Safety Manager

Date

Jeff Wills – Project Manager

Date

Joseph Gavin – Office Health and Safety Officer

Date

Site-Specific Health and Safety Plan
Queens Plaza Off-Site Properties
Long Island City, New York

TABLES

1. Toxicological, Physical and Chemical Properties of Compounds Potentially Present at the Site
2. Action Levels for Worker Breathing Zone

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at Offsite Properties (Queens Plaza Residential Development)

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
1,2,4-Trimethylbenzene	95-63-6	TWA 25 ppm (125 mg/m ³)	TWA 25 ppm (125 mg/m ³)	None established	N.D.	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, fatigue, dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eyes, skin, respiratory system, central nervous system, blood	Clear, colorless liquid with a distinctive, aromatic odor. BP: 337°F FLP: 112°F UEL: 6.4% LEL: 0.9% Class II Flammable Liquid
1,2-Dichlorobenzene	95-50-1	TWA 25 ppm STEL 50 ppm	C 50 ppm (300 mg/m ³)	C 50 ppm (300 mg/m ³)	200 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, nose; liver, kidney damage; skin blisters	Eyes, skin, respiratory system, liver, kidneys	Colorless to pale-yellow liquid with a pleasant, aromatic odor. [herbicide] BP: 357°F FLP: 151°F UEL: 9.2% LEL: 2.2% Class IIIA Combustible Liquid
1,2-Dichloroethane	107-06-2	TWA 10 ppm	Ca TWA 1 ppm (4 mg/m ³) STEL 2 ppm (8 mg/m ³)	TWA 50 ppm C 100 ppm 200 ppm [5-minute maximum peak in any 3 hours]	Ca [50 ppm]	inhalation, ingestion, skin absorption, skin and/or eye contact	Irritation eyes, corneal opacity; central nervous system depression; nausea, vomiting; dermatitis; liver, kidney, cardiovascular system damage; [potential occupational carcinogen]	Eyes, skin, kidneys, liver, central nervous system, cardiovascular system	Colorless liquid with a pleasant, chloroform-like odor. [Note: Decomposes slowly, becomes acidic & darkens in color.] BP: 182°F FLP: 56°F UEL: 16% LEL: 6.2% Class IB Flammable Liquid
1,2-Dichloroethene (total)	540-59-0	TWA 200 ppm (790 mg/m ³)	TWA 200 ppm (790 mg/m ³)	TWA 200 ppm (790 mg/m ³)	1000 ppm	inhalation, ingestion, skin and/or eye contact	Irritation eyes, respiratory system; central nervous system depression	Eyes, respiratory system, central nervous system	Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor BP: 118-140°F FLP: 36-39°F UEL: 12.8% LEL: 5.6% Class IB Flammable Liquid
1,3,5-Trimethylbenzene	108-67-8	None established	TWA 25 ppm (125mg/m ³)	None established	N.D.	Inhalation; ingestion; skin and/or eye contact	Eye, skin, nose, and throat, resp syst irritation; bronchitis; hypochromic anemia; headache, drowsiness, weakness, dizziness, nausea, incoordination, vomit, confusion; chemical pneumonitis	Eyes, skin, resp sys, CNS, blood	Clear, colorless liquid with a distinctive, aromatic odor BP: 329°F FL.P: 122°F Class II Flammable liquid
1,3,5-Trimethylbenzene	108-67-8	TWA 25 ppm (125 mg/m ³)	TWA 25 ppm (125 mg/m ³)	None established	N.D.	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eyes, skin, respiratory system, central nervous system, blood	Clear, colorless liquid with a distinctive, aromatic odor. BP: 329°F FLP: 122°F Class II Flammable Liquid

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at Offsite Properties (Queens Plaza Residential Development)

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
1,4-Dichlorobenzene	106-46-7	TWA 10 ppm	Ca	TWA 75 ppm (450 mg/m ³)	Ca [150 ppm]	inhalation, skin absorption, skin and/or eye contact	Eye irritation, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [potential occupational carcinogen]	Liver, respiratory system, eyes, kidneys, skin	Colorless or white crystalline solid with a mothball-like odor. [insecticide] BP: 345°F F.P: 150°F LEL: 2.5% Combustible Solid
2,4-Dimethylphenol	105-67-9	None established	None established	None established	None established	inhalation, skin absorption, skin and/or eye contact	Irritation eyes, skin, respiratory system, mouth, throat, stomach; dizziness, weakness, fatigue, nausea, headache; systemic damage; moderate to severe eye injury.	Skin, CVS, eyes, CNS	Clear, colorless liquid with a faint ether or chloroform-like odor BP: 178°F
2-Butanone (MEK)	78-93-3	TWA 200 ppm (590 mg/m ³) STEL 300 ppm (885 mg/m ³)	TWA 200 ppm (590 mg/m ³) STEL 300 ppm (885 mg/m ³)	TWA 200 ppm (590 mg/m ³)	3000 ppm	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose; headache; dizziness; vomiting; dermatitis	Eyes, skin, respiratory system, central nervous system	Colorless liquid with a moderately sharp, fragrant, mint- or acetone-like odor. BP: 175°F F.L.P: 16°F UEL(200°F): 11.4% LEL(200°F): 1.4% Class IB Flammable Liquid
Acenaphthene	83-32-9	None established	None established	None established	None established	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, respiratory system	Eyes, skin, respiratory system	Brown solid
Acetone	67-64-1	TWA 500 ppm STEL 50 ppm	TWA 250 ppm (590 mg/m ³)	TWA 1000 ppm (2400 mg/m ³)	2500 ppm [10%LEL]	inhalation, ingestion, skin and/or eye contact	Irritation eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis	Eyes, skin, respiratory system, central nervous system	Colorless liquid with a fragrant, mint-like odor BP: 133°F F.L.P: 0°F UEL: 12.8% LEL: 2.5% Class IB Flammable Liquid
Anthracene	65996-93-2	TWA 0.2 mg/m ³	Ca TWA 0.1 mg/m ³ (cyclohexane-extractable fraction)	TWA 0.2 mg/m ³ (benzene-soluble fraction)	Ca [80 mg/m ³]	inhalation, skin and/or eye contact	Dermatitis, bronchitis, [potential occupational carcinogen]	respiratory system, skin, bladder, kidneys	Black or dark-brown amorphous residue. Combustible Solids
Antimony	7440-36-0	TWA 0.5 mg/m ³	TWA 0.5 mg/m ³	TWA 0.5 mg/m ³	50 mg/m ³ (as Sb)	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, mouth; cough; dizziness; headache; nausea, vomiting, diarrhea; stomach cramps; insomnia; anorexia; unable to smell properly	Eyes, skin, respiratory system, cardiovascular system	Silver-white, lustrous, hard, brittle solid; scale-like crystals; or a dark-gray, lustrous powder. BP: 2975°F
Arsenic (inorganic)	7440-38-2 (metal)	TWA 0.01 mg/m ³	Ca C 0.002 mg/m ³ [15-min]	TWA 0.010 mg/m ³	Ca [5 mg/m ³ (as As)]	Inhalation; ingestion; skin absorption; skin and/or eye contact	Ulceration of nasal septum, dermatitis, GI disturbances, peripheral neuropathy, resp irritation, hyperpigmentation of skin, [potential occupational carcinogen]	Liver, kidneys, skin, lungs, lymphatic sys	Metal: sliver-gray or tin-white, brittle, odorless solid BP: sublimes
Asbestos	1332-21-4	TWA 0.1 f/cc	Ca 100,000 fibers/m ³	TWA 0.1 fiber/cm ³	Ca [IDLH value has not been determined]	Inhalation; ingestion; skin and/or eye contact	Asbestosis (chronic exposure), dyspnea, interstitial fibrosis, restricted pulmonary function, finger clubbing, irritation eyes, [potential occupational carcinogen]	Respiratory system, eyes,	White or greenish (chrysotile), blue (crocidolite), or gray-green (amosite), fibrous, odorless solids. BP: decomposes

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at Offsite Properties (Queens Plaza Residential Development)

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Asphalt fumes	8052-42-4	TWA 0.5 mg/m ³ (fumes)	Ca C 5 mg/m ³ [15 min]	None established	Ca [IDLH value has not been determined]	Skin absorption; inhalation; skin and/or eye contact	Irritation eyes, resp sys	Eyes, respiratory system	Black or dark brown cement-like substance Combustible solid
Barium	7440-39-3	TWA 0.5 mg/m ³	None established	TWA 0.5 mg/m ³	None established	Inhalation, ingestion, skin contact	Irritation skin, respiratory system, (	Skin, eyes, respiratory system	Yellow white powder BP: 1640 C
Benzene	71-43-2	TWA 0.5 ppm STEL 2.5 ppm	Ca TWA 0.1 ppm STEL 1 ppm	TWA 1 ppm STEL 5 ppm	Ca [500 ppm]	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]	Eyes, skin, respiratory system, blood, central nervous system, bone marrow	Colorless to light yellow liquid with an aromatic odor [Note: Solid below 42 °F] BP: 176°F Fl.Pt = 12°F LEL: 1.2% UEL: 7.8% Class B Flammable liquid
Benzo[a]anthracene	56-55-3	None established	None established	None established	None established	Inhalation; ingestion; skin absorption; skin and/or eye contact	Irritation eyes, skin, respiratory system, CNS	Skin	Pale Yellow crystal, solid BP: 438 C
Benzo[a]pyrene	50-32-8	None established	TWA 0.1 mg/m ³	TWA 0.2 mg/m ³	None established	Inhalation; ingestion; skin absorption; skin and/or eye contact	POISON. This material is an experimental carcinogen, mutagen, tumorigen, neoplastigen and teratogen. It is a probable carcinogen in humans and a known human mutagen. IARC Group 2A carcinogen. It is believed to cause bladder, skin and lung cancer. Exposure to it may damage the developing foetus. May cause reproductive damage. Skin, respiratory and eye irritant or burns.	Skin, eye, bladder, lung, reproductive	Yellow crystals or powder [found in cigarette smoke, coal tar, fuel exhaust gas and in many other sources] BP: 495 C
Benzo[b]fluoranthene	205-99-2	None established	TWA 0.1 mg/m ³	TWA 0.2 mg/m ³	None established	Inhalation; ingestion; skin and/or eye contact	No data were identified on the toxicity of benzo[b]fluoranthene to humans. Based on results of studies in animals, IARC concluded that benzo[b]fluoranthene is possibly carcinogenic to humans	Respiratory system, skin, bladder, kidneys	Off-white to tan powder
Benzo[k]fluoranthene	207-08-9	None established	None established	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, respiratory tract, gastrointestinal; fatal if swallowed, inhaled, absorbed through the skin; vomiting, nausea, diarrhea	Lungs, respiratory system	Yellow crystals BP: 480 C

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at Offsite Properties (Queens Plaza Residential Development)

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Beryllium	7440-41-7 (metal)	TWA 0.002 mg/m ³	Ca C 0.0005 mg/m ³	TWA 0.002 mg/m ³ C 0.005 mg/m ³ (30 minutes) with a maximum peak of 0.025 mg/m ³	Ca [4 mg/m ³ (as Be)]	inhalation, skin and/or eye contact	Berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness, exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation eyes; dermatitis; [potential occupational carcinogen]	Eyes, skin, respiratory system	Metal: A hard, brittle, gray-white solid. BP: 4532°F
Bis(2-ethylhexyl) phthalate	117-81-7	TWA 5 mg/m ³	TWA 5 mg/m ³ STEL 10 mg/m ³ (do not exceed during any 15-minute work period)	TWA 5 mg/m ³	None established	inhalation, skin and/or eye contact	Irritation eyes, skin, nose, throat; affect the nervous system and liver; damage to male reproductive glands	Eyes, skin, nose, respiratory system, nervous system, reproductive system, liver	Colorless to light colored, thick liquid with slight odor
Butane	106-97-8	TWA 1000 ppm	TWA 800 ppm (1900 mg/m ³)	None established	None established	inhalation, skin and/or eye contact (liquid)	Drowsiness, narcosis, asphyxia; liquid: frostbite	central nervous system	Colorless gas with a gasoline-like or natural gas odor. BP: 31°F UEL: 8.4% LEL: 1.6% Flammable Gas
Cadmium	7440-43-9 (metal)	TWA 0.01 mg/m ³	Ca	TWA 0.005 mg/m ³	Ca [9 mg/m ³ (as Cd)]	inhalation, ingestion	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]	respiratory system, kidneys, prostate, blood	Metal: Silver-white, blue-tinged lustrous, odorless solid. BP: 1409°F
Carbon Disulfide	75-15-0	TWA 1 ppm	TWA 1 ppm (3 mg/m ³) STEL 10 ppm (30 mg/m ³) [skin]	TWA 20 ppm C 30 ppm 100 ppm (30-minute maximum peak)	500 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	Dizziness, headache, poor sleep, lassitude (weakness, exhaustion), anxiety, anorexia, weight loss; psychosis; polyneuropathy; Parkinson-like syndrome; ocular changes; coronary heart disease; gastritis; kidney, liver injury; eye, skin burns; dermatitis; reproductive effects	central nervous system, peripheral nervous system, cardiovascular system, eyes, kidneys, liver, skin, reproductive system	Colorless to faint-yellow liquid with a sweet ether-like odor. BP: 116°F F.P: -22°F UEL: 50.0% LEL: 1.3% Class IB Flammable Liquid
Chlorobenzene	108-90-7	TWA 10 ppm	None established	TWA 75 ppm (350 mg/m ³)	1000 ppm	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose; drowsiness, incoordination; central nervous system depression; in animals: liver, lung, kidney injury	Eyes, skin, respiratory system, central nervous system, liver	Colorless liquid with an almond- like odor BP: 270°F F.L.P: 82°F UEL: 9.6% LEL: 1.3%
Chloroethane	75-00-3	TWA 100ppm	Handle with caution in the workplace	TWA 1000 ppm (2600 mg/m ³)	3800 ppm [10%LEL]	inhalation, skin absorption (liquid), ingestion (liquid), skin and/or eye contact	Incoordination, inebriation; abdominal cramps; cardiac arrhythmias, cardiac arrest; liver, kidney damage	Liver, kidneys, respiratory system, cardiovascular system, central nervous system	Colorless gas or liquid (below 54°F) with a pungent, ether-like odor. BP: 54°F F.L.P: NA (Gas) -58°F (Liquid) UEL: 15.4% LEL: 3.8%

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at Offsite Properties (Queens Plaza Residential Development)

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Chloroform	67-66-3	TWA 10 ppm	Ca STEL 2 ppm (9.78 mg/m ³) [60-minute]	C 50 ppm (240 mg/m ³)	Ca [500 ppm]	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; dizziness, mental dullness, nausea, confusion; headache, lassitude (weakness, exhaustion); anesthesia; enlarged liver; [potential occupational carcinogen]	Liver, kidneys, heart, eyes, skin, central nervous system	Colorless liquid with a pleasant odor BP: 143°F
Chromium	7440-47-3	TWA 0.5 mg/m ³ (metal and Cr III compounds) TWA 0.05 mg/m ³ (water-soluble Cr IV compounds) TWA 0.01 mg/m ³ (insoluble Cr IV compounds)	TWA 0.5 mg/m ³	TWA 1 mg/m ³	250 mg/m ³ (as Cr)	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin; lung fibrosis (histologic)	Eyes, skin, respiratory system	Blue-white to steel-gray, lustrous, brittle, hard, odorless solid. BP: 4788°F
Chrysene; Phenanthrene; Pyrene; Coal tar pitch volatiles	65996-93-2	TWA 0.2 mg/m ³	Ca TWA 0.1 mg/m ³ (cyclohexane-extractable fraction)	TWA 0.2 mg/m ³ (benzene-soluble fraction)	Ca [80 mg/m ³]	Inhalation, skin and/or eye contact	Dermatitis, bronchitis, [potential occupational carcinogen]	Respiratory system, skin, bladder, kidneys	Black or dark-brown amorphous residue. Combustible Solids
cis-1,2-Dichloroethene	158-59-2	TWA 200 ppm	TWA 200 ppm	TWA 200 ppm	None established	inhalation, skin absorption, ingestion	Harmful if swallowed, inhaled, or absorbed through skin. Irritant. Narcotic. Suspected carcinogen	Skin	Colorless liquid BP: 60 C FLP: 4 C UEL: 12.8% LEL: 9.7 %
Copper	7440-50-8	TWA 0.2mg/m ³ (fume) 1 mg/m ³ (dusts and mists)	TWA 1 mg/m ³	TWA 1 mg/m ³	100 mg/m ³ (as Cu)	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, respiratory system; cough, dyspnea (breathing difficulty), wheezing	Eyes, skin, respiratory system, liver, kidneys (increase(d) risk with Wilson's disease)	Noncombustible Solid in bulk form, but powdered form may ignite. BP: 4703°F
Coal Tar Pitch Volatiles; Chrysene; Phenanthrene; Pyrene	65996-93-2	TWA 0.2 mg/m ³	Ca TWA 0.1 mg/m ³ (cyclohexane-extractable fraction)	TWA 0.2 mg/m ³ (benzene-soluble fraction)	Ca [80 mg/m ³]	Inhalation, skin and/or eye contact	Dermatitis, bronchitis, [potential occupational carcinogen]	respiratory system, skin, bladder, kidneys	Black or dark-brown amorphous residue. Combustible Solids
Dibenzo[a,h]anthracene	53-70-3	None established	None established	None established	None established	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin	Eyes, skin; skin photosensitization.	Colorless crystalline powder BP: 524°C
Diesel Fuel #2	68476-34-6	None established	None established	Designated as an OSHA Select Carcinogen	None established	ingestion, skin and/or eye contact	Kidney damage; potential lung damage; suspected carcinogen; irritation of eyes, skin, respiratory tract; dizziness, headache, nausea; chemical pneumonitis (from aspiration of liquid); dry, red skin; irritant contact dermatitis; eye redness, pain.	Eyes, skin, kidneys	Clear yellow brown combustible liquid; floats on water; distinct diesel petroleum hydrocarbon odor. BP: 356-716°F FLP: 154.4-165.2°F LEL: 0.6% UEL: 7.0%
Ethylbenzene	100-41-4	TWA 100 ppm STEL 125 ppm	TWA 100 ppm (435 mg/m ³) STEL 125 ppm (545 mg/m ³)	TWA 100 ppm (435 mg/m ³)	800 ppm [10%LEL]	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eyes, skin, respiratory system, central nervous system	Colorless liquid with an aromatic odor. BP: 277°F FLP: 55°F UEL: 6.7% LEL: 0.8% Class IB Flammable Liquid

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at Offsite Properties (Queens Plaza Residential Development)

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Fluoranthene	206-44-0	None established	None established	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; possible burns; heart and liver injury, pulmonary edema, respiratory arrest, gastrointestinal disturbances.	Heart, liver, lungs.	Yellow needles.
Fluorene	86-73-7	None established	None established	None established	None established	inhalation, ingestion, skin and/or eye contact	Irritation skin, digestive tract	Skin	White crystals BP: 563°F
Fuel Oil #2	68476-30-2	TWA 100mg/m ³ (aerosol and vapor, as total hydrocarbons)	None established	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; CNS effects; nausea, vomiting, headache, cramping, dizziness, weakness, loss of coordination., drowsiness; kidney, liver damage	Eyes, skin, CNS	Clear or yellow to red oily liquid, kerosene-like odor BP: 347 - 689 °F UEL:5-6% LEL: 0.7-1.0%
Gasoline	8006-61-9	TWA 300 ppm STEL 500 ppm	Carcinogen	None established	Ca [IDLH value has not been determined]	Skin absorption; inhalation; ingestion; skin and/or eye contact	Eyes and skin irritation, mucous membrane; dermatitis; headache; listlessness, blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis; possible liver, kidney damage [Potential occupational carcinogen]	Eyes, skin, respiratory system, CNS, Liver, Kidneys	Clear liquid with a characteristic odor, aromatic Fl.Pt = -45°F LEL = 1.4% UEL = 7.6% Classs 1B Flammable Liquid
Hexachlorobutadiene	87-68-3	TWA 0.02 ppm	Ca TWA 0.02 ppm (0.24 mg/m ³) [skin]	None established	Ca [N.D.]	inhalation, skin absorption, ingestion, skin and/or eye contact	In animals: irritation eyes, skin, respiratory system; kidney damage; [potential occupational carcinogen]	Eyes, skin, respiratory system, kidneys	Clear, colorless liquid with a mild, turpentine-like odor. BP: 419°F
Hydrogen Sulfide	7783-06-4	TWA (1 ppm) STEL (5 ppm) (adopted values for which changes are proposed in the NIC)	C 10 ppm (15 mg/m ³) [10-minute]	C 20 ppm 50 ppm [10-minute maximum peak]	100 ppm	inhalation, skin and/or eye contact	Irritation eyes, respiratory system; apnea, coma, convulsions; conjunctivitis, eye pain, lacrimation (discharge of tears), photophobia (abnormal visual intolerance to light), corneal vesiculation; dizziness, headache, lassitude (weakness, exhaustion), irritability, insomnia; gastrointestinal disturbance; liquid: frostbite	Eyes, respiratory system, central nervous system	Colorless gas with a strong odor of rotten eggs. BP: -77°F UEL: 44.0% LEL: 4.0% Flammable Gas
Indeno[1,2,3-cd]pyrene	193-39-5	None established	None established	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; possible human carcinogen (skin); weakness; affect liver, lung tissue, renal tissue; impairment of blood forming tissue	Skin	Fluorescent green-yellow crystalline solid BP: 536 C
Indeno[1,2,3-cd]pyrene	193-39-5	None established	None established	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; possible human carcinogen (skin); weakness; affect liver, lung tissue, renal tissue; impairment of blood forming tissue	Skin	Yellowish crystal solid BP: 536 C

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at Offsite Properties (Queens Plaza Residential Development)

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Isopropylbenzene	98-82-8	TWA 50 ppm	TWA 50 ppm (245 mg/m ³) [skin]	TWA 50 ppm (245 mg/m ³) [skin]	900 ppm [10%LEL]	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma	Eyes, skin, respiratory system, central nervous system	Colorless liquid with a sharp, penetrating, aromatic odor. BP: 306°F F.L.P: 96°F UEL: 6.5% LEL: 0.9%
Lead	7439-92-1	TWA 0.05 mg/m ³	TWA (8-hour) 0.050 mg/m ³	TWA 0.050 mg/m ³	100 mg/m ³ (as Pb)	inhalation, ingestion, skin and/or eye contact	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension	Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue	A heavy, ductile, soft, gray solid. BP: 3164°F Noncombustible Solid in bulk form
Manganese	7439-96-5 (metal)	TWA 0.2 mg/m ³	TWA 1 mg/m ³ STEL 3 mg/m ³	C 5 mg/m ³	500 mg/m ³ (as Mn)	inhalation, ingestion	Manganism; asthenia, insomnia, mental confusion; metal fume fever: dry throat, cough, chest tightness, dyspnea (breathing difficulty), rales, flu-like fever; low-back pain; vomiting; malaise (vague feeling of discomfort); lassitude (weakness, exhaustion); kidney damage	respiratory system, central nervous system, blood, kidneys	A lustrous, brittle, silvery solid. BP: 3564°F
Mercury (organo) alkyl compounds (as Hg)	7439-97-6	TWA 0.01 mg/m ³ STEL 0.03 mg/m ³ [skin]	TWA 0.01 mg/m ³ STEL 0.03 mg/m ³ [skin]	TWA 0.01 mg/m ³ C 0.04 mg/m ³	2 mg/m ³ (as Hg)	inhalation, skin absorption, ingestion, skin and/or eye contact	Paresthesia; ataxia, dysarthria; vision, hearing disturbance; spasticity, jerking limbs; dizziness; salivation; lacrimation (discharge of tears); nausea, vomiting, diarrhea, constipation; skin burns; emotional disturbance; kidney injury; possible teratogenic effects	Eyes, skin, central nervous system, peripheral nervous system, kidneys	Appearance and odor vary depending upon the specific (organo) alkyl mercury compound
Mercury compounds [except (organo) alkyls] (as Hg) Mercury	7439-97-6	TWA 0.025 mg/m ³ (elemental and inorganic forms)	Hg Vapor: TWA 0.05 mg/m ³ [skin] Other: C 0.1 mg/m ³ [skin]	TWA 0.1 mg/m ³	10 mg/m ³ (as Hg)	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria	Eyes, skin, respiratory system, central nervous system, kidneys	Metal: Silver-white, heavy, odorless liquid. [Note: "Other" Hg compounds include all inorganic & aryl Hg compounds except (organo) alkyls.] BP: 674°F
Methyl tert-butyl ether (MTBE)	1634-04-4	TWA 50 ppm	No established REL	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, mucous membrane, respiratory; dizziness, nausea, headache, intoxication	Eyes, skin, mucous membrane, respiratory system, central nervous system	Colorless liquid BP: 55.2 C

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at Offsite Properties (Queens Plaza Residential Development)

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Methylene Chloride	75-09-2	TWA 50 ppm, A3 - suspected human carcinogen	Ca	TWA 25 ppm STEL 125 ppm	Ca [2300 ppm]	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numbness, tingle limbs; nausea; [potential occupational carcinogen]	Eyes, skin, cardiovascular system, central nervous system	Colorless liquid with a chloroform-like odor BP: 104°F UEL: 23% LEL: 13%
Naphtha (coal tar)	8030-30-6	None established	TWA 100 ppm (400 mg/m ³)	TWA 100 ppm (400 mg/m ³)	1000 ppm [10%LEL]	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose; dizziness, drowsiness; dermatitis; in animals: liver, kidney damage	Eyes, skin, respiratory system, central nervous system, liver, kidneys	Reddish-brown, mobile liquid with an aromatic odor BP: 320-428°F F.L.P: 100-109°F Class II Combustible Liquid
Naphthalene	91-20-3	TWA 10 ppm STEL 15 ppm	TWA 10 ppm (50 mg/m ³) STEL 15 ppm (75 mg/m ³)	TWA 10 ppm (50 mg/m ³)	250 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage	Eyes, skin, blood, liver, kidneys, central nervous system	Colorless to brown solid with an odor of mothballs. BP: 424°F F.L.P: 174°F UEL: 5.9% LEL: 0.9%
n-Butylbenzene	104-51-8	None established	None established	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; CNS depression, lung damage; nausea, vomiting, headache, dizziness, weakness, loss of coordination, blurred vision, drowsiness, confusion, disorientation	Eyes, skin, respiratory system, central nervous system	Colorless liquid with a sweet odor BP: 183 C F.L.P: 59 C UEL: 5.8% LEL: 0.8%
Nickel	7440-02-0 (Metal)	TWA 1.5 mg/m ³ (elemental) TWA 0.1 mg/m ³ (soluble inorganic compounds) TWA 0.2 mg/m ³ (insoluble inorganic compounds) TWA 0.1 mg/m ³ (Nickel subsulfide)	Ca TWA 0.015 mg/m ³	TWA 1 mg/m ³	Ca [10 mg/m ³ (as Ni)]	inhalation, ingestion, skin and/or eye contact	Sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	Nasal cavities, lungs, skin	Metal: Lustrous, silvery, odorless solid. BP: 5139°F
Nitrobenzene	98-95-3	TWA 1 ppm	TWA 1 ppm (5 mg/m ³) [skin]	TWA 1 ppm (5 mg/m ³) [skin]	200 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; anoxia; dermatitis; anemia; methemoglobinemia; in animals: liver, kidney damage; testicular effects	Eyes, skin, blood, liver, kidneys, cardiovascular system, reproductive system	Yellow, oily liquid with a pungent odor like paste shoe polish. BP: 411°F F.L.P: 190°F LEL(200°F): 1.8%
n-Propylbenzene	103-65-1	None established	None established	None established	None established	inhalation, ingestion, skin and/or eye contact	Harmful if swallowed, Irritation eyes, skin, digestive tract, respiratory tract, central nervous system	Eyes, skin, central nervous system, respiratory system	colorless or light yellow liquid BP: 159 C F.L.P: 47 C UEL: 6% LEL: 0.8%

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at Offsite Properties (Queens Plaza Residential Development)

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Petroleum hydrocarbons (Petroleum distillates)	8002-05-9	None established	TWA 350 mg/m ³ C 1800 mg/m ³ [15 min]	TWA 500 ppm (2000 mg/m ³)	1,100 [10% LEL]	Inhalation; ingestion; skin and/or eye contact	Irritation eyes, skin, nose, throat; dizziness, drowsiness, headache, nausea; dried/cracked skin; chemical pneumonitis	CNS, eyes, respiratory system, skin	Colorless liquid with a gasoline or kerosene-like odor BP: 86-460°F Fl. Pt = -40 to -86°F UEL: 5.9% LEL: 1.1% Flammable liquid
Phenol	108-95-2	TWA 5 ppm	TWA 5 ppm (19 mg/m ³) C 15.6 ppm (60 mg/m ³) [15-minute] [skin]	TWA 5 ppm (19 mg/m ³) [skin]	250 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, nose, throat; anorexia, weight loss; lassitude (weakness, exhaustion), muscle ache, pain; dark urine; cyanosis; liver, kidney damage; skin burns; dermatitis; ochronosis; tremor, convulsions, twitching	Eyes, skin, respiratory system, liver, kidneys	Colorless to light-pink, crystalline solid with a sweet, acrid odor. BP: 359°F UEL: 8.6% LEL: 1.8%
p-Isopropyltoluene	99-87-6	None established	None established	None established	None established	inhalation, skin absorption, eye contact	Irritation skin	CNS, skin	Colorless, clear liquid, sweetish aromatic odor BP: 350.8°F Class III Flammable liquid
sec-Butylbenzene	135-98-8	None established	None established	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, upper airway; central nervous system, headache, dizziness; gastrointestinal disturbance	Respiratory system, central nervous system, eyes, skin;	Colorless liquid BP: 344°F Fl.P: 126 °F UEL: 6.9% LEL: 0.8% Combustible liquid
Selenium	7782-49-2	TWA 0.2 mg/m ³	TWA 0.2 mg/m ³	TWA 0.2 mg/m ³	1 mg/m ³ (as Se)	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin burns; in animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage	Eyes, skin, respiratory system, liver, kidneys, blood, spleen	Amorphous or crystalline, red to gray solid. [Note: Occurs as an impurity in most sulfide ores.] BP: 1265°F
Silver	7440-22-4 (metal)	TWA 0.1 mg/m ³ (metal, dust, fumes) TWA 0.01 mg/m ³ (Soluble compounds, as Ag)	TWA 0.01 mg/m ³	TWA 0.01 mg/m ³	10 mg/m ³ (as Ag)	inhalation, ingestion, skin and/or eye contact	Blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance	Nasal septum, skin, eyes	Metal: White, lustrous solid BP: 3632°F
tert-Butylbenzene	98-06-6	None established	None established	None established	None established	inhalation, skin absorption, ingestion,	Eye and respiratory irritant; CNS depression; liver or kidney damage	Respiratory system, central nervous system, eyes, liver, kidney	Colorless liquid with an aromatic odor BP: 168 - 169 C Fl.P: 34 C UEL:5.6 % LEL: 0.8 %

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at Offsite Properties (Queens Plaza Residential Development)

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Tetrachloroethene	127-18-4	TWA 25 ppm STEL 100 ppm (STEL) listed as A3, animal carcinogen	Ca Minimize workplace exposure concentrations	TWA 100 ppm C 200 ppm (for 5 minutes in any 3-hour period), with a maximum peak of 300 ppm	Ca [150 ppm]	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]	Eyes, skin, respiratory system, liver, kidneys, central nervous system	Colorless liquid with a mild, chloroform-like odor. BP: 250°F Noncombustible Liquid
Toluene	108-88-3	TWA 20 ppm	TWA 100 ppm (375 mg/m ³) STEL 150 ppm (560 mg/m ³)	TWA 200 ppm C 300 ppm 500 ppm (10-minute maximum peak)	500 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage	Eyes, skin, respiratory system, central nervous system, liver, kidneys	Colorless liquid with a sweet, pungent, benzene-like odor. BP: 232°F Fl.P: 40°F UEL: 7.1% LEL: 1.1% Class IB Flammable Liquid
Trichloroethene	79-01-6	TWA 10 ppm STEL 25 ppm	Ca	TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 2 hours)	Ca [1000 ppm]	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]	Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system	Colorless liquid (unless dyed blue) with a chloroform-like odor. BP: 189°F UEL(77°F): 10.5% LEL(77°F): 8%
Xylene (m, o & p isomers)	108-38-3, 95-47-6, 106-42-3	TWA 100 ppm (435 mg/m ³) STEL 150 ppm	TWA 100 ppm (435 mg/m ³)	TWA 100 ppm (435 mg/m ³)	900 ppm	Skin absorption, inhalation, ingestion, skin, and/or eye contact	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys	Colorless liquid with an aromatic odor BP: 282°F, 292°F, 281°F Fl. Pt. 82°F, 90°F, 81°F LEL: 1.1%, 0.9%, 1.1% UEL: 7.0%, 6.7%, 7.0% Class C Flammable Liquid
Zinc	7440-66-6	TWA 10 mg/m3 (Inhalable fraction)	None established	TWA 10 mg/m3 (for zinc oxide fume)	None established	skin and/or eye contact, inhalation, ingestion	Irritation eyes, skin, respiratory tract; gastrointestinal disturbances	Eyes, skin, respiratory system	Bluish gray solid BP: 1664.6°F Flammable

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at Offsite LIRR Property (Queens Plaza Residential Development)

References:

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Sax, N.I. and R.J. Lewis. 1989. Dangerous Properties of Industrial Materials. 7th Edition. Van Nostrand Reinhold. New York.
Guide to Occupational Exposure Values. 2008. American Conference of Governmental Industrial Hygienists (ACGIH).
NIOSH Pocket Guide to Chemical Hazards. 2005. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health

Abbreviations:

ACGIH – American Conference of Governmental Industrial Hygienists.
BP – Boiling point at 1 atmosphere, °F
C – Ceiling, is a concentration that should not be exceeded during and part of the working exposure.
Ca – Considered by NIOSH to be a potential occupational carcinogen
CAS# – CAS# Chemical Abstracts Service registry number which is unique for each chemical.
Fl. Pt. – Flash point
IDLH – Immediately Dangerous to Life and Health concentrations represent the maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects.
LEL – Lower explosive (flammable) limit in air, % by volume (at room temperature)
mg/m³ – Milligrams of substance per cubic meter of air
NIOSH – National Institute for Occupational Safety and Health.
OSHA – Occupational Safety and Health Administration
PEL – OSHA Permissible Exposure Limit (usually) a time weighted average concentration that must not be exceeded during any 8 hour work shift of a 40 hr work week.
ppm – parts per million
REL – NIOSH Recommended Limit indicated a time weighted average concentration that must not be exceeded during any 10 hour work shift of a 40 hr work week
STEL – Short-term exposure limit
TLV – ACGIH Threshold Limit Values (usually 8 hour time weighted average concentrations).
TWA – 8-hour, time-weighted average
UEL – Upper explosive (flammable) limit in air, % by volume (at room temperature)

TABLE 2
ACTION LEVELS FOR WORKER BREATHING ZONE

Instrument	Action Level *	Level of Respiratory Protection/Action
PID	0 to <5 ppm (one minute sustained)	Level D *
PID	>5 to <50 ppm (one minute sustained)	Utilize APR (Level C)
PID	>50 to <100 ppm (one minute sustained)	Level B
PID	>100 ppm	Stop work** (ventilate, apply foam)
CGI/H2S Meter	<5 ppm	Level D
CGI/H2S Meter	>5% to <25 ppm	Level B
CGI/H2S Meter	>25 ppm	Stop work**
CGI/CO Meter	>25 ppm	Level B
CGI/CO Meter	>50 ppm	Stop work** (ventilate area)
CGI/O2 Meter	<10% LEL, in excavation	Level D
	19.5% oxygen – 23.5%	Level D
CGI/O2 Meter	>10% LEL, in excavation	Allow to vent, apply foam**
	<19.5% or >23.5% oxygen	Stop work, Oxygen Deficient or Enriched ATM**
CGI/CO Meter	>25 to <35 ppm (five minutes sustained)	Allow to vent **
	>35 ppm	(five minutes sustained) Stop work **

Note:

Action levels are based on above background levels.

* Instrument readings will be taken in the breathing zone of the workers, unless otherwise indicated.

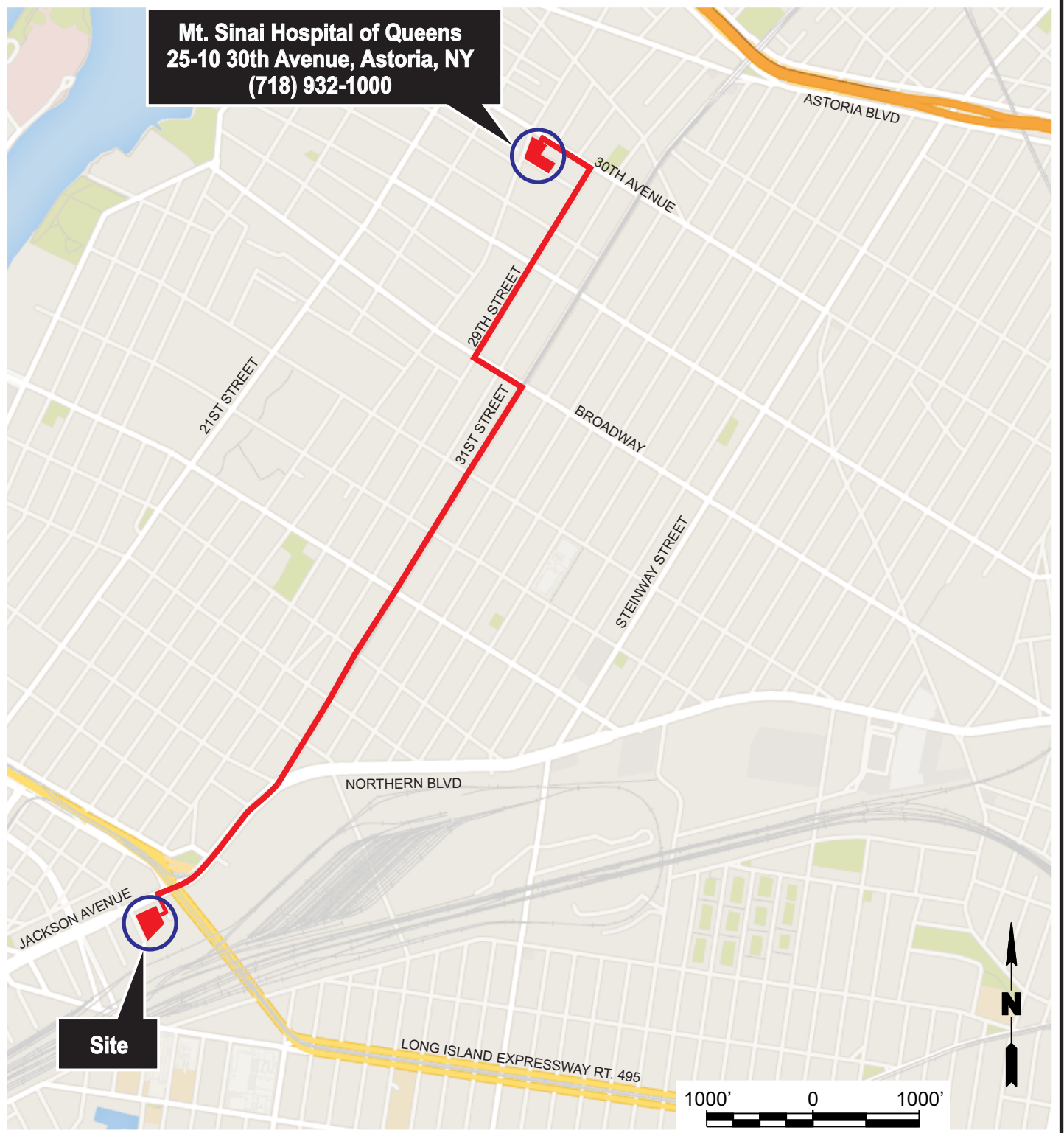
** Suspend work in immediate area. Conduct air monitoring periodically to determine when work can continue. Implement mitigative measures.

Site-Specific Health and Safety Plan
Queens Plaza Off-Site Properties
Long Island City, New York

FIGURES

1. Site Location Map
- 2A. Route to Mt. Sinai Hospital of Queens
- 3A. Route to CityMD Urgent Care

Mt. Sinai Hospital of Queens
25-10 30th Avenue, Astoria, NY
(718) 932-1000



1. From Site, drive northwest on West Street toward Jackson Avenue/NY-25A.
2. Turn RIGHT onto Jackson Avenue/NY-25A.
3. Turn slight LEFT onto 31st Street.
4. Turn LEFT onto Broadway, then Turn RIGHT onto 29th Street.
5. Turn LEFT onto 30th Avenue.

Mt. Sinai Hospital of Queens, 2510 30th Ave. Astoria NY 11102, (718)-932-1000

All in One health
(718)-932-1000

Title:

ROUTE TO MT. SINAI HOSPITAL OF QUEENS

OFFSITE
QUEENS PLAZA RESIDENTIAL DEVELOPMENT

Prepared for:

LIC OPERATOR CO., L.P.

ROUX

ROUX ASSOCIATES, INC.
Environmental Consulting
& Management

Compiled by: J.W.

Date: 05FEB16

Prepared by: G.M.

Scale: AS SHOWN

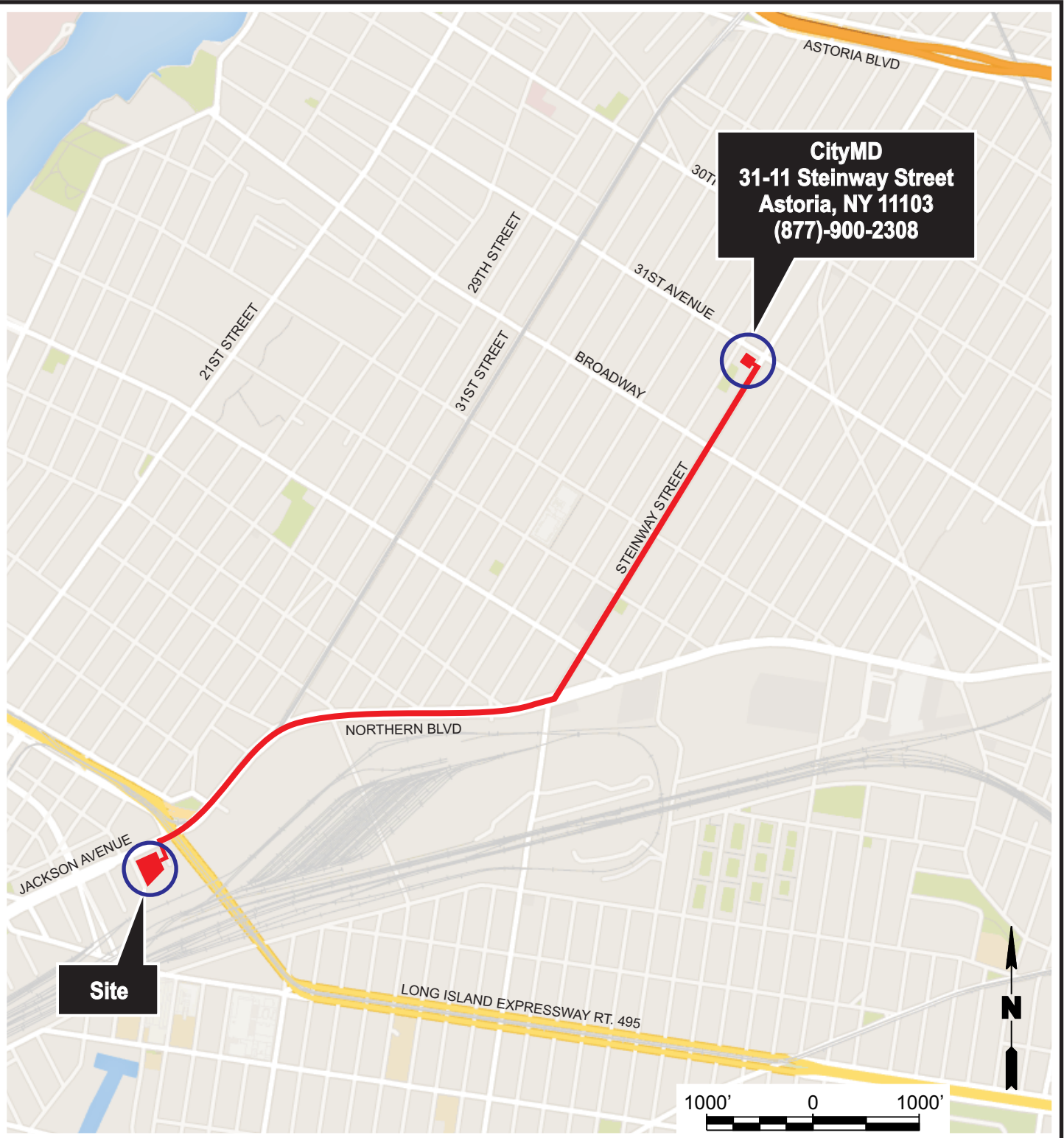
Project Mgr.: J.W.

Project No.: 2409.0003Y002

File: 2409.0003Y109.02.CDR

FIGURE

2A



1. From Site, drive northwest on West Street toward Jackson Avenue/NY-25A.
2. Turn RIGHT onto Jackson Avenue/NY-25A.
3. Turn slight LEFT onto Steinway Street.

CityMD
31-11 Steinway Street
Astoria, NY, 11103
(877)-900-2308

All in One health
(718)-932-1000

ROUTE TO CITYMD URGENT CARE

OFFSITE
QUEENS PLAZA RESIDENTIAL DEVELOPMENT

Prepared for:

LIC OPERATOR CO., L.P.



ROUX ASSOCIATES, INC.
Environmental Consulting
& Management

Compiled by: J.W.	Date: 05FEB16
Prepared by: G.M.	Scale: AS SHOWN
Project Mgr.: J.W.	Project No.: 2409.0003Y002
File: 2409.0003Y109.02.CDR	

FIGURE

3A

Site-Specific Health and Safety Plan
Queens Plaza Off-Site Properties
Long Island City, New York

APPENDICES

- A. Job Safety Analysis Forms
- B. Hazard Communication MSDS / SDS for Chemicals Used
- C. Roux Health & Safety Lessons Learned / Accident Report Forms
- D. Health and Safety Briefing / Meeting Log and Daily Site Safety Checklist
- E. Generic Community Air Monitoring Program
- F. Roux Subsurface Utility Clearance Procedure
- G. Roux Heavy Equipment Exclusion Zone Policy
- H. *ACORD*® Automobile Loss Notice Form
- I. Roux Peer Observation Form
- J. All One Health Responsibilities Form

Site-Specific Health and Safety Plan
Queens Plaza Off-Site Properties
Long Island City, New York

APPENDIX A

Job Safety Analysis Forms

JOB SAFETY ANALYSIS

COMPANY/ PROJECT NAME or ID/ LOCATION (City, State)		DATE	☒ NEW ☐ REVISED	PAGE 1 of _____ Roux Control No.: _____
WORK ACTIVITY (Description):				
DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE	
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE CRITICAL ACTIONS FOR TASK-SPECIFIC REQUIREMENTS)				
☐ REFLECTIVE VEST ☐ HARD HAT ☐ LIFELINE / HARNESS ☐ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☐ SAFETY SHOES _____	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☐ PPE CLOTHING _____	☐ GLOVES _____ ☐ OTHER _____	
¹JOB STEPS	²POTENTIAL HAZARDS	³CRITICAL ACTIONS TO MITIGATE HAZARDS		
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

¹ Each Job or Operation consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the associated hazards in Column 2

² A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **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. Specify the hazards and do not limit the description to a single word such as "Caught"

³ Aligning with the first two columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

JOB SAFETY ANALYSIS		Ctrl. No. GEN-004	DATE 1/5/2015	☐ NEW ☒ REVISED	PAGE 1 of 2
JSA TYPE CATEGORY: Generic	WORK TYPE: Drilling	WORK ACTIVITY (Description): Direct Push Soil Borings / Well Installation			
DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE		
Jeffrey Wills	Project Hydrogeologist	Ray Fitzpatrick	OHSO		
Thalassa Sodre	Staff Assistant Engineer				
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: <u>Composite-toe or steel toe boots</u>	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: <u>Fluorescent reflective vest or high visibility clothing, Long Sleeve Shirt</u>	☒ GLOVES: <u>Leather, Nitrile and cut resistant</u> ☒ OTHER: <u>Insect Repellent, sunscreen (as needed)</u>		
REQUIRED AND / OR RECOMMENDED EQUIPMENT					
Geoprobe or Truck-Mounted Direct Push Drill Rig, Hand Tools, Photoionization Detector and/or Multi-Gas Meter (or equivalent), Macrocore liners, Liner Opening Tool, 42" Cones & Flags					
Exclusion Zone Policy – All non-essential personnel will maintain a distance of 10' feet from drilling equipment while moving/engaged.					
"SHOW ME YOUR HANDS"					
Driller and helper should show that hands are clear from controls and moving parts					
Assess ¹JOB STEPS	Analyze ²POTENTIAL HAZARDS	Act ³CRITICAL ACTIONS			
1. Mobilization of drilling rig (ensure the Subsurface Clearance Protocol and Drill Rig Checklist are completed)	1a. CONTACT: Equipment/property damage. 1b. FALL: Slip/trip/fall hazards.	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. 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.			
2. Raising tower/derrick of drill rig	2a. CONTACT: Overhead hazards. 2b. CONTACT: Pinch Points when raising the rig and instability of rig	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 from overhead structures. 2b. Inspect the equipment prior to use and avoid pinch points. 2b. Lower out riggers on rig 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.			

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".

3. Advancement of drilling equipment and well installation (Continued)	3b. EXPOSURE: Noise and dust. 3c. CAUGHT: Limb/extremity pinching; abrasion/crushing. 3d. CONTACT: Equipment imbalance during advancement of drill equipment. 3e. EXPOSURE: Inhalation of contamination/vapors. 3f. FALL: Slip/trip/fall hazards. 3g. EXERTION: Potential for muscle strain/injury while lifting and installing well casings, lifting sand bags, and/or lifting rods.	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. 3c. Always wear leather gloves when making connections and using hand tools; wear cut-resistant (i.e., Kevlar) gloves when handling cutting tools. 3c. Inspect the equipment prior to use for potential pinch points. Keep hands away from being between pinch points and use of tools is preferable compared to fingers and hands. 3c. Inspect drill head for worn surface or missing teeth; replace if damaged or blunt. 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. 3c. Drillers and helpers will understand and use the "Show Me Your Hands" Policy. 3c. Spinning rods/casing have an exclusion zone of 10 feet while in operation. 3d. Drillers will advance the borehole with caution to avoid causing the rig to become imbalanced and/or tip. 3d. 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. 3d. 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). 3e. Air monitoring using a calibrated photoionization detector (PID) will be used to periodically to monitor the breathing zone of the work area. 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 precautions in accordance with the site specific health and safety plan. 3f. Contain drill cuttings and drilling water to prevent fall hazards from developing in work area. 3f. See 1b. 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. Decontaminate equipment.	4a. EXPOSURE/CONTACT: To contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, vapors). 4b. EXPOSURE: To chemicals in cleaning solution including ammonia.	4a. Wear chemical-resistant disposable gloves and safety glasses. 4a. Contain decontamination water so that it does not spill. 4a. Use an absorbent pad to clean spills, if necessary. 4a. See 3b. 4b. See 4a. Review MSDS 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.

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-007	DATE: 1/5/2015	☐ NEW ☒ REVISED	PAGE 1 of 1
JSA TYPE CATEGORY GENERIC		WORK TYPE Drilling		WORK ACTIVITY (Description) Movement of 55-gallon Drums/Drum Handling	
DEVELOPMENT TEAM		POSITION / TITLE		REVIEWED BY:	POSITION / TITLE
Thalassa Sodre		Staff Assistant Engineer		Jeff Wills	Project Manager
REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT					
☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES		☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☒ SAFETY SHOES: <u>Steel toed boots</u>		☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: <u>Fluorescent reflective vest or high visibility clothing</u> ☒ GLOVES: <u>Cut-resistant gloves</u> ☐ OTHER:	
REQUIRED AND / OR RECOMMENDED EQUIPMENT					
Required Equipment: Drum Cart and/or forklift, safety cones, and caution tape					
EXCLUSION ZONE: A 10' exclusion zone will be maintained around forklift.					
Assess 1JOB STEPS		Analyze 2POTENTIAL HAZARDS		Act 3CRITICAL ACTIONS	
1. Secure Work Area, Inspect 55-gal drums for proper condition, labeling, check drum ring and bolts.		1a. FALL: Tripping/falling due to uneven surface terrain. 1b. EXPOSURE: Drums could potentially be damaged and contain hazardous material. 1c. OVEREXERTION: Potential muscle strain while loosening or tightening bolts.		1a. Inspect walking path for uneven terrain, weather-related hazards (i.e., tree debris, puddles, etc.), and obstructions prior to accessing work area. 1a. Use established pathways and walk on stable, secure ground. 1a. Secure work area and coordinate and communicate the planned work activities with other personnel working in the area. 1a. 1b. When inspecting drums, don nitrile gloves under cut resistant glove. If drum is not properly labeled, do not open and cease all drum transport related 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. 1c. Keep back straight and secure grip on drum ratchet.	
2. When using a forklift, position drum clamp in between drum ribs. When using a drum dolly, secure fastening hook on top of drum. .		2a. CAUGHT/CONTACT: Hazards between drum/forklift clamp or dolly fastener/drum. 2b. OVEREXERTION/CONTACT: Hazards associated with balancing drum on drum cart (leaning back and pulling drum with your back).		2a. Position drum clamp between the ribs on the drum to prevent possible slipping. Do not place hands between drum clamp and drum; wear cut resistant gloves. 2b. Do not jerk body. Wear cut-resistant gloves and steel toed boots. 2b. Ensure that drums are not over-filled.	
3. Transport drums to designated location and disengage drum clamp.		3a. EXPOSURE/ CONTACT: Hazards associated with drum transport; skin contact and vapors. 3b. CAUGHT: Pinching hazards associated with maneuvering drums. 3c. FALL: Tripping/ falling due to obstructions and uneven terrain.		3a. Maintain a 10' EZ around forklift. Ensure drum clamp is secure on drum before beginning to move. 3a. Ensure that drum is sealed and lid is tight before beginning to move. 3b. Do not place fingers between drum clamp and drum; wear cut resistant gloves. 3c. See 2b. 3c. If path is too rough for drum cart, utilize forklift. 3c. Utilize a spotter while operating the forklift.	

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-006	DATE 2/8/2016	☐ NEW ☒ REVISED	PAGE 1 of 2
JSA TYPE CATEGORY Generic		WORK TYPE Surveying		WORK ACTIVITY (Description) Elevation Surveying	
DEVELOPMENT TEAM		POSITION / TITLE		REVIEWED BY:	POSITION / TITLE
Bjorn Wespestad		Project Engineer		Jeff Wills	Project Manager
Thalassa Sodre		Staff Assistant Engineer			
REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT					
☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES		☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☒ SAFETY SHOES: <u>Steel-toe boots</u>		☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: <u>Fluorescent reflective vest or high visibility clothing</u> ☒ GLOVES: <u>Cut-resistant or leather</u> ☐ OTHER	
REQUIRED AND / OR RECOMMENDED EQUIPMENT					
Surveying equipment (i.e., leveling rod/measuring ruler, tripod and scope).					
Assess 1JOB STEPS		Analyze 2POTENTIAL HAZARDS		Act 3CRITICAL ACTIONS	
1. Locate surveying position for instrument and rod and set-up work area		1a. FALL: Slip/trip hazards. 1b. CONTACT: Traffic (surveying locations could potentially be located in parking areas and sidewalks). 1c. OVEREXERTION: Hazard due to carrying, lifting, and bending while transporting equipment. 1d. CAUGHT/CONTACT: Pinch Points / sharp edges associated with setting up the tripod.		1a. Inspect area for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to setting up at the survey location. 1b. Be aware of oncoming traffic. Utilize a flagman / spotter for locations in streets or high-traffic areas. 1b. Place 42 inch cones around the work area, and delineate work zone with caution tape, if necessary. 1b. Wear appropriate PPE including high visibility clothing or reflective safety vest. 1b. Face traffic, maintain eye contact with oncoming vehicles, and establish a safe exit route. 1c. Use proper body positioning and lifting techniques; keep back straight, lift with legs, keep load close to body, and never reach with a load. 1c. Avoid carrying too much equipment at one time and team-lift equipment that is more than 50lb. 1d. Wear cut resistant gloves when handling the tripod. Don't carry tripod by the pointed ends.	
2. Open / close manhole cover to well that is being surveyed (if necessary).		2a. OVEREXERTION: Muscle strain 2b. CAUGHT: Pinch points associated with removing / replacing manholes and working with hand tools. 2c. EXPOSURE: To potentially hazardous vapors. 2d. CONTACT: With traffic.		2a. See 1c. Bend knees when reaching to open well. Use manhole lifting hook or pry bar to avoid bending. 2b. Wear leather gloves or cut resistant gloves when working with well cover and hand tools. 2b. Use proper tools (ratchet and crowbar or pry bar for well cover) and inspect before use. 2b. Do not put fingers under well cover. 2c. No open flames/heat sources. 2c. To minimize exposure to vapors allow well to vent after opening it and before survey activities begin. 2c. Work on the upwind side of well. 2d. See 1b.	

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. Perform survey.	3a. FALL: Slip/trip hazards 3b. CONTACT: Traffic (surveying locations could be potentially located in parking areas and sidewalks)	3a. See 1a. 3b. See 1b. 3b. Personnel using the scope will be devoting most of their attention to the surveying activity. Personnel holding the measuring stick should be extra vigilant of survey personnel and communicate any potential hazards to the instrument person via handheld radio or similar means. Ensure reflective safety vest is worn.
4. Break down work area.	4a. CONTACT: Traffic (surveying locations can potentially be located in parking areas and sidewalks). 4b. EXERTION: Hazard due to carrying, lifting, and bending while transporting equipment	4a. See 1b. 4b. See 1c.

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-005		DATE 1/5/2015	☐ NEW ☒ REVISED	PAGE 1 of 2
JSA TYPE CATEGORY Generic		WORK TYPE: Gauging and Sampling		
WORK ACTIVITY (Description): Gauging and Sampling				
DEVELOPMENT TEAM		POSITION / TITLE		REVIEWED BY:
Gina Masciello		Project Scientist		Jeff Wills
Thalassa Sodre		Staff Assistant Engineer		
REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT				
☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES		☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☒ SAFETY SHOES: <u>Composite-toe or steel toe boots</u>		☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: <u>Fluorescent reflective vest or high visibility clothing</u> ☒ GLOVES: <u>Leather, Nitrile and cut resistant</u> ☒ OTHER: <u>Knee pads, Insect Repellant, sunscreen (as needed)</u>
REQUIRED AND / OR RECOMMENDED EQUIPMENT				
42 inch Safety Cones, Caution Tape, Interface Probe and/or Water Level Meter, 20 lb. Fire Extinguisher, Buckets. Tools as needed: Socket Wrench, Screw Driver, Crow Bar, Mallet, and Wire Brush.				
Assess 1JOB STEPS		Analyze 2POTENTIAL HAZARDS		Act 3CRITICAL ACTIONS
1. Mobilization to monitoring well(s).		1a. FALL: Personal injury from slip/trip/fall due to uneven terrain and/or obstructions. 1b. CONTACT: With traffic/third parties. 1c. EXPOSURE: To biological hazards.		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. 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. Inspect work area for bees and insects. 1c. Use insect/tick repellent as necessary.
2. Open/close well.		2a. OVEREXERTION: Muscle strain. 2b. CAUGHT: Pinch points associated with removing/replacing manholes and working with hand tools. 2c. EXPOSURE: To potential hazardous vapors.		2a. Use proper lifting techniques; keep back straight, lift with legs and bend knees when reaching to open/close well. 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. No open flames/heat sources. 2c. To minimize exposure to vapors allow well to vent after opening it and before sampling activities begin. 2c. Stand up-wind, if possible, to avoid vapors.
3. Gauge well.		3a. CONTACT: With contamination (e.g. contaminated groundwater). 3b. CONTACT: With traffic.		3a. Wear chemical-resistant disposable 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. See 1b.
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.
Assess 1JOB STEPS		Analyze 2POTENTIAL HAZARDS		Act 3CRITICAL ACTIONS

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".

4. Purge and sample well (Continued).	4b. CONTACT: Personal injury from cuts, abrasions, or punctures by glassware or sharp objects. 4c. EXERTION: Muscle strain while carrying equipment. 4d. CONTACT: With traffic.	4b. To avoid spills or breakage, place sample ware on even surface. 4b. Do not over tighten caps on glass sample ware. 4b. Wear cut-resistant (i.e., Kevlar) gloves and chemical-resistant disposable gloves when sampling and handling glassware (i.e., VOA vials) or when using cutting tools. 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 50lbs or heavier. 4c. Make multiple trips to carry equipment. 4d. See 1b.
5. Management of purge water.	5a. EXPOSURE/CONTACT: To contamination (e.g., SPH, contaminated groundwater, vapors). 5b. EXERTION: Muscle strain from lifting/carrying and moving containers.	5a. Do not overfill container and pour liquids in such a manner that they do not splash. 5a. Properly dispose of used materials/PPE in appropriate container in designated storage area. 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.

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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.	DATE 1/12/2015	☐ NEW ☒ REVISED	PAGE 1 of 2
JSA TYPE CATEGORY: Site Specific Site: Morton Village		WORK TYPE: Drilling	WORK ACTIVITY (Description): Hollow Stem Auger Soil Borings /Well Installation		
DEVELOPMENT TEAM		POSITION / TITLE	REVIEWED BY:	POSITION / TITLE	
Dennis Mayer		Operations Manager	Jeff Wills	Project Manager	
Gina Vanderlin		Project Scientist			
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 <u>steel or composite toe</u>	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: <u>fluorescent long sleeve shirt or long sleeve shirt and reflective safety vest.</u>	☒ GLOVES: <u>Leather, Nitrile and cut resistant</u> ☒ OTHER: <u>Insect Repellent, sunscreen (as needed)</u>	
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. Fire Extinguisher, 42" Cones & Flags, "Work Area" Signs					
EXCLUSION ZONE POLICY – All non-essential personnel shall maintain a 20 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 1JOB STEPS		Analyze 2POTENTIAL HAZARDS		Act 3CRITICAL ACTIONS	
1. Mobilization / demobilization and establish a work area		1a. See Mobilization/ Demobilization		1a. See Mobilization/ Demobilization JSA	
2. Raising tower/derrick of drilling rig		2a. CONTACT: Overhead hazards. 2b. CONTACT: Amputation/crush points when raising the rig and instability of rig.		2a. Prior to raising the tower/derrick, 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. ExxonMobil requirements for raising a tower/derrick in the area of overhead wires must be reviewed prior to drilling. 2a. The tower/derrick must not be raised beneath overhead power lines unless approved by both the Roux PM. 2a. Maintain at a minimum 10' from from overhead structures. 2a. Do not move the rig while the tower/derrick is raised. 2b. Inspect the equipment prior to use and avoid amputation points. 2b. Lower out riggers on rig to ensure stability prior to raising rig tower derrick. Keep feet and body out of the line of fire when lowering out-riggers 2b. If the rig needs to be mounted, be sure to use three points of contact.	
3. Advancement of augers for soil borings, steel casing modification, and well material installation.		3a. CONTACT: Flying / spraying debris. 3b. EXPOSURE: Noise and dust.		3a. Wear required PPE (especially hand, eye, ear protection). 3a. Maintain minimum 20' EZ distance when operating to avoid lines of fire of possible flying materials 3b. Wet borehole area with sprayer to minimize dust. Stand upwind and keep body away from rig. 3b. Wear hearing protection while drill rig is operating/or the noise levels exceed 85dBA.	

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4. Advancement of augers for soil borings, steel casing modification, and well material installation (Continued).	4c. CAUGHT: Limb/extremity amputation; abrasion/crushing. 4d. CONTACT: Equipment imbalance during advancement of drill equipment, sparks/heat generated during steel casing modification with chop saw, and installing steel override casing. 4e. EXPOSURE: Inhalation of contamination/vapors. 4f. FALL: Slip/trip/fall hazards. 4g. EXERTION: Installing well casings and lifting augers.	4c. Always wear leather gloves when making connections and using hand tools; wear cut-resistant (i.e., Kevlar) gloves when handling cutting tools. 4c. Inspect the equipment prior to use for potential pinch points. 4c. Test all emergency shutdown devices prior to drilling. 4c. Inspect drill head for worn surface or missing teeth; replace if damaged or blunt. 4c. Inspect augers, do not use if auger flight if damaged or bent. 4c. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body. 4c. 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. 4c. Drillers and helpers will understand and use the "Show Me Your Hands" Policy. 4c. Spinning augers should have an exclusion zone of 20 feet when in operation. 4d. Drillers will advance the borehole with caution to avoid causing the rig to become imbalanced and/or tip. 4d. 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. 4d. 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). 4d. When lifting and lowering steel override casing into borehole, personnel that are non-essential will be positioned away from direct line of fire incase casing falls over or swings during advancement. 4d. Flame retardant clothing must be worn while sparks are generated. 4e. Air monitoring using a calibrated photoionization detector (PID) will be used to periodically monitor the breathing zone of the work area. 4e. The Action Level for breathing zone air is five parts per million (sustained) as detected by the PID. 4e. 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. 4f. See 1b. 4f. Remove soil cuttings to avoid a tripping hazard from developing near augers. 4g. Keep back straight and bend at the knees. 4g. Utilize team lifting for objects over 50lbs. 4g. Use mechanical lifting device for odd shaped objects.
5. Cleaning the auger flights	5a. CONTACT: Cuts/scrapes or puncture wound from hand tool contacting auger.	5a. Follow "No 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 ¼ 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	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. 5b. See 5a.

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JOB SAFETY ANALYSIS		Cntrl. No. GEN-010	DATE: 1/5/2015	☐ NEW ☒ REVISED	PAGE 1 of 2
JSA TYPE CATEGORY GENERIC		WORK TYPE Site Recon	WORK ACTIVITY (Description) Mobilization/Demobilization		
DEVELOPMENT TEAM	POSITION / TITLE		REVIEWED BY:	POSITION / TITLE	
Jared Lefkowitz	Staff Assistant Scientist		Ray Fitzpatrick	OSHO	
Jeff Wills	Project Hydrogeologist				
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: <u>Steel Toe or composite toe</u>		☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: <u>Fluorescent reflective vest of high-visibility clothing;</u> <u>long sleeve shirt; long pants</u> ☐ GLOVES: <u>Leather, nitrile, and cut resistant (as needed)</u> ☐ OTHER	
REQUIRED AND / OR RECOMMENDED EQUIPMENT					
Required Equipment:					
EXCLUSION ZONE: A minimum exclusion zone of 10' will be maintained around moving equipment (if necessary)					
Assess ¹JOB STEPS	Analyze ²POTENTIAL HAZARDS		Act ³CRITICAL 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. 1b. CONTACT: Personal injury and/or property damage caused by being struck by Site traffic or equipment used in Site activities. 1c. CAUGHT: Personal injury from pinch points and being in line-of-fire of vehicle and/or equipment.		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. 1a. Wear boots with adequate treads. 1a. Delineate unsafe areas with 42" cones, caution tape and/or flagging. 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. 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 when unnecessary. 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 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. 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. 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 of work area. 1c. Wear leather gloves when handling any tools or equipment. Avoid wearing loose clothing. Wear cut-resistant gloves (Kevlar or similar) when handling sharp objects/cutting tools. 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. Ensure loose clothing is secure.		

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Assess ¹ JOB STEPS	Analyze ² POTENTIAL HAZARDS	Act ³ CRITICAL ACTIONS
	1d. OVEREXERTION: Muscle strains while lifting/carrying equipment. 1e. EXPOSURE: Personal injury from exposure to biological and environmental hazards. 1f. EXPOSURE: Heat and cold related injuries. 1g. EXPOSURE: Personal injury from noise hazards.	1d. Use body positioning and lifting techniques that avoid muscle strain; keep back straight, lift with legs, 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 awkward to carry or over 50 lbs. 1e. Inspect area to avoid contact with biological hazards (i.e. poisonous plants, stinging insects, ticks, etc.). 1e. Wear long sleeved clothes, apply insect repellent containing DEET, 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. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing). Take breaks as needed. 1f. Watch for cold stress symptoms (severe shivering, slowing of body movement, weakness, stumbling or inability to walk, collapse). Take breaks 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. Wear hearing protection if sound levels exceed 85 dBA.

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JOB SAFETY ANALYSIS		Cntrl. No. GEN-009	DATE: 1/5/2015	☐ NEW ☒ REVISED	PAGE 1 of 2
JSA TYPE CATEGORY GENERIC		WORK TYPE Hand Tools		WORK ACTIVITY (Description) Pre-Clearing activities, including Air Knifing and Soil Vacuuming	
DEVELOPMENT TEAM		POSITION / TITLE		REVIEWED BY:	
Jeff Wills		Project Hydrogeologist		Ray Fitzpatrick	
Dennis Mayer		Manager (ADT)		OHSO	
REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT					
☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES		☐ GOGGLES ☒ FACE SHIELD (while air knifing) ☒ HEARING PROTECTION (as needed) ☒ SAFETY SHOES: <u>Steel or composite toed</u>		☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: <u>Fluorescent reflective vest or high visibility clothing</u> ☒ GLOVES: <u>Nitrile and cut resistant</u> ☒ OTHER: <u>Dust mask (as needed)</u>	
REQUIRED AND / OR RECOMMENDED EQUIPMENT					
Required Equipment: Air Knife, Vactor Truck (Vac Truck), Compressor, Hand Tools, Photoionization Detector, Multi-Gas Meter, Traffic Cones, 20 lb. Fire Extinguisher, "Work Area" and/or "Exclusion Zone" Signs					
EXCLUSION ZONE: A 10 foot exclusion zone will be maintained around air knife and/or soil vacuum operations.					
Assess 1JOB STEPS		Analyze 2POTENTIAL HAZARDS		Act 3CRITICAL 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 and soil vacuum, and/or clearance with hand tools		3a. CONTACT: Flying debris. 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. OVEREXERTION: 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. 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. Pre-clearing with air knife and soil vacuum, and/or clearance with hand tools (continued)	3d. OVEREXERTION: (continued) Poor body positioning when handling equipment and materials. 3e. FALL: Tripping/falling due to uneven terrain, weather conditions, and materials/equipment stored at the Site. 3f. CAUGHT: Pinch points associated with the equipment and vacuum hose. 3g. EXPOSURE: Noise from vac truck and/or air compressor.	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. 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. 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 of equipment. 3f. Drillers and helpers will understand and use the "Show Me Your Hands Policy". 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). 4b. EXERTION: Muscle strain while maneuvering drums with drum cart/lift gate. 4c. CAUGHT: Pinch points associated with handling drum lid.	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. 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. 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). 5b. EXPOSURE: To chemicals in cleaning solution.	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. See 4a.

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JOB SAFETY ANALYSIS		Cntrl. No. GEN-012	DATE: 1/5/2015	☐ 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	
Jeff Wills		Project Hydrogeologist	Ray Fitzpatrick	OHSM	
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 Repellent, sunscreen (as needed)	
REQUIRED AND / OR RECOMMENDED EQUIPMENT					
Recommended Equipment; 42" traffic cones, caution tape, trowel					
EXCLUSION ZONE: A minimum 10' exclusion zone will be maintained around moving equipment, if present.					
Assess 1JOB STEPS		Analyze 2POTENTIAL HAZARDS		Act 3CRITICAL ACTIONS	
1. Secure location		1a. CONTACT: Personnel and vehicular traffic may enter the work area. 1b. FALL: Tripping/falling due to uneven terrain or entry/exit from excavations. 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 occurred. Exposure to explosive vapors due to tank farm operations, Biological hazards - ticks, bees/wasps, poison ivy, thorns, insects, etc.		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 fluorescent 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. 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 will 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 appropriate (when stabilization is complete), ladders must be employed for steep embankments, excavations, pits, and trenches. 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 also 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 an area with air conditioning (i.e., car, site trailer, etc.). Move to an area that is warm. 1c. No open flames/heat sources. 1c. Flame resistant 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/repel 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 repellent 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. 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.	

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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. 2b. EXPOSURE: Exposure to contamination (impacted soil) and/or lab preservatives.	2a. Wear cut-resistant (i.e., Kevlar) gloves under chemical-resistant 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. Wear chemical-resistant disposable gloves over cut resistant gloves to protect hands when handling samples; use containment material or plastic sheeting to protect surrounding areas. 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.
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 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. 3b. Wear chemical-resistant disposable gloves and safety glasses. 3b. Work on the upwind side of decon area. 3b. Use an absorbent pad to clean spills. 3b. Properly dispose of used materials/PPE in provided drums in designated drum storage area.

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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 Cntrl#: GEN-015		DATE 2/8/16	☐ NEW ☒ REVISED	PAGE 1 of 2
JSA TYPE CATEGORY: GENERIC	WORK TYPE: Drilling	WORK ACTIVITY (Description): Well Development		
DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE	
Amy Hoffman	Staff Geologist	Jeff Wills	Project 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: <u>Composite-toe or steel toe boots</u>	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: <u>Fluorescent reflective vest or high visibility clothing</u>	☒ GLOVES: <u>Leather, Nitrile and cut resistant</u> ☒ OTHER: <u>Insect repellent, sunscreen (as needed)</u>	
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, Submercible Pump, Surge Block/Plunger, 20 lb. Fire Extinguisher, Holding Tanks and/or Buckets, Tools as needed: Socket and Pipe Wrench, Screw Driver, Pry Bar, Ratchet, Vault Key.				
Maintain a 20 Foot Exclusion Zone During Development Activities				
"SHOW ME YOUR HANDS" Driller and helper should show that hands are clear from controls and moving parts				
Assess 1JOB STEPS	Analyze 2POTENTIAL HAZARDS	Act 3CRITICAL ACTIONS		
1. Mobilization / Demobilization (Review Mobilization and Demobilization JSA)	1a. CONTACT: Equipment/property damage. 1b. FALL: Slip/trip/fall hazards.	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 if there is tight clearance simultaneously on multiple sides of the equipment or if turning angles limit driver visibility. Stay away from the line-of-fire. 1a. Inspect the driving path for uneven terrain. 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.		
2. Open/close well.	2a. OVEREXERTION: Muscle strain (some wells have large vault covers). 2b. CAUGHT: Pinch points associated with removing/replacing manholes and working with hand tools. 2c. EXPOSURE: Potentially hazardous vapors. 2d. CONTACT: Traffic.	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. Wear 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. 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. 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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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, torque.

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. 3b. CONTACT/EXPOSURE: Contamination (e.g., SPH, contaminated groundwater, vapors). 3c. OVEREXERTION: Muscle strain from lifting equipment. 3d. CONTACT: Injury while handling wench line/cable, or with active surging equipment	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. 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. See 2a. 3c. Use mechanical device to insert and remove surge block/plunger if greater than 50lb. 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. 4b. FALL: Using side mounted ladder when attaching hose to tank. Slip, trip, fall from lines/hoses 4c. CONTACT: Contamination (e.g., SPH, contaminated groundwater). 4d. EXERTION: Muscle strain from lifting/carrying equipment. 4e. FALL: Spilled purge water.	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. Inspect ladder steps make sure steps are not bent/damaged and free of debris/fluid. 4b. Use three points of contact at all times when using ladder. 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. 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. Use lifting techniques to minimize muscle strain when carrying equipment. When possible, use mechanic means to lift equipment. 4d. Use two people to lift any equipment or material that is over 50 lbs. 4e. Clean up any spills using absorbent pads or spill kits.
5. Decontaminate equipment	5a. CONTACT/EXPOSURE: Contamination (e.g., SPH, contaminated groundwater, vapors). 5b. EXPOSURE/CONTACT: Chemicals in cleaning solution	5a. See 3b. 5b. Decontaminate equipment in well-ventilated area. Wear nitrile gloves to avoid skin contact with cleaning solutions.

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

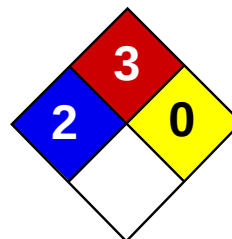
² A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics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

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".

Site-Specific Health and Safety Plan
Queens Plaza Off-Site Properties
Long Island City, New York

APPENDIX B

Hazard Communication MSDS /
SDS for Chemicals Used



Health	2
Fire	3
Reactivity	0
Personal Protection	H

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: C₆H₆

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 powerful 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, dimanganese heptoxide) produced by interaction of permanganates and sulfuric acid will explode on contact with benzene. Peroxodisulfuric acid is a very powerful 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 powerful 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.

Created: 10/10/2005 08:35 PM

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

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Material Safety Data Sheet
cis-1,2-Dichloroethylene, 97%

MSDS# 97773

Section 1 - Chemical Product and Company Identification

MSDS Name: cis-1,2-Dichloroethylene, 97%
Catalog Numbers: AC113380000, AC113380025, AC113380100, AC113380500
Synonyms: cis-Acetylene dichloride.

Company Identification: Acros Organics BVBA
Janssen Pharmaceuticaaan 3a
2440 Geel, Belgium

Company Identification: (USA) Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

For information in the US, call: 800-ACROS-01

For information in Europe, call: +32 14 57 52 11

Emergency Number, Europe: +32 14 57 52 99

Emergency Number US: 201-796-7100

CHEMTREC Phone Number, US: 800-424-9300

CHEMTREC Phone Number, Europe: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#: 156-59-2
Chemical Name: cis-1,2-Dichloroethylene
%: 97
EINECS#: 205-859-7

Hazard Symbols:

XN F



Risk Phrases:

11 20 52/53

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Warning! Flammable liquid and vapor. May cause respiratory tract irritation. Harmful if inhaled. May be harmful if swallowed. Causes eye and skin irritation. Unstabilized substance may polymerize. Target Organs: Central nervous system, respiratory system, eyes, skin.

Potential Health Effects

Eye: Causes moderate eye irritation.

Skin: Causes moderate skin irritation. May cause dermatitis.

Ingestion: May cause gastrointestinal irritation with nausea, vomiting and diarrhea. May be harmful if swallowed. May cause central nervous system depression.

Inhalation: May cause respiratory tract irritation. May cause narcotic effects in high concentration.

Chronic:

Section 4 - First Aid Measures

Eyes:	In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical aid.
Skin:	In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.
Ingestion:	If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical aid.
Inhalation:	If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
Notes to Physician:	

Section 5 - Fire Fighting Measures

General Information:	As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors may form an explosive mixture with air. Use water spray to keep fire-exposed containers cool. Flammable liquid and vapor. Fire or excessive heat may result in violent rupture of the container due to bulk polymerization. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas. Hazardous polymerization may occur under fire conditions.
Extinguishing Media:	Use water fog, dry chemical, carbon dioxide, or regular foam.
Autoignition Temperature:	440 deg C (824.00 deg F)
Flash Point:	6 deg C (42.80 deg F)
Explosion Limits: Lower:	9.70 vol %
Explosion Limits: Upper:	12.80 vol %
NFPA Rating:	health: 2; flammability: 3; instability: 2;

Section 6 - Accidental Release Measures

General Information:	Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks:	Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Remove all sources of ignition. Use a spark-proof tool. Provide ventilation.

Section 7 - Handling and Storage

Handling:	Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Use spark-proof tools and explosion proof equipment. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Avoid ingestion and inhalation. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames. Use only with adequate ventilation. Pure vapor will be uninhibited and may polymerize in vents or other confined spaces.
Storage:	Keep away from sources of ignition. Store in a tightly closed container. Flammables-area. Store protected from light and air.

Section 8 - Exposure Controls, Personal Protection

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
cis-1,2-Dichloroethy ylene	200 ppm	none listed	none listed

OSHA Vacated PELs: cis-1,2-Dichloroethylene: None listed

Engineering Controls:	Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.
Exposure Limits	
Personal Protective Equipment	

Eyes: Wear chemical splash goggles.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Liquid

Color: Clear

Odor: Pleasant odor

pH: Not available

Vapor Pressure: 201 mm Hg @ 25 deg C

Vapor Density: 3.34 (air=1)

Evaporation Rate: Not available

Viscosity: Not available

Boiling Point: 60 deg C @ 760 mm Hg (140.00°F)

Freezing/Melting Point: -80 deg C (-112.00°F)

Decomposition Temperature: Not available

Solubility in water: Insoluble

Specific Gravity/Density: 1.2800

Molecular Formula: C₂H₂Cl₂

Molecular Weight: 96.94

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures. This material is a monomer and may polymerize under certain conditions if the stabilizer is lost.
Conditions to Avoid: Light, ignition sources, exposure to air, excess heat.
Incompatibilities with Other Materials: Strong oxidizing agents, strong bases, copper.
Hazardous Decomposition Products: Hydrogen chloride, phosgene, carbon monoxide, carbon dioxide.
Hazardous Polymerization: May occur.

Section 11 - Toxicological Information

RTECS#: CAS# 156-59-2: KV9420000

RTECS:

LD50/LC50: CAS# 156-59-2: Inhalation, rat: LC50 = 13700 ppm;

Carcinogenicity: cis-1,2-Dichloroethylene - Not listed as a carcinogen by ACGIH, IARC, NTP, or CA Prop 65.

Other: See actual entry in RTECS for complete information.

Section 12 - Ecological Information

Not available

Section 13 - Disposal Considerations

Dispose of in a manner consistent with federal, state, and local regulations.

Section 14 - Transport Information

US DOT

Shipping Name: 1,2-DICHLOROETHYLENE

Hazard Class: 3

UN Number: UN1150

Packing Group: II

Canada TDG

Shipping Name: Not available

Hazard Class:

UN Number:
Packing Group:

Section 15 - Regulatory Information

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: XN F

Risk Phrases:

R 11 Highly flammable.

R 20 Harmful by inhalation.

R 52/53 Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 7 Keep container tightly closed.

S 16 Keep away from sources of ignition - No smoking.

S 29 Do not empty into drains.

S 61 Avoid release to the environment. Refer to special instructions/safety data sheets.

WGK (Water Danger/Protection)

CAS# 156-59-2: Not available

Canada

CAS# 156-59-2 is listed on Canada's NDSL List

Canadian WHMIS Classifications: Not available

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

CAS# 156-59-2 is not listed on Canada's Ingredient Disclosure List.

US Federal

TSCA

CAS# 156-59-2 is listed on the TSCA
Inventory.

Section 16 - Other Information

MSDS Creation Date: 2/09/1998

Revision #6 Date 7/20/2009

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential, or exemplary damages howsoever arising, even if the company has been advised of the possibility of such damages.



SAFETY DATA SHEET CREOSOTE

1 IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

PRODUCT NAME	CREOSOTE
CAS-No.	8001-58-9
EC No.	232-287-5
SUPPLIER	Bartoline Limited Barmston Close Beverley East Yorkshire HU17 0LW Tel. 01482 678710 Fax 01482 872606 HSE Manager Email info@bartoline.co.uk
APPLICATION	A wood preservative for use by professional operators against wood rotting fungi and wood destroying insects on external timbers.
EMERGENCY TELEPHONE	01482 678727 0800-1700

2 HAZARDS IDENTIFICATION

Harmful in contact with skin and if swallowed. May cause cancer. Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Irritating to eyes, respiratory system and skin.

CLASSIFICATION (1999/45) Carc. Cat. 1;R45. Xn;R21/22. Xi;R36/37/38. N;R50/53.

3 COMPOSITION/INFORMATION ON INGREDIENTS

Name	EC No.	CAS-No.	Content	Classification (67/548)
BENZ(A)ANTHRACENE	200-280-6	56-55-3	5-10%	Carc. Cat. 2;R45 N;R50/53
CRESOL Mixed Isomers	215-293-2	1319-77-3	< 1%	T;R24/25 C;R34
DIPHENYL	202-163-5	92-52-4	5-10%	Xi;R36/37/38 N;R50/53
NAPHTHALENE	202-049-5	91-20-3	< 1%	Carc. Cat. 3;R40 Xn;R22 N;R50/53
PHENOL	203-632-7	108-95-2	< 1%	Muta. Cat. 3;R68 T;R23/24/25 C;R34 Xn;R48/20/21/22
XYLENOL	215-089-3	1300-71-6	1-5%	T;R24/25 C;R34 N;R51/53

The Full Text for all R-Phrases are Displayed in Section 16

EC No.	232-287-5
CAS-No.	8001-58-9

COMPOSITION COMMENTS

This coal tar product is a complex mixture of constituents of variable composition.

4 FIRST-AID MEASURES

INHALATION

Move the exposed person to fresh air at once. Provide rest, warmth and fresh air. Get medical attention if any discomfort continues. Place unconscious person on the side in the recovery position and ensure breathing. When breathing is difficult, properly trained personnel may assist affected person by administering oxygen. If breathing stops, provide artificial respiration.

INGESTION

Get medical attention immediately! Rinse mouth thoroughly. Provide rest, warmth and fresh air. NEVER MAKE AN UNCONSCIOUS PERSON VOMIT OR DRINK FLUIDS! Do not induce vomiting. If vomiting occurs, the head should be kept low so that stomach vomit doesn't enter the lungs.

CREOSOTE**SKIN CONTACT**

Remove affected person from source of contamination. Promptly wash contaminated skin with water. Promptly remove clothing if soaked through and wash the skin with water. Continue to rinse for at least 15 minutes. Get medical attention if irritation persists after washing.

EYE CONTACT

Remove victim immediately from source of exposure. Make sure to remove any contact lenses from the eyes before rinsing. Promptly wash eyes with plenty of water while lifting the eye lids. Get medical attention promptly if symptoms occur after washing.

5 FIRE-FIGHTING MEASURES**EXTINGUISHING MEDIA**

Extinguish with foam, carbon dioxide, dry powder or water fog.

SPECIAL FIRE FIGHTING PROCEDURES

Keep up-wind to avoid fumes. Move container from fire area if it can be done without risk. Use supplied air respirator if product is involved in a fire. Containers close to fire should be removed or cooled with water.

UNUSUAL FIRE & EXPLOSION HAZARDS

No unusual fire or explosion hazards noted.

SPECIFIC HAZARDS

When heated and in case of fire, toxic vapours/gases may be formed.

PROTECTIVE MEASURES IN FIRE

Wear full protective clothing. Use air-supplied respirator during fire fighting.

6 ACCIDENTAL RELEASE MEASURES**PERSONAL PRECAUTIONS**

Wear protective clothing as described in Section 8 of this safety data sheet.

ENVIRONMENTAL PRECAUTIONS

Do not allow ANY environmental contamination. Never use water by itself on spillage; this will spread the spill and cause further contamination. Spillages or uncontrolled discharges into watercourses must be IMMEDIATELY alerted to the Environmental Agency or other appropriate regulatory body.

SPILL CLEAN UP METHODS

Wear necessary protective equipment. Absorb small quantities with paper towels and evaporate in safe place (fume hood). Allow sufficient time for vapours to completely clear the hood ducts, then burn the paper in a location away from combustible materials. Flush spilled material into suitable retaining areas or container with large quantities of water.

7 HANDLING AND STORAGE**USAGE PRECAUTIONS**

Avoid spilling, skin and eye contact. Keep away from heat, sparks and open flame. Ventilate well, avoid breathing vapours. Use approved respirator if air contamination is above accepted level.

USAGE DESCRIPTION

Apply by brush, dipping or spraying. DO NOT spray on windy days and protect plants from splashes.

STORAGE PRECAUTIONS

Store in tightly closed original container in a dry and cool place.

STORAGE CLASS

Toxic storage.

8 EXPOSURE CONTROLS/PERSONAL PROTECTION

Name	Std	TWA - 8 hrs		STEL - 15 min		Notes
CRESOL Mixed Isomers	OES	5 ppm(Sk)	22 mg/m3(Sk)			
DIPHENYL	OES	0.2 ppm	1.3 mg/m3	0.6 ppm	3.8 mg/m3	
NAPHTHALENE	OEL		50 mg/m3			
PHENOL	WEL	2 ppm(Sk)	7.8 mg/m3(Sk)			Sk

WEL = Workplace Exposure Limit.

OEL = Occupational Exposure Limit.

Sk = Can be absorbed through skin.

PROTECTIVE EQUIPMENT

CREOSOTE**PROCESS CONDITIONS**

DO NOT use on internal timbers of residential property Although outdoor use will not normally require any respiratory protection, it is recommended that users who are in contact with the product for long periods use a respirator which conforms to EN141 with a Type A2- P2 filter.

ENGINEERING MEASURES

Provide adequate ventilation, including appropriate local extraction, to ensure that the defined occupational exposure limit is not exceeded.

RESPIRATORY EQUIPMENT

If ventilation is insufficient, suitable respiratory protection must be provided.

HAND PROTECTION

Use protective gloves made of: Rubber, neoprene or PVC.

EYE PROTECTION

Wear approved chemical safety goggles where eye exposure is reasonably probable.

OTHER PROTECTION

Wear appropriate clothing to prevent any possibility of liquid contact and repeated or prolonged vapour contact.

HYGIENE MEASURES

Use appropriate skin cream to prevent drying of skin. Wash at the end of each work shift and before eating, smoking and using the toilet. Wash promptly with soap & water if skin becomes contaminated. Promptly remove any clothing that becomes contaminated. When using do not eat, drink or smoke. DO NOT SMOKE IN WORK AREA!

SKIN PROTECTION

Wash hands after use and wash off any adhesive which comes into contact with skin.

9 PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE	Dark coloured liquid		
COLOUR	Dark brown.		
ODOUR	Strong Aromatic		
SOLUBILITY	Immiscible with water Soluble in: Hydrocarbons.		
BOILING POINT (°C)	180 - 350	RELATIVE DENSITY	0.91 - 1.12 20
VAPOUR DENSITY (air=1)	Not determined	FLASH POINT (°C)	70
VOLATILE ORGANIC COMPOUND (VOC)	910 - 1120g/l		

10 STABILITY AND REACTIVITY

STABILITY

Stable under normal temperature conditions and recommended use.

CONDITIONS TO AVOID

Avoid heat, flames and other sources of ignition. Avoid contact with strong oxidisers.

HAZARDOUS POLYMERISATION

Will not polymerise.

MATERIALS TO AVOID

Strong acids. Natural Rubber

HAZARDOUS DECOMPOSITION PRODUCTS

Fire creates: Acid smoke/fumes of: Carbon monoxide (CO). Carbon dioxide (CO₂).

11 TOXICOLOGICAL INFORMATION

TOXICOLOGICAL INFORMATION

This product contains coal tar. Volume 35 of IARC monograph states that there is limited evidence that coal tar derived Creosotes are carcinogenic in humans and sufficient evidence for the carcinogenicity of Creosote in experimental animals. Limitations in the human exposure studies reviewed by IARC (including the presence of other chemicals, small study populations and not well documented exposure levels) contributed to IARC's conclusions regarding human exposure to creosote. When applied to the skin of mice in experimental studies, creosote produced skin tumors and in one study produced lung tumours.

GENERAL INFORMATION

Known or suspected carcinogen for humans.

CREOSOTE

INHALATION

SHORT TERM: The substance as a whole may cause irritation. One or more constituents may cause nausea, vomiting, headache, central nervous system effects, blood disorders and eye damage. **LONG TERM:** The substance as a whole may cause nausea, vomiting and headache. One or more constituents may cause irritation, central nervous system damage, liver cancer, kidney cancer, nasal cancer and lung cancer.

INGESTION

SHORT TERM: The substance as a whole may cause irritation (possibly severe), changes in body temperature, nausea, vomiting, difficulty breathing, irregular heartbeat, headache, dizziness, bluish skin colour, convulsions and cardiovascular collapse. **LONG TERM:** The substance as a whole may cause irritation, nausea, vomiting, headache, gastrointestinal effects, dizziness, changes in body temperature, visual disturbances, difficulty breathing, irregular heartbeat, bluish skin colour and cardiovascular collapse. One or more of the constituents may cause liver cancer.

SKIN CONTACT

SHORT TERM: The substance as a whole may cause irritation (possibly severe), thermal burns from heated material, skin discolouration, skin disorders, sensitivity to sunlight, changes in body temperature, nausea, vomiting, headache, difficulty breathing, irregular heartbeat, bluish skin colour and convulsions. One or more constituents may cause bluish skin colour and convulsions. One or more constituents may cause central nervous system damage. **LONG TERM:** The substance as a whole may cause dermatitis, skin discolouration, skin disorders, sensitivity to sunlight, changes in body temperature, nausea, vomiting, headache, difficulty breathing, irregular heartbeat, bluish skin colour, lung cancer and skin cancer.

EYE CONTACT

SHORT TERM: The substance as a whole may cause irritation (possibly severe), sensitivity to sunlight. **LONG TERM:** The substance as a whole may cause irritation and sensitivity to sunlight.

ROUTE OF ENTRY

Ingestion. Skin and/or eye contact. Inhalation. Skin absorption.

TARGET ORGANS

Eyes. Skin. Central nervous system. Kidneys. Liver.

12 ECOLOGICAL INFORMATION

ECOTOXICITY

The product contains substances which are toxic to aquatic organisms and which may cause long term adverse effects in the aquatic environment.

MOBILITY

The product contains volatile organic compounds (VOC) which will evaporate easily from all surfaces. The product is insoluble in water and will spread on the water surface.

BIOACCUMULATION

No data available on bioaccumulation.

DEGRADABILITY

Expected to be slowly but ultimately biodegradable.

ACUTE FISH TOXICITY

Toxic to aquatic environment and may cause long term adverse effects.

13 DISPOSAL CONSIDERATIONS

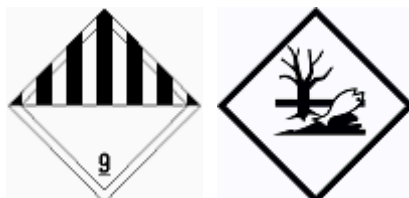
GENERAL INFORMATION

Waste is classified as hazardous waste. When handling waste, consideration should be made to the safety precautions applying to handling of the product. Waste, residue, empty containers, discarded work clothes and used disposable towels must be collected in designated receptacles, labelled with content. The packaging should be collected for reuse. Waste is classified as hazardous waste. Disposal to licensed waste disposal site in accordance with the local Waste Disposal Authority.

DISPOSAL METHODS

Liquid components can be disposed of by incineration. Waste material is classified as hazardous waste and should be disposed of by incineration or collected by a registered waste disposal company, operating within the scope of the Hazardous waste Regulations 2005 in the UK or local equivalent regulations in other countries.

14 TRANSPORT INFORMATION



UK ROAD CLASS

9

PROPER SHIPPING NAME

ENVIRONMENTALLY HAZARDOUS SUBSTANCE LIQUID NOS (CREOSOTE OIL)

CREOSOTE

UN NO. ROAD	3082	UK ROAD PACK GR.	III
ADR CLASS NO.	9	ADR CLASS	Class 9: Miscellaneous dangerous substances and articles.
ADR PACK GROUP	III	TUNNEL RESTRICTION CODE	(E)
HAZARD NO. (ADR)	90 Environmentally hazardous substance; miscellaneous dangerous substances.	ADR LABEL NO.	9
RID CLASS NO.	9	UN NO. SEA	3082
IMDG PACK GR.	III	EMS	F-A, S-F
MARINE POLLUTANT	YES	UN NO. AIR	9

15 REGULATORY INFORMATION

LABELLING



Toxic



Dangerous for the environment

CONTAINS

BENZ(A)ANTHRACENE

RISK PHRASES

R21/22	Harmful in contact with skin and if swallowed.
R45	May cause cancer.
R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R36/37/38	Irritating to eyes, respiratory system and skin.

SAFETY PHRASES

P11	Restricted to professional users. WEAR SUITABLE PROTECTIVE CLOTHING (COVERALLS) AND SYNTHETIC RUBBER/PVC GLOVES AND EYE PROTECTION when using. AVOID EXCESSIVE CONTAMINATION OF COVERALLS AND LAUNDRY REGULARLY. DO NOT BREATHE SPRAY MIST. Otherwise wear respiratory protective equipment and eye protection (see HSE Guidance booklet HS (G) 53. Respiratory protective equipment - a practical guide for users. However, engineering controls may replace personal protective equipment if a COSHH assessment shows they provide an equal or higher standard of protection. TAKE OFF IMMEDIATELY all contaminated clothing. DO NOT CONTAMINATE FOODSTUFFS, EATING UTENSILS OR FOOD CONTACT SURFACES. COVER WATER STORAGE TANKS before application. UNPROTECTED PERSONS AND ANIMALS SHOULD BE KEPT AWAY FROM TREATED AREAS FOR 48 HOURS OR UNTIL SURFACES ARE DRY. THIS MATERIAL AND ITS CONTAINER must be disposed of in a safe way. DO NOT APPLY in the presence of naked flames, hot surfaces or unprotected electrical equipment. DANGEROUS TO FISH AND OTHER AQUATIC LIFE. DO NOT CONTAMINATE watercourses or ground. ALL BATS ARE PROTECTED UNDER THE WILDLIFE AND COUNTRYSIDE ACT 1981. BEFORE TREATING ANY STRUCTURE USED BY BATS, CONSULT ENGLISH NATURE, SCOTTISH NATURAL HERITAGE OR THE COUNTRYSIDE COUNCIL FOR WALES. AVOID ALL CONTACT WITH PLANT LIFE. DO NOT USE ON INTERNAL TIMBERS OF RESIDENTIAL PROPERTY. WHEN USING DO NOT EAT, DRINK OR SMOKE. KEEP AWAY FROM FOOD, DRINK AND ANIMAL FEEDING STUFFS. KEEP OUT OF REACH OF CHILDREN. WASH HANDS AND EXPOSED SKIN before meals and after use. WASH SPLASHES from skin or eyes immediately. KEEP IN ORIGINAL CONTAINER. tightly closed, in a safe place. IF YOU FEEL UNWELL, seek medical advice (show the label where possible).

CREOSOTE

ENSURE ADEQUATE VENTILATION when applying.

VENTILATE TREATED AREAS THOROUGHLY after application.

UK REGULATORY REFERENCES

Health and Safety at Work Act 1974. The Control of Substances Hazardous to Health Regulations 1988.

ENVIRONMENTAL LISTING

Rivers (Prevention of Pollution) Act 1961. Control of Pollution (Special Waste Regulations) Act 1980.

EU DIRECTIVES

System of specific information relating to Dangerous Preparations. 2001/58/EC.

APPROVED CODE OF PRACTICE

Classification and Labelling of Substances and Preparations Dangerous for Supply.

GUIDANCE NOTES

Workplace Exposure Limits EH40. Introduction to Local Exhaust Ventilation HS(G)37. CHIP for everyone HSG(108).

NATIONAL REGULATIONS

The Chemicals (Hazard Information and Packaging for Supply) Regulations 2002. No. 1689. Workplace Exposure Limits 2005 (EH40) Health and Safety at Work Act (As Amended) 1974 Control of Substances Hazardous to Health Regulations 2002 (as amended) The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2007 (CDG 2007) Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC, including amendments. Users of this product are reminded of their duties under the current Control of Substances Hazardous to Health Regulations and a suitable and sufficient assessment of all the risk should be undertaken before using this product. The guidelines given in the HSE publication COSHH ESSENTIALS - Easy Steps To Control Chemicals gives sound advice for deciding safe working control measures.

16 OTHER INFORMATION

GENERAL INFORMATION

WHEN USED FOR THE OPURPOSE IF PRESERVING WOOD THIS MATERIAL IS REGULATED UNDER THE CONTROL OF PESTICIDES REGULATIONS 1986

REVISION DATE 13/04/2010

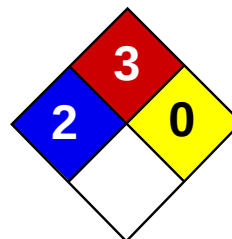
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RISK PHRASES IN FULL

R34	Causes burns.
R22	Harmful if swallowed.
R48/20/21/22	Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed.
R36/37/38	Irritating to eyes, respiratory system and skin.
R40	Limited evidence of a carcinogenic effect.
R45	May cause cancer.
R68	Possible risk of irreversible effects.
R23/24/25	Toxic by inhalation, in contact with skin and if swallowed.
R24/25	Toxic in contact with skin and if swallowed.
R51/53	Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

DISCLAIMER

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of the company's knowledge and belief, accurate and reliable as of the date indicated. However, no warranty guarantee or representation is made to its accuracy, reliability or completeness. It is the user's responsibility to satisfy himself as to the suitability of such information for his own particular use.



Health	2
Fire	3
Reactivity	0
Personal Protection	H

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; $\log(\text{oil/water}) = 3.1$

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, ignition 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 consciousness, 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 gastrointestinal/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:**

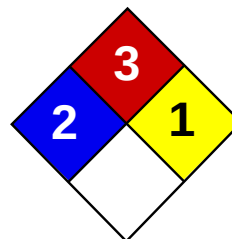
-Manufacturer's Material Safety Data Sheet. -Fire Protection Guide to Hazardous Materials, 13th ed., National Fire Protection Association (NFPA) -Registry of Toxic Effects of Chemical Substances (RTECS) -Chemical Hazard Response Information System (CHRIS) -Hazardous Substance Data Bank (HSDB) -New Jersey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

Other Special Considerations: Not available.

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Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Cumene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Cumene

Catalog Codes: SLC3052

CAS#: 98-82-8

RTECS: GR8575000

TSCA: TSCA 8(b) inventory: Cumene

CI#: Not available.

Synonym: Isopropyl benzene; Cumol; 2-Phenyl propane; (1-Methylethyl)benzene

Chemical Name: Isopropylbenzene

Chemical Formula: C₆H₅CH(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
Cumene	98-82-8	100

Toxicological Data on Ingredients: Cumene: ORAL (LD50): Acute: 1400 mg/kg [Rat]. 12750 mg/kg [Mouse]. DERMAL (LD50): Acute: 12300 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of skin contact (irritant, permeator), of eye contact (irritant), of ingestion, of inhalation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:

Very hazardous in case of skin contact (permeator). CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to lungs, the nervous system, mucous membranes. 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. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:

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

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate 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. Seek medical attention.

Ingestion:

Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 424°C (795.2°F)

Flash Points: CLOSED CUP: 36°C (96.8°F). OPEN CUP: 44°C (111.2°F).

Flammable Limits: LOWER: 0.9% UPPER: 6.5%

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.

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, 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: 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:

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. Eliminate all ignition sources. 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/ vapour/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.

Storage:

Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

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: 50 CEIL: 75 (ppm) TWA: 245 CEIL: 365 (mg/m³) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 120.2 g/mole

Color: Clear Colorless.

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

Boiling Point: 152.4°C (306.3°F)

Melting Point: -96°C (-140.8°F)

Critical Temperature: Not available.

Specific Gravity: 0.862 (Water = 1)

Vapor Pressure: 8 mm of Hg (@ 20°C)

Vapor Density: 4.14 (Air = 1)

Volatility: Not available.

Odor Threshold: 1.2 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.7

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

Acute oral toxicity (LD50): 1400 mg/kg [Rat]. Acute dermal toxicity (LD50): 12300 mg/kg [Rabbit].

Chronic Effects on Humans: The substance is toxic to lungs, the nervous system, mucous membranes.

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

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 more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : Isopropylbenzene : UN1918 PG: III

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: Cumene Massachusetts RTK: Cumene TSCA 8(b) inventory: Cumene SARA 313 toxic chemical notification and release reporting: Cumene CERCLA: Hazardous substances.: Cumene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):

CLASS B-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F).

DSCL (EEC):

R10- Flammable. R22- Harmful if swallowed. R38- Irritating to skin. R41- Risk of serious damage to eyes.

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: 1

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

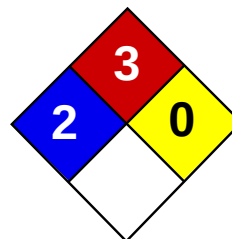
References: Not available.

Other Special Considerations: Not available.

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

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Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Methyl tert-butyl ether MSDS

Section 1: Chemical Product and Company Identification

Product Name: Methyl tert-butyl ether

Catalog Codes: SLM2152

CAS#: 1634-04-4

RTECS: KN5250000

TSCA: TSCA 8(b) inventory: Methyl tert-butyl ether

CI#: Not available.

Synonym:

Chemical Name: Methyl tert-Butyl Ether

Chemical Formula: C₅H₁₂O

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
Methyl {tert-}butyl ether	1634-04-4	100

Toxicological Data on Ingredients: Methyl tert-butyl ether: ORAL (LD50): Acute: 4000 mg/kg [Rat]. 5960 mg/kg [Mouse]. VAPOR (LC50): Acute: 23576 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Extremely hazardous in case of eye contact (irritant), of ingestion. Very hazardous in case of skin contact (irritant), of inhalation. Hazardous in case of skin contact (permeator). Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:

Extremely hazardous in case of eye contact (irritant), of ingestion. Very hazardous in case of skin contact (irritant), of inhalation. Hazardous in case of skin contact (permeator). CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to lungs, the nervous system, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged inhalation of vapors may lead to chronic respiratory irritation.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cold water may be used. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:

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

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate 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. Seek medical attention.

Ingestion:

Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 224°C (435.2°F)

Flash Points: CLOSED CUP: -28°C (-18.4°F).

Flammable Limits: LOWER: 2.5% UPPER: 15.1%

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.

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, 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: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

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. Eliminate all ignition sources.

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/ vapour/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.

Storage:

Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

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: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Characteristic. (Strong.)

Taste: Not available.

Molecular Weight: 88.15 g/mole

Color: Clear Colorless.

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

Boiling Point: 55.2°C (131.4°F)

Melting Point: -109°C (-164.2°F)

Critical Temperature: Not available.

Specific Gravity: 0.7405 (Water = 1)

Vapor Pressure: 245 mm of Hg (@ 20°C)

Vapor Density: 3.1 (Air = 1)

Volatility: 100% (v/v).

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

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

Solubility:

Soluble in methanol, diethyl ether. Partially soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: 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): 4000 mg/kg [Rat]. Acute toxicity of the vapor (LC50): 23576 ppm 4 hour(s) [Rat].

Chronic Effects on Humans: The substance is toxic to lungs, the nervous system, mucous membranes.

Other Toxic Effects on Humans:

Extremely hazardous in case of ingestion. Very hazardous in case of skin contact (irritant), of inhalation. Hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

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 more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : Methyl tert-butyl ether : UN2398 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: Methyl tert-butyl ether Massachusetts RTK: Methyl tert-butyl ether TSCA 8(b) inventory: Methyl tert-butyl ether SARA 313 toxic chemical notification and release reporting: Methyl tert-butyl ether CERCLA: Hazardous substances.: Methyl tert-butyl ether

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

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. R38- Irritating to skin. R41- Risk of serious damage to eyes.

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

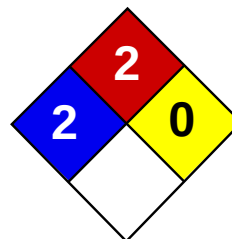
References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:23 PM

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

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Health	2
Fire	2
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Naphthalene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Naphthalene

Catalog Codes: SLN1789, SLN2401

CAS#: 91-20-3

RTECS: QJ0525000

TSCA: TSCA 8(b) inventory: Naphthalene

CI#: Not available.

Synonym:

Chemical Name: Not available.

Chemical Formula: C₁₀H₈

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
Naphthalene	91-20-3	100

Toxicological Data on Ingredients: Naphthalene: ORAL (LD50): Acute: 490 mg/kg [Rat]. 533 mg/kg [Mouse]. 1200 mg/kg [Guinea pig]. DERMAL (LD50): Acute: 20001 mg/kg [Rabbit]. VAPOR (LC50): Acute: 170 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of ingestion. Hazardous in case of eye contact (irritant), of inhalation. Slightly hazardous in case of skin contact (irritant, permeator). Severe over-exposure can result in death.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Classified Development toxin [POSSIBLE]. The substance is toxic to blood, kidneys, the nervous system, the reproductive system, liver, mucous membranes, gastrointestinal tract, upper respiratory tract, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate 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 immediate medical attention.

Ingestion:

Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 567°C (1052.6°F)

Flash Points: CLOSED CUP: 88°C (190.4°F). OPEN CUP: 79°C (174.2°F).

Flammable Limits: LOWER: 0.9% UPPER: 5.9%

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

Fire Hazards in Presence of Various Substances: Not available.

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 solid. **SMALL FIRE:** Use DRY chemical powder. **LARGE FIRE:** Use 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: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:

Flammable solid. Stop leak if without risk. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. 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 locked up Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe dust. 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:

Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. Keep container dry. Keep in a cool place.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust 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:

Israel: TWA: 10 (ppm) TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) [1995] TWA: 52 STEL: 79 (mg/m³) from ACGIH [1995]
Australia: STEL: 15 (ppm) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Crystalline solid.)

Odor: Aromatic.

Taste: Not available.

Molecular Weight: 128.19 g/mole

Color: White.

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

Boiling Point: 218°C (424.4°F)

Melting Point: 80.2°C (176.4°F)

Critical Temperature: Not available.

Specific Gravity: 1.162 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: 4.4 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.038 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties:

Partially dispersed in hot water, methanol, n-octanol. Very slightly dispersed in cold water. See solubility in methanol, n-octanol.

Solubility:

Partially soluble in methanol, n-octanol. Very slightly soluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Highly reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: May attack some forms of rubber and plastic

Polymerization: No.

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): 490 mg/kg [Rat]. Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 170 ppm 4 hour(s) [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. DEVELOPMENTAL TOXICITY: Classified Development toxin [POSSIBLE]. The substance is toxic to blood, kidneys, the nervous system, the reproductive system, liver, mucous membranes, gastrointestinal tract, upper respiratory tract, central nervous system (CNS).

Other Toxic Effects on Humans:

Very hazardous in case of ingestion. Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant, permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Ecotoxicity in water (LC50): 305.2 ppm 96 hour(s) [Trout].

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 more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 4.1: Flammable solid.

Identification: : Naphthalene, refined : UN1334 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:

Rhode Island RTK hazardous substances: Naphthalene Pennsylvania RTK: Naphthalene Florida: Naphthalene Minnesota: Naphthalene Massachusetts RTK: Naphthalene TSCA 8(b) inventory: Naphthalene TSCA 8(a) PAIR: Naphthalene TSCA 8(d) H and S data reporting: Naphthalene: 06/01/87 SARA 313 toxic chemical notification and release reporting: Naphthalene: 1% CERCLA: Hazardous substances.: Naphthalene: 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-4: Flammable solid. CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R36- Irritating to eyes. R40- Possible risks of irreversible effects. R48/22- Harmful: danger of serious damage to health by prolonged exposure if swallowed. R48/23- Toxic: danger of serious damage to health by prolonged exposure through inhalation. R63- Possible risk of harm to the unborn child.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 2

Reactivity: 0

Personal Protection: E

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

Health: 2

Flammability: 2

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust 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

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MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATHESON TRI-GAS, INC.
150 Allen Road Suite 302
Basking Ridge, New Jersey 07920
Information: 1-800-416-2505

Emergency Contact:
CHEMTREC 1-800-424-9300
Calls Originating Outside the US:
703-527-3887 (Collect Calls Accepted)

SUBSTANCE: BUTYL BENZENE

TRADE NAMES/SYNONYMS:

MTG MSDS 139; BUTYLBENZENE; 1-PHENYLBUTANE; N-BUTYLBENZENE; UN 2709;
MAT03530; RTECS CY9070000

CHEMICAL FAMILY: hydrocarbons, aromatic

CREATION DATE: Jan 24 1989

REVISION DATE: Dec 11 2008

2. COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: BUTYL BENZENE

CAS NUMBER: 104-51-8

PERCENTAGE: 100

3. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=2 REACTIVITY=0



EMERGENCY OVERVIEW:

COLOR: colorless

PHYSICAL FORM: liquid

ODOR: odorless

MAJOR HEALTH HAZARDS: respiratory tract irritation, skin irritation, eye irritation, central nervous system depression

PHYSICAL HAZARDS: Combustible liquid and vapor.

POTENTIAL HEALTH EFFECTS:

INHALATION:

SHORT TERM EXPOSURE: irritation, vomiting, headache, symptoms of drunkenness, coma

LONG TERM EXPOSURE: lung damage

SKIN CONTACT:

SHORT TERM EXPOSURE: irritation, headache, symptoms of drunkenness

LONG TERM EXPOSURE: same as effects reported in short term exposure

EYE CONTACT:

SHORT TERM EXPOSURE: irritation, tearing

LONG TERM EXPOSURE: same as effects reported in short term exposure

INGESTION:

SHORT TERM EXPOSURE: vomiting, headache, symptoms of drunkenness, coma

LONG TERM EXPOSURE: lung damage

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

SKIN CONTACT: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

EYE CONTACT: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

INGESTION: DO NOT induce vomiting. Never make an unconscious person vomit or drink fluids. If vomiting occurs, keep head lower than hips to help prevent aspiration. If person is unconscious, turn head to side. Get medical attention.

NOTE TO PHYSICIAN: For inhalation, consider oxygen. For ingestion, consider gastric lavage, catharsis and activated charcoal slurry.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Severe fire hazard. Vapor/air mixtures are explosive above flash point. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back.

EXTINGUISHING MEDIA: regular dry chemical, carbon dioxide, water, regular foam

Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny

entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Evacuation radius: 800 meters (1/2 mile). Do not attempt to extinguish fire unless flow of material can be stopped first. Flood with fine water spray. Do not scatter spilled material with high-pressure water streams. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas.

FLASH POINT: 160 F (71 C) (OC)

LOWER FLAMMABLE LIMIT: 0.8%

UPPER FLAMMABLE LIMIT: 5.8%

AUTOIGNITION: 770 F (410 C)

FLAMMABILITY CLASS (OSHA): IIIA

6. ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:

Avoid heat, flames, sparks and other sources of ignition. Stop leak if possible without personal risk. Reduce vapors with water spray. Small spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Large spills: Dike for later disposal. Remove sources of ignition. Keep unnecessary people away, isolate hazard area and deny entry.

7. HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:

BUTYL BENZENE:

No occupational exposure limits established.

VENTILATION: Provide local exhaust ventilation system. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles with a faceshield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: Under conditions of frequent use or heavy exposure, respiratory protection may be needed. Respiratory protection is ranked in order from minimum to maximum. Consider warning properties before

use.

Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode.

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: liquid

COLOR: colorless

ODOR: odorless

MOLECULAR WEIGHT: 134.21

MOLECULAR FORMULA: C₁₀-H₁₄

BOILING POINT: 356 F (180 C)

FREEZING POINT: -116 F (-82 C)

VAPOR PRESSURE: 1 mmHg @ 23 C

VAPOR DENSITY (air=1): 4.6

SPECIFIC GRAVITY (water=1): 0.9

WATER SOLUBILITY: insoluble

PH: Not available

VOLATILITY: Not available

ODOR THRESHOLD: Not available

EVAPORATION RATE: Not available

COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available

SOLVENT SOLUBILITY:

Miscible: alcohol, ether, benzene

10. STABILITY AND REACTIVITY

REACTIVITY: Stable at normal temperatures and pressure.

CONDITIONS TO AVOID: Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat. Keep out of water supplies and sewers.

INCOMPATIBILITIES: oxidizing materials

HAZARDOUS DECOMPOSITION:

Thermal decomposition products: miscellaneous decomposition products

POLYMERIZATION: Will not polymerize.

11. TOXICOLOGICAL INFORMATION

BUTYL BENZENE:

LOCAL EFFECTS:

Irritant: inhalation, skin, eye

TARGET ORGANS: central nervous system

12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA:

INVERTEBRATE TOXICITY: 340 ug/L 48 hour(s) EC50 (Immobilization) Water flea (Daphnia magna)

13. DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations.

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101:

PROPER SHIPPING NAME: Butyl benzenes

ID NUMBER: UN2709

HAZARD CLASS OR DIVISION: 3

PACKING GROUP: III

LABELING REQUIREMENTS: 3

MARINE POLLUTANT: BUTYL BENZENE



CANADIAN TRANSPORTATION OF DANGEROUS GOODS:

SHIPPING NAME: Butylbenzenes

UN NUMBER: UN2709

CLASS: 3

PACKING GROUP/CATEGORY: III

15. REGULATORY INFORMATION

U.S. REGULATIONS:

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4): Not regulated.

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart B): Not regulated.

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart C): Not regulated.

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370 Subparts B

and C):

ACUTE: Yes

CHRONIC: No

FIRE: Yes

REACTIVE: No

SUDDEN RELEASE: No

SARA TITLE III SECTION 313 (40 CFR 372.65): Not regulated.

OSHA PROCESS SAFETY (29 CFR 1910.119): Not regulated.

STATE REGULATIONS:

California Proposition 65: Not regulated.

CANADIAN REGULATIONS:

WHMIS CLASSIFICATION: Not determined.

NATIONAL INVENTORY STATUS:

U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CANADA INVENTORY (DSL/NDL): Not determined.

16. OTHER INFORMATION

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Material Safety Data Sheet

HAZARD WARNINGS	RISK PHRASES	PROTECTIVE CLOTHING
	Combustible material; avoid heat and sources of ignition. The health risks of this compound have not been fully determined. Exposure may cause irritation of the skin, eyes, and respiratory system.	   

Section I. Chemical Product and Company Identification

Chemical Name	n-Propylbenzene		
Catalog Number	P0523	Supplier	TCI America 9211 N. Harborside St. Portland OR 1-800-423-8616
Synonym	1-Phenylpropane		
Chemical Formula	CH ₃ CH ₂ CH ₂ C ₆ H ₅		
CAS Number	103-65-1	In case of Emergency Call	Chemtrec® (800) 424-9300 (U.S.) (703) 527-3887 (International)

Section II. Composition and Information on Ingredients

Chemical Name	CAS Number	Percent (%)	TLV/PEL	Toxicology Data
n-Propylbenzene	103-65-1	Min. 99.0 (GC)	Not available.	Rat LD ₅₀ (inhalation) 65000ppm/2H Rat LD ₅₀ (oral) 6040mg/kg

Section III. Hazards Identification

Acute Health Effects	No specific information is available in our data base regarding the toxic effects of this material for humans. However, exposure to any chemical should be kept to a minimum. Skin and eye contact may result in irritation. May be harmful if inhaled or ingested. Always follow safe industrial hygiene practices and wear proper protective equipment when handling this compound.
Chronic Health Effects	CARCINOGENIC EFFECTS : Not available. MUTAGENIC EFFECTS : Not available. TERATOGENIC EFFECTS : Not available. DEVELOPMENTAL TOXICITY : Not available. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section IV. First Aid Measures

Eye Contact	Check for and remove any contact lenses. IMMEDIATELY flush eyes with running water for at least 15 minutes, keeping eyelids open. COLD water may be used. DO NOT use an eye ointment. Flush eyes with running water for a minimum of 15 minutes, occasionally lifting the upper eyelids. Seek medical attention. Treat symptomatically and supportively.
Skin Contact	After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. COLD water may be used. Cover the irritated skin with an emollient. Seek medical attention. Treat symptomatically and supportively. Wash any contaminated clothing before reusing.
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 artificial respiration. WARNING: It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention and, if possible, show the chemical label. Treat symptomatically and supportively.
Ingestion	INDUCE VOMITING by sticking finger in throat. Lower the head so that the vomit will not reenter the mouth and throat. Loosen tight clothing such as a collar, tie, belt, or waistband. If the victim is not breathing, administer artificial respiration. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Seek immediate medical attention and, if possible, show the chemical label. Treat symptomatically and supportively.

Section V. Fire and Explosion Data

Flammability	Combustible.	Auto-Ignition	Not available.
Flash Points	47.8°C (118°F).	Flammable Limits	Not available.
Combustion Products	These products are toxic carbon oxides (CO, CO ₂).		
Fire Hazards	No specific information is available regarding the flammability of this compound in the presence of various materials.		
Explosion Hazards	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. No additional information is available regarding the risks of explosion.		

Continued on Next Page

Emergency phone number (800) 424-9300

Fire Fighting Media
and Instructions

SMALL FIRE: Use DRY chemicals, CO₂, alcohol foam or water spray.
LARGE FIRE: Use alcohol foam, water spray or fog.

Section VI. Accidental Release MeasuresSpill Cleanup
Instructions

Combustible liquid.
Keep away from heat and sources of ignition. Mechanical exhaust required. 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. Eliminate all sources of ignition. Consult federal, state, and/or local authorities for assistance on disposal.

Section VII. Handling and StorageHandling and Storage
Information

COMBUSTIBLE. Handle with caution and minimize exposure. DO NOT ingest. Do not breathe gas, fumes, vapor or spray. Wear suitable protective clothing. If ingested, seek medical advice immediately and show the container or the label. Treat symptomatically and supportively.
Always store away from incompatible compounds such as oxidizing agents.

Section VIII. 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 station and safety shower is proximal to the work-station location.

Personal Protection

Splash goggles. Lab coat. Dust respirator. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.



Exposure Limits

Not available.

Section IX. Physical and Chemical Properties

Physical state @ 20°C

Liquid.

Solubility

Very slightly soluble in water.
Soluble in alcohol, ether, all proportions in acetone, benzene, and petroleum ether.

Specific Gravity

0.86

Molecular Weight

120.19

Partition Coefficient

Not available.

Boiling Point

159°C (318.2°F)

Vapor Pressure

Not available.

Melting Point

-99°C (-146.2°F)

Vapor Density

Not available.

Refractive Index

1.4920 @ 20°C

Volatility

Not available.

Critical Temperature

Not available.

Odor

Not available.

Viscosity

Not available.

Taste

Not available.

Section X. Stability and Reactivity Data

Stability

This material is stable if stored under proper conditions. (See Section VII for instructions)

Conditions of Instability

Avoid excessive heat and light.

Incompatibilities

Reactive with strong oxidizing agents.

Section XI. Toxicological Information

RTECS Number

DA8750000

Routes of Exposure

Eye contact. Ingestion. Inhalation.

Toxicity Data

Rat LD₅₀ (inhalation) 65000ppm/2H
Rat LD₅₀ (oral) 6040mg/kg

Chronic Toxic Effects

CARCINOGENIC EFFECTS : Not available.
MUTAGENIC EFFECTS : Not available.
TERATOGENIC EFFECTS : Not available.
DEVELOPMENTAL TOXICITY : Not available.
Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Acute Toxic Effects

No specific information is available in our data base regarding the toxic effects of this material for humans. However, exposure to any chemical should be kept to a minimum. Skin and eye contact may result in irritation. May be harmful if inhaled or ingested. Always follow safe industrial hygiene practices and wear proper protective equipment when handling this compound.

Section XII. Ecological Information

Ecotoxicity Not available.

Environmental Fate Not available.

Section XIII. Disposal Considerations

Waste Disposal Recycle to process, if possible. Consult your local or regional authorities. You may be able to dissolve or mix material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber system. Observe all federal, state, and local regulations when disposing of the substance.

Section XIV. Transport Information

DOT Classification DOT CLASS 3: Flammable liquid.

PIN Number UN2364

Proper Shipping Name n-Propylbenzene

Packing Group (PG) III

DOT Pictograms

**Section XV. Other Regulatory Information and Pictograms**

TSCA Chemical Inventory (EPA) This compound is **ON** the EPA Toxic Substances Control Act (TSCA) inventory list.

WHMIS Classification (Canada) WHMIS CLASS B-3: Combustible liquid with a flash point between 35°C (100°F) and 93.3°C (200°F).

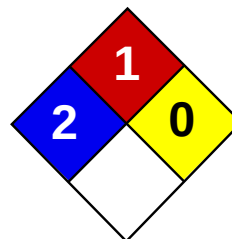
EINECS Number (EEC) 203-132-9

EEC Risk Statements
R10- Flammable.
R18- In use, may form flammable/explosive vapor-air mixture.

Japanese Regulatory Data Not available.

Section XVI. Other Information**Version 1.0****Validated on 10/26/1998.****Printed 3/18/2005.****Notice to Reader**

TCI laboratory chemicals are for research purposes only and are NOT intended for use as drugs, food additives, households, or pesticides. The information herein is believed to be correct, but does not claim to be all inclusive and should be used only as a guide. Neither the above named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All chemical reagents must be handled with the recognition that their chemical, physiological, toxicological, and hazardous properties have not been fully investigated or determined. All chemical reagents should be handled only by individuals who are familiar with their potential hazards and who have been fully trained in proper safety, laboratory, and chemical handling procedures. Although certain hazards are described herein, we can not guarantee that these are the only hazards which exist. Our MSDS sheets are based only on data available at the time of shipping and are subject to change without notice as new information is obtained. Avoid long storage periods since the product is subject to degradation with age and may become more dangerous or hazardous. It is the responsibility of the user to request updated MSDS sheets for products that are stored for extended periods. Disposal of unused product must be undertaken by qualified personnel who are knowledgeable in all applicable regulations and follow all pertinent safety precautions including the use of appropriate protective equipment (e.g. protective goggles, protective clothing, breathing equipment, facial mask, fume hood). For proper handling and disposal, always comply with federal, state, and local regulations.



Health	2
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Phenanthrene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Phenanthrene

Catalog Codes: SLP1318

CAS#: 85-01-8

RTECS: SF7175000

TSCA: TSCA 8(b) inventory: Phenanthrene

CI#: Not available.

Synonym:

Chemical Name: Not available.

Chemical Formula: C₁₄H₁₀

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
Phenanthrene	85-01-8	100

Toxicological Data on Ingredients: Phenanthrene: ORAL (LD50): Acute: 700 mg/kg [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:

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

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:

Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: OPEN CUP: 171°C (339.8°F).

Flammable Limits: Not available.

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

Fire Hazards in Presence of Various Substances: Not available.

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:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. 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.

Storage:

Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust 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: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 178.22 g/mole

Color: Not available.

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

Boiling Point: 340°C (644°F)

Melting Point: 101°C (213.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.179 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: 6.14 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 700 mg/kg [Mouse].

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans:

Hazardous in case of skin contact (irritant, sensitizer), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

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 more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations: TSCA 8(b) inventory: Phenanthrene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCL (EEC):

R36/38- Irritating to eyes and skin. R43- May cause sensitization by skin contact.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

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

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 11:16 AM

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

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SAFETY DATA SHEET

PHENOL LIQUEFIED

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY:

PRODUCT NAME:	PHENOL LIQUEFIED
PART No.:	RM194
SUPPLIER:	J M Loveridge plc Southbrook Road, Southampton Hampshire SO15 1BH Tel: 023 8022 2008 Fax: 023 8022 2117

2. COMPOSITION/INFORMATION ON INGREDIENTS:

EU INDEX No.:	- - -
EEC (EINECS) No.	203-632-7

3. HAZARDS IDENTIFICATION:

Toxic in contact with skin and if swallowed. Causes burns.

4. FIRST AID MEASURES:

GENERAL:	IN ALL CASES OF DOUBT OR WHEN SYMPTOMS PERSIST, ALWAYS SEEK MEDICAL ATTENTION
INHALATION:	Move affected person to fresh air. If recovery not rapid, seek medical attention.
INGESTION:	Only when conscious, rinse mouth with plenty of water and give plenty of water to drink - (approx 500ml). DO NOT INDUCE VOMITING. In case of spontaneous vomiting, be sure that vomit can freely drain because of danger of suffocation. Keep patient at rest and obtain medical attention.
SKIN:	Remove contaminated clothing. Wash affected area with plenty of soap and water for 15 minutes then swab with glycerol/IMS mixture (70/30%). Obtain medical attention. Launder clothing before re-use.
EYES:	Keeping eye open, immediately irrigate with water or eye-wash for 15 minutes. Obtain medical attention.

5. FIRE FIGHTING MEASURES:

EXTINGUISHING MEDIA:	Use extinguishing media suitable against surrounding fire or the cause of fire. Noncombustible or flammable but will burn or decompose in fire situation.
SPECIAL FIRE FIGHTING PROCEDURES:	Take measures to retain water used for extinguishing. Do not release contaminated water into drains, soil and surface water. Dispose of contaminated water and soil according to local regulations.
HAZARDOUS COMBUSTION PRODUCTS:	Noxious or toxic vapours may be released in fire situation.
PROTECTIVE MEASURES IN FIRE:	Fire fighters should wear self-contained breathing apparatus.

6. ACCIDENTAL RELEASE MEASURES:

PERSONAL PRECAUTION IN SPILL:	Avoid direct contact with skin, eyes and clothing.
PRECAUTIONS TO PROTECT ENVIRONMENT:	Prevent contamination of soil, drains and surface water.
SPILL CLEANUP METHODS:	Take-up spillage with absorbent, inert material and place in a suitable and closable labelled container for recovery or disposal. Wash the area clean with water and detergent, observing environmental requirements.

7. HANDLING AND STORAGE:

USAGE PRECAUTIONS:	HANDLING - Product should be used in accordance with good industrial principles for handling and storing of hazardous chemicals. Avoid vapour inhalation, skin and eye contact.
STORAGE PRECAUTIONS:	Avoid direct sunlight. Store in a cool, dry, well ventilated place, in securely closed original container.

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION:

VENTILATION:	Work in a fume cupboard or use local exhaust ventilation. Respiratory protection required in insufficiently ventilated working areas.
RESPIRATORS:	If unable to control vapour emissions below OES limits, wear self contained breathing apparatus.
PROTECTIVE GLOVES:	Use impervious gloves made of butyl rubber or PVC.
EYE PROTECTION:	Approved chemical safety goggles or face protection.
OTHER PROTECTION:	Wear protective clothing and closed footwear. Wear suitable personal protective equipment appropriate to the task.
HYGIENIC WORK PRACTICES:	SKIN PROTECTION - apply barrier cream to hands and exposed skin. Promptly remove any clothing that becomes contaminated. Wash promptly if skin becomes contaminated.

9. PHYSICAL AND CHEMICAL PROPERTIES:

APPEARANCE:	Clear, colourless liquid.

ODOUR/TASTE:	Characteristic phenolic odour.		
DENSITY/SPECIFIC GRAVITY (g/ml):	1.05 - 1.06	Temperature (°C):	20

10. STABILITY AND REACTIVITY:

STABILITY:	Stable under normal conditions of use.		
MATERIALS TO AVOID:	Natural rubbers, aluminium, brass, copper, galvanised iron. Aldehydes, halogens, hydrogen peroxide, nitrates, nitrites.		
HAZARDOUS DECOMP. PRODUCTS:	Noxious, toxic or corrosive vapours may be released in a fire situation.		

11. TOXICOLOGICAL INFORMATION:

Toxicological data	LD50. Skin. Rat. 660 mg/kg (phenol)		
TOXIC DOSE - LD 50:	317 (phenol) mg/kg (oral rat)		
INHALATION:	Irritating to mucous membranes. Irritating to the respiratory system. Over exposure may cause pulmonary oedema.		
INGESTION:	May cause burns to mucous membranes, throat and stomach. Toxic/systemic effects may cause, nausea, muscular weakness, shock or collapse.		
SKIN:	May cause systemic effects (poisoning) by skin absorption. Fat soluble and rapidly absorbed through the skin. Initially painless due to anaesthetising effect then irritation, rash or burning may develop. Affected tissue becomes white. Contact with skin area of approx. 20cm ² has been known to be fatal. Causes burns and may cause dermatitis. Sensitisation possible in predisposed persons.		
EYES:	Causes burns. May cause severe corneal damage.		
OTHER HEALTH EFFECTS:	Phenol has been found to cause cancer in laboratory animals and may cause adverse mutagenic effects..		
ROUTE OF ENTRY:	Skin absorption. Inhalation.		
TARGET ORGANS:	Central nervous system, lungs, liver and kidneys.		

12. ECOLOGICAL INFORMATION:

ECOLOGICAL INFORMATION:	Prevent contamination of soil, drains or surface water, use appropriate containment method to avoid environmental contamination.		
DEGRADABILITY:	PHENOL - Chemical oxygen demand (COD) - 2.33g O ₂ /g. Biological oxygen demand (BOD 5 day) - 1.68g O ₂ /g.		
WATER HAZARD CLASSIFICATION:	Hazard to drinking water supply.		

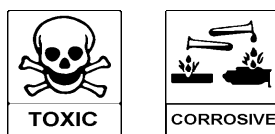
13. DISPOSAL CONSIDERATIONS:

DISPOSAL METHODS:	This material and/or its container must be disposed of as hazardous waste according to Special Waste Regulations 1996 or according to local regulations, in compliance with Duty of Care Regulations and Special Waste Regulations.
WASTE CLASS:	WASTE CODE: 0705** HAZARDOUS PROPERTY: H6, H8

14. TRANSPORT INFORMATION:

UK ROAD PACK GR.:	III
ADR CLASS No.:	6.1
ADR CLASS:	Division 6.1: Toxic substances.
ADR ITEM No.:	14°(c)
HAZARD No. (ADR):	60 Toxic or slightly toxic substance.
ADR MARGINAL:	2601
ADR LABEL No.:	6.1
HAZCHEM CODE:	2X
PROPER SHIPPING NAME I:	PHENOL SOLUTION
UN No. SEA:	UN 2821
IMDG CLASS:	6.1
IMDG PAGE No.:	6225
IMDG PACK GR.:	III
UN No., AIR:	UN-ID 2821
ICAO CLASS:	6.1
AIR PACK GR.:	III

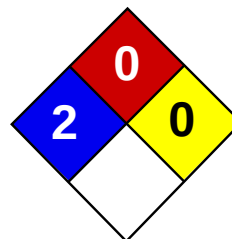
15. REGULATORY INFORMATION:

LABEL FOR SUPPLY:

RISK PHRASES:	R-24/25 Toxic in contact with skin and if swallowed. R-34 Causes burns.
SAFETY PHRASES:	S-26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S-45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S-36/37/39 Wear suitable protective clothing, gloves and eye/face protection. S-28C After contact with skin, wash immediately with plenty of soap and water.
UK REGULATORY REFERENCES:	Chemicals (Hazard Information & Packaging) Regulations 1993. Classification,

16. OTHER INFORMATION:

INFORMATION SOURCES:	This product has been classified in accordance with CHIP3 regulations.
REVISION COMMENTS:	Edition 01; Revised item(s): all sections.
ISSUED BY:	MK
SDS No.:	343
DATE:	12/07/02
DISCLAIMER:	The foregoing data has been compiled for safety information only and does not form part of any selling specification. Information contained in this Data Sheet is to the best of JMLs knowledge correct at the time of publication. Customers should always satisfy themselves, that the product which they have selected is entirely suitable for their purpose under their conditions of use and in compliance with current regulations. For any further information, please contact the supplier.



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; Percosolve; Tetrachloroethene; Tetraleno; Tetralox; Tetravec; Tetrogue; 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 Published 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. Symptoms 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, disorientation, seizures, emotional 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 extremities, peripheral neuropathy and other

Section 12: Ecological Information

Ecotoxicity:

Ecotoxicity in water (LC50): 18.4 mg/l 96 hours [Fish (Fathead 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):

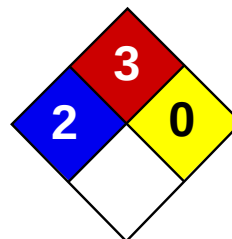
R40- Possible risks of irreversible effects. R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. S23- Do not breathe gas/fumes/vapour/spray S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S37- Wear suitable 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:** 11/06/2008 12:00 PM

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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: C₆H₅-CH₃ or C₇H₈

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: Causes mild to moderate eye irritation with a burning sensation. Splash contact with eyes also causes conjunctivitis, blepharospasm, corneal edema, corneal abrasions. 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, Hypophosphatemia), 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.

Created: 10/10/2005 08:30 PM

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

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Material Safety Data Sheet

Trichloroethylene, stabilized

ACC# 23850

Section 1 - Chemical Product and Company Identification

MSDS Name: Trichloroethylene, stabilized

Product Grade : SQ, ExcelaR, EL

Catalog Numbers: 28455, 28456, 28457, 14715, 41957

Synonyms: Trichloroethylene

Company Identification:

Fisher Scientific

Part of Thermo Fisher Scientific

THERMO ELECTRON LLS INDIA PVT.LTD.

Godrej Coliseum, 101A-101B, Somaiya Hospital Road,

Off Eastern Express Highway, Sion (East), Mumbai-400 022, India

For information, call: 022 – 6680 3001/2, **Call India Toll Free** – 1800 209 7001

Emergency Number: 022-66803004/14

For CHEMTREC assistance, call: 800-424-9300 [International]

For International CHEMTREC assistance, call: 703-527-3887 [International]

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
79-01-6	Trichloroethylene	>99	201-167-4

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: clear, colorless liquid.

Warning! Breathing vapors may cause drowsiness and dizziness. Causes eye and skin irritation. Aspiration hazard if swallowed. Can enter lungs and cause damage. May cause cancer based on animal studies. May cause liver damage.

Target Organs: Central nervous system, liver, eyes, skin.

Potential Health Effects

Eye: Causes moderate eye irritation. May result in corneal injury. Contact produces irritation, tearing, and burning pain. Contact with trichloroethylene causes pain but no permanent injury to the eyes. (Doc of TLV)

Skin: Causes mild skin irritation. Prolonged and/or repeated contact may cause defatting of the skin and dermatitis. May cause peripheral nervous system function impairment including persistent neuritis, and temporary loss of touch. Damage to the liver and other organs has been observed in workers who have been overexposed.

Ingestion: May cause irritation of the digestive tract. Aspiration of material into the lungs may cause chemical pneumonitis, which may be fatal.

Inhalation: May cause respiratory tract irritation. May cause liver abnormalities. May cause cardiac abnormalities. May cause peripheral nervous system effects. Inhalation overexposure may lead to central nervous system depression, producing effects such as dizziness, headache, confusion, incoordination, nausea, weakness, and loss of consciousness. Extreme exposures may cause other CNS effects including death. The chief symptoms of TCE exposure were found to be abnormal fatigue, irritability, headache, gastric disturbances, and intolerance to alcohol. (Doc to TLV)

Chronic: Possible cancer hazard based on tests with laboratory animals. Chronic inhalation may cause effects similar to those of acute inhalation. Prolonged or repeated skin contact may cause defatting and dermatitis. May cause peripheral nervous system function impairment including persistent neuritis, and temporary loss of touch. Damage to the liver and other organs has been observed in workers who have been overexposed.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

Skin: Get medical aid if irritation develops or persists. Flush skin with plenty of soap and water.

Ingestion: If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Possible aspiration hazard. Get medical aid immediately.

Inhalation: Get medical aid immediately. Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Do NOT use mouth-to-mouth resuscitation.

Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool.

Extinguishing Media: Use extinguishing media most appropriate for the surrounding fire.

Flash Point: None

Autoignition Temperature: 420 deg C (788.00 deg F)

Explosion Limits, Lower:8

Upper: 10.5

NFPA Rating: (estimated) Health: 2; Flammability: 1; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Provide ventilation. Approach spill from upwind. Control runoff and isolate discharged material for proper disposal.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Avoid contact with eyes, skin, and clothing. Avoid breathing vapor.

Storage: Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Trichloroethylene	50 ppm TWA; 100 ppm STEL	1000 ppm IDLH	100 ppm TWA; 200 ppm Ceiling

OSHA Vacated PELs: Trichloroethylene: 50 ppm TWA; 270 mg/m³ TWA

Personal Protective Equipment

Eyes: Wear chemical splash goggles.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Liquid

Appearance: clear, colorless

Odor: chloroform-like

pH: Not available.

Vapor Pressure: 58 mm Hg @ 20 deg C

Vapor Density: 4.5 (air=1)

Evaporation Rate: 0.69 (CCl₄=1)

Viscosity: 0.0055 poise

Boiling Point: 87 deg C

Freezing/Melting Point: -86 deg C

Decomposition Temperature: Not available.

Solubility: Slightly soluble.

Specific Gravity/Density: 1.46

Molecular Formula: C₂HCl₃

Molecular Weight: 131.39

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: Light, confined spaces.

Incompatibilities with Other Materials: Active metals.

Hazardous Decomposition Products: Hydrogen chloride, phosgene, carbon monoxide, carbon dioxide.

Hazardous Polymerization: May occur.

Section 11 - Toxicological Information

RTECS#:

CAS# 79-01-6: KX4550000

LD50/LC50:

CAS# 79-01-6:

Draize test, rabbit, eye: 20 mg/24H Moderate;
Draize test, rabbit, skin: 2 mg/24H Severe;
Inhalation, mouse: LC50 = 8450 ppm/4H;
Inhalation, mouse: LC50 = 220000 mg/m³/20M;
Inhalation, mouse: LC50 = 262000 mg/m³/30M;
Inhalation, mouse: LC50 = 40000 mg/m³/4H;
Inhalation, rat: LC50 = 140700 mg/m³/1H;
Oral, mouse: LD50 = 2402 mg/kg;
Oral, mouse: LD50 = 2400 mg/kg;
Oral, rat: LD50 = 4920 mg/kg;
Skin, rabbit: LD50 = >20 gm/kg;
Skin, rabbit: LD50 = 20 mL/kg;

Carcinogenicity:

CAS# 79-01-6:

- **ACGIH:** Not listed.
- **California:** carcinogen, initial date 4/1/88
- **NTP:** Suspect carcinogen
- **IARC:** Group 2A carcinogen

Epidemiology: In six epidemiological studies completed, there was no evidence to suggest that trichloroethylene has increased the incidence of cancer in humans. (Documentation of the TLV, 7th edition)

Teratogenicity: No information available.

Reproductive Effects: Experimental reproductive effects have been observed.

Mutagenicity: Human mutation data has been reported. IARC and the National Toxicology Program (NTP) stated that variability in the mutagenicity test results with trichloroethylene may be due to the presence of various stabilizers used in TCE which are mutagens (e.g. epoxybutane, epichlorohydrin). See actual entry in RTECS for complete information. R68 Mutagen Category 3 (CHIP 2002, UK).

Neurotoxicity: No information available.

Other Studies:

Section 12 - Ecological Information

Ecotoxicity: Fish: Fathead Minnow: 41-67 mg/L; 96 hrs.; LC50 Daphnia: Daphnia: 2.2-100 mg/L; 48 hrs.; LC50 Mollusk Shrimp: 2 mg/L; 96 hrs.; LC50 Bluegill sunfish, LD50 = 44,700 ug/L/96Hr. Fathead minnow, LC50 = 40.7 mg/L/96Hr.

Environmental: In air, substance is photooxidized and is reported to form phosgene, dichloroacetyl chloride, and formyl chloride. In water, it evaporates rapidly. Potential for



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mobility in soil is high.

Physical: No information available.

Other: Bioconcentration potential is low (BCF less than 100).

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series:

CAS# 79-01-6: waste number U228.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	TRICHLOROETHYLENE	TRICHLOROETHYLENE
Hazard Class:	6.1	6.1
UN Number:	UN1710	UN1710
Packing Group:	III	III

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 79-01-6 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs



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CAS# 79-01-6: 100 lb final RQ; 45.4 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 79-01-6: immediate, delayed, reactive.

Section 313

This material contains Trichloroethylene (CAS# 79-01-6, >99%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR

Clean Air Act:

CAS# 79-01-6 is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

CAS# 79-01-6 is listed as a Hazardous Substance under the CWA. CAS# 79-01-6 is listed as a Priority Pollutant under the Clean Water Act. CAS# 79-01-6 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 79-01-6 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains Trichloroethylene, a chemical known to the state of California to cause cancer.

California No Significant Risk Level: CAS# 79-01-6: 50 æg/day NSRL (oral); 80 æg/day NSRL (inhalation)

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

T

Risk Phrases:

R 36/38 Irritating to eyes and skin.

R 45 May cause cancer.

R 52/53 Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

R 67 Vapours may cause drowsiness and dizziness.

Safety Phrases:

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 53 Avoid exposure - obtain special instructions before use.

S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

WGK (Water Danger/Protection)

CAS# 79-01-6: 3



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Canada - DSL/NDSL

CAS# 79-01-6 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D1B, D2B.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

CAS# 79-01-6 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 2/01/1999

Revision #7 Date: 12/27/2006

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.



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MATERIAL SAFETY DATA SHEET

Section 1 - Chemical Product and Company Identification

MSDS Name: 1,2,4-Trimethylbenzene
Catalog Numbers: AC140090000, AC140090010, AC140090025, AC140095000
Synonyms: Pseudocumene.
Company Identification: Acros Organics BVBA
 Janssen Pharmaceuticaaan 3a
 2440 Geel, Belgium
Company Identification: (USA) Acros Organics
 One Reagent Lane
 Fair Lawn, NJ 07410
For information in the US, call: 800-ACROS-01
For information in Europe, call: +32 14 57 52 11
Emergency Number, Europe: +32 14 57 52 99
Emergency Number US: 201-796-7100
CHEMTREC Phone Number, US: 800-424-9300
CHEMTREC Phone Number, Europe: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#: 95-63-6
Chemical Name: 1,2,4-Trimethylbenzene
%: 98
EINECS#: 202-436-9

Hazard Symbols:

XN N



Risk Phrases:

10 20 36/37/38 51/53

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Warning! Flammable liquid and vapor. Harmful if inhaled. Causes eye, skin, and respiratory tract irritation. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Target Organs: Blood, central nervous system, respiratory system, eyes, skin.

Potential Health Effects

Eye: Causes eye irritation. Causes redness and pain.
Skin: Causes skin irritation. Causes redness and pain. May be harmful if absorbed through the skin.
Ingestion: May cause irritation of the digestive tract. Aspiration of material into the lungs may cause chemical pneumonitis, which may be fatal. May be harmful if swallowed. May cause central nervous system depression.
Inhalation: Harmful if inhaled. Causes respiratory tract irritation. May cause drowsiness, unconsciousness, and central nervous system depression.
Chronic: Prolonged or repeated skin contact may cause dermatitis. May cause anemia and other blood cell abnormalities. Prolonged exposure may produce a narcotic effect. Prolonged or repeated exposure may cause nausea, dizziness, and headache.

Section 4 - First Aid Measures

- Eyes:** Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.
- Skin:** Get medical aid. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
- Ingestion:** Do not induce vomiting. Possible aspiration hazard. Get medical aid immediately. Call a poison control center.
- Inhalation:** Get medical aid immediately. Remove from exposure and move to fresh air immediately. If breathing is difficult, give oxygen. Possible aspiration hazard. Do not use mouth-to-mouth resuscitation if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.

Notes to Physician:

Section 5 - Fire Fighting Measures

- General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors may form an explosive mixture with air. Vapors can travel to a source of ignition and flash back. Will burn if involved in a fire. Containers may explode in the heat of a fire. Flammable liquid and vapor.
- Extinguishing Media:** Use water spray to cool fire-exposed containers. Use water spray, dry chemical, carbon dioxide, or chemical foam.
- Autoignition Temperature:** 500 deg C (932.00 deg F)
- Flash Point:** 48 deg C (118.40 deg F)
- Explosion Limits: Lower:** 0.9 vol %
- Explosion Limits: Upper:** 6.4 vol %
- NFPA Rating:** health: 2; flammability: 2; instability: 0;

Section 6 - Accidental Release Measures

- General Information:** Use proper personal protective equipment as indicated in Section 8.
- Spills/Leaks:** Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Wear a self contained breathing apparatus and appropriate personal protection. (See Exposure Controls, Personal Protection section). Remove all sources of ignition. Use a spark-proof tool. Do not let this chemical enter the environment.

Section 7 - Handling and Storage

- Handling:** Use spark-proof tools and explosion proof equipment. Do not get in eyes, on skin, or on clothing. Do not ingest or inhale. Use only in a chemical fume hood. Keep away from heat, sparks and flame.
- Storage:** Keep away from sources of ignition. Store in a cool, dry place. Store in a tightly closed container. Flammables-area.

Section 8 - Exposure Controls, Personal Protection

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
1,2,4-Trimethylbenzene	25 ppm TWA (listed under Trimethyl benzene).	25 ppm TWA; 125 mg/m3 TWA	none listed

OSHA Vacated PELs: 1,2,4-Trimethylbenzene: 25 ppm TWA; 125 mg/m3 TWA (listed under Trimethyl benzene)

Engineering Controls:

Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use only under a chemical fume hood.

Exposure Limits

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Clear liquid

Color: colorless

Odor: aromatic odor

pH: Not available

Vapor Pressure: 7 mm Hg @ 44.4 deg C

Vapor Density: 4.15 (air=1)

Evaporation Rate: Not available

Viscosity: Not available

Boiling Point: 168 deg C @ 760 mmHg (334.40°F)

Freezing/Melting Point: -44 deg C (-47.20°F)

Decomposition Temperature: Not available

Solubility in water: Insoluble

Specific Gravity/Density: 0.880 g/cm3

Molecular Formula: C9H12

Molecular Weight: 120.19

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: Incompatible materials, ignition sources, excess heat.

Incompatibilities with Other Materials Strong oxidizing agents.

Hazardous Decomposition Products Carbon monoxide, carbon dioxide.

Hazardous Polymerization Will not occur.

Section 11 - Toxicological Information

RTECS#: CAS# 95-63-6: DC3325000

LD50/LC50: RTECS:
CAS# 95-63-6: Inhalation, rat: LC50 = 18000 mg/m3/4H;
Oral, mouse: LD50 = 6900 mg/kg;
Oral, rat: LD50 = 5 gm/kg;

Carcinogenicity: 1,2,4-Trimethylbenzene - Not listed as a carcinogen by ACGIH, IARC, NTP, or CA Prop 65.

Other: See actual entry in RTECS for complete information.

Section 12 - Ecological Information

Ecotoxicity: Fish: Fathead Minnow: LC50 = 77.2 mg/L; 96 Hr; Flow-through at 25 C (pH 7.24)

Other: Do not empty into drains.

Section 13 - Disposal Considerations

Dispose of in a manner consistent with federal, state, and local regulations.

Section 14 - Transport Information

US DOT
Shipping Name: FLAMMABLE LIQUIDS, N.O.S. (1,2,4-Trimethylbenzene)
Hazard Class: 3
UN Number: UN1993
Packing Group: III
Canada TDG

Shipping Name: Not available
Hazard Class:
UN Number:
Packing Group:

Section 15 - Regulatory Information

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: XN N

Risk Phrases:

R 10 Flammable.

R 20 Harmful by inhalation.

R 36/37/38 Irritating to eyes, respiratory system and skin.

R 51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

S 61 Avoid release to the environment. Refer to special instructions/safety data sheets.

WGK (Water Danger/Protection)

CAS# 95-63-6: 3

Canada

CAS# 95-63-6 is listed on Canada's DSL List

Canadian WHMIS Classifications: B3, D1B, D2B

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

CAS# 95-63-6 is listed on Canada's Ingredient Disclosure List

US Federal

TSCA

CAS# 95-63-6 is listed on the TSCA
Inventory.

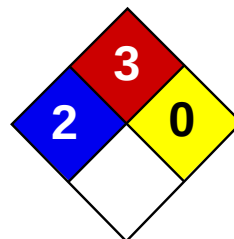
Section 16 - Other Information

MSDS Creation Date: 5/19/1999

Revision #5 Date 8/30/2007

Revisions were made in Sections: 3, 4, 5, 6, 7, 8, 9, 10, 11, 1

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Health	2
Fire	3
Reactivity	0
Personal Protection	H

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; $\log(\text{oil/water}) = 3.1$

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 female 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 also cause 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.

Created: 10/11/2005 12:54 PM

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

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Site-Specific Health and Safety Plan
Queens Plaza Off-Site Properties
Long Island City, New York

APPENDIX C

Roux Health and Safety Lessons Learned /
Accident Report Forms

☐ Roux Associates, Inc. ☐ Remedial Engineering, P.C.
(Check applicable company name)

ACCIDENT REPORT

Joe Gentile, Corporate Health and Safety Manager

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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) ☐ Final (5-10 days) Date: _____ 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

OTHER INCIDENT TYPES

-----Severity Level-----
☐ Fatality ☐ First Aid ☐ Medical
☐ Restricted Work ☐ Lost Time ☐ Treatment

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

ACTIVITY TYPE (Check most appropriate one.)

☐ Decommissioning ☐ Geoprobe ☐ Sampling
☐ Demolition ☐ Motor Vehicle ☐ System Start-up
☐ Dewatering ☐ Operations/ ☐ Trenching
☐ Drilling ☐ Maintenance ☐ 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)				

No One Gets Hurt!

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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:

(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.)

No One Gets Hurt!

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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)

HEALTH & SAFETY LESSONS LEARNED

ROUX REPORT FORM

☒ 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 - San Francisco

Project Manager: Jeff Wills

Project Principal: Joshua Levine

Project Name: Offsite LIRR - QPRD

Project Location: Long Island City, NY

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	3. ☐ Security (e.g. theft, trespassing, vandalism)	4. ☐ Environmental (spill, permit exceedance, etc.)	6. ☐ Property/Equipment Damage
2. ☐ Injury / Illness		5. ☐ Transportation of personnel (vehicle accident)	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.)

Health & Safety Lessons Learned Incident Report – Page 2

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 2. Construction 3. Demolition 4. Dewatering 5. Drilling (well install) 6. Excavation / Trenching	7. Gauging 8. Geoprobe / Direct Push 9. Mobil Remediation (includes vacuum event and chemical injection) 10. NAPL Recovery 11. O&M (remediation system)	12. Pavement Cutting 13. Pump Test 14. Sampling 15. Site Visit / Survey 16. Subsurface Clearance 17. System Install	18. System Startup 19. UST Removal (includes exposure and backfill) 20. Waste Management 21. Well Abandonment 22. Other:

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 System 93. Chemical Oxidation System 94. Dual Phase Product Recovery System 95. Groundwater Pump and Treat System 96. POET System 97. Shed or Trailer	98. Vapor Extraction System 99. Vapor-Phase Treatment 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 Involved 118. MPT – Traffic Control Devices 119. Not in List (describe): _____

Site-Specific Health and Safety Plan
Queens Plaza Off-Site Properties
Long Island City, New York

APPENDIX D

Health and Safety Briefing /
Meeting Log and Daily Site Safety Checklist



DAILY SITE SAFETY CHECKLIST

Job Name: _____

Date(s) _____

Location: _____

Client Site # _____

Weather: M-

T-

W-

TR-

F-

•"On the Job" interactive meeting held before work starts
•Conducted at least once per day
•Involves everyone working at the Site
•Should familiarize everyone with work area & vicinity
•Work permit procedures
•Emergency access/exits & "rally" point
•Emergency contacts/phone #s, hospital route
•Should be interactive

•Provide details of work planned for the day
•Review the Job Safety Analysis (JSA) and work hazards
•Required PPE for the planned work
•SPSAs are discussed
•HASP is reviewed
•Ensure safety equipment is on Site
•Test required safety equipment (such as emergency stop controls)
•Can also include inspection of tools and equipment to be used

Instructions: Please only use form for Monday through Friday of one calander week. All attending must initial in boxes below.

#	CHECKLIST ITEM	DATE				
		M-	T-	W-	TR-	F-
1	The HASP (including emergency phone #s) has been reviewed & signed by Roux staff & subcontractors.					
2	Personnel are LPS and OSHA-40 (as applicable) trained and SSE are identified and have an on-site mentor.					
3	Emergency meeting point known, First Care facility and ER identified.					
4	Applicable JSAs have been identified and approved by Roux management. (JSAs Reviewed?)					
5	Roux personnel & subcontractors have discussed hazards associated with Site-specific work.					
6	Any potential slips, trips or fall hazards have been identified.					
7	All workers have appropriate PPE, including long sleeves and have signed in for the day (2nd Page).					
8	No person on-Site has the appearance of being under the influence of motor skill altering substances and are familiar with D&A policy.					
9	Critical equipment on-Site is noted and is in safe working order.					
10	Site control has been established and exclusion zone is identified (using safety cones or barricades to mark out work area).					
11	Appropriate permits has been obtained and potential ignition sources were identified if applicable for Hot Permits					
12	If applicable, all third party permits to construct are on hand and access is permissible.					
13	Lock Out / Tag Out procedures have been followed where applicable, for electric and water.					
14	Electrical power operated tools shall be properly grounded and used with a GFCI.					
15	Traffic Safety Control measures have been put in place where applicable.					
16	All vessels containing flammable/corrosive material are labeled and MSDSs are available for all chemicals.					
17	Subsurface work : Drilling, trenching, etc. conducted according to required Protocol, including pre-field preparations, utility mark-out and "hand" clearing					
18	Excavated soils are properly stored; excavations are properly shored/sloped and barricaded.					
19	Good housekeeping procedures are meet; food and beverages are consumed outside of the work area.					
20	A first aid kit, eye wash bottle/station, and fire extinguishers are available for use.					
21	No smoking signs are visibly posted in areas of potential flammable vapors.					
Initial on right to verify that these actions have taken place						

Comments and Exceptions

NOTE: THIS IS A TWO-SIDED FORM; PLEASE COMPLETE BOTH SIDES



DAILY SITE SAFETY CHECKLIST

Job Name: _____

Date(s) _____

Location: _____

Client Site # _____

Weather: M-

T-

W-

TR-

F-

- "On the Job" interactive meeting held before work starts
- Conducted at least once per day
- Involves everyone working at the Site
- Should familiarize everyone with work area & vicinity
- Work permit procedures
- Emergency access/exits & "rally" point
- Emergency contacts/phone #s, hospital route
- Should be interactive

- Provide details of work planned for the day
- Review the Job Safety Analysis (JSA) and work hazards
- Required PPE for the planned work
- SPSAs are discussed
- HASP is reviewed
- Ensure safety equipment is on Site
- Test required safety equipment (such as emergency stop controls)
- Can also include inspection of tools and equipment to be used

Instructions: Please only use form for Monday through Friday of one calander week. All attending must initial in boxes below.

#	CHECKLIST ITEM	DATE				
		M-	T-	W-	TR-	F-
1	The HASP (including emergency phone #s) has been reviewed & signed by Roux staff & subcontractors.					
2	Personnel are LPS and OSHA-40 (as applicable) trained and SSE are identified and have an on-site mentor.					
3	Emergency meeting point known, First Care facility and ER identified.					
4	Applicable JSAs have been identified and approved by Roux management. (JSAs Reviewed?)					
5	Roux personnel & subcontractors have discussed hazards associated with Site-specific work.					
6	Any potential slips, trips or fall hazards have been identified.					
7	All workers have appropriate PPE, including long sleeves and have signed in for the day (2nd Page).					
8	No person on-Site has the appearance of being under the influence of motor skill altering substances and are familiar with D&A policy.					
9	Critical equipment on-Site is noted and is in safe working order.					
10	Site control has been established and exclusion zone is identified (using safety cones or barricades to mark out work area).					
11	Appropriate permits has been obtained and potential ignition sources were identified if applicable for Hot Permits					
12	If applicable, all third party permits to construct are on hand and access is permissible.					
13	Lock Out / Tag Out procedures have been followed where applicable, for electric and water.					
14	Electrical power operated tools shall be properly grounded and used with a GFCI.					
15	Traffic Safety Control measures have been put in place where applicable.					
16	All vessels containing flammable/corrosive material are labeled and MSDSs are available for all chemicals.					
17	Subsurface work : Drilling, trenching, etc. conducted according to required Protocol, including pre-field preparations, utility mark-out and "hand" clearing					
18	Excavated soils are properly stored; excavations are properly shored/sloped and barricaded.					
19	Good housekeeping procedures are meet; food and beverages are consumed outside of the work area.					
20	A first aid kit, eye wash bottle/station, and fire extinguishers are available for use.					
21	No smoking signs are visibly posted in areas of potential flammable vapors.					
Initial on right to verify that these actions have taken place						

Comments and Exceptions

NOTE: THIS IS A TWO-SIDED FORM; PLEASE COMPLETE BOTH SIDES



DAILY TAILGATE HEALTH & SAFETY MEETING LOG

Job Name _____

Date(s) _____

Location: _____

Client Site # _____

SUBCONTRACTOR: _____

Activities Planned _____

JSAs Utilized	

Potential Hazards <i>NOT IN JSA</i>	Mitigative Measures
LPO Scheduled for:	

Meeting Attendance

Name	Company	Mon.	Tue.	Wed.	Thur.	Fri.

Initial in Boxes

Site-Specific Health and Safety Plan
Queens Plaza Off-Site Properties
Long Island City, New York

APPENDIX E

Generic Community Air Monitoring Program

APPENDIX E

New York State Department of Health Generic Community Air Monitoring Plan

Overview

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

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

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

Community Air Monitoring Plan

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

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

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing

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

VOC Monitoring, Response Levels, and Actions

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

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

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring

particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed $150 \text{ mcg}/\text{m}^3$ above the upwind level and provided that no visible dust is migrating from the work area.
2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than $150 \text{ mcg}/\text{m}^3$ above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within $150 \text{ mcg}/\text{m}^3$ of the upwind level and in preventing visible dust migration.
3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

Site-Specific Health and Safety Plan
Queens Plaza Off-Site Properties
Long Island City, New York

APPENDIX F

Roux Subsurface Utility Clearance Procedure

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				

Key reminders for execution:

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 as being 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 SOP. 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.

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 On-site	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 & Storm-water 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:



Color Code

ELECTRIC
Gas-oil Steam
Communications CATV
WATER
Reclaimed Water
SEWER
Temp. Survey Markings
Proposed Excavation

Other Comments / Findings:

Completed by: _____

Signature: _____ Date: _____

Site-Specific Health and Safety Plan
Queens Plaza Off-Site Properties
Long Island City, New York

APPENDIX G

Roux Heavy Equipment Exclusion Zone Policy

STANDARD OPERATING PROCEDURE 1.13
HEAVY EQUIPMENT EXCLUSION ZONE POLICY

CORPORATE HEALTH AND SAFETY MANAGER	:	Joseph W. Gentile
EFFECTIVE DATE	:	November 2011
REVISION NUMBER	:	0

Objective

The purpose of the Exclusion Zone Policy 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 other equipment entering the Exclusion Zone while the equipment is in operation/moving to ensure that Roux and Subcontractor employees are not unnecessarily exposed to the hazards of the equipment.

A. Definition

For the purpose of this policy, heavy equipment includes, but is not necessarily limited to: excavation equipment, drill rigs, vacuum trucks, forklifts, lull telehandlers, man lifts, bobcats, delivery trucks, etc.

B. Requirements

1. 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.).

2. 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; and
- 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); and
- Greater than the tip-over distance of the heavy equipment.

3. 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).

4. The spotter (or another individual) should be assigned responsibility for enforcing the Exclusion Zone. This 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.

5. 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.

6. 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.

7. The Exclusion Zone should be delineated using cones, fencing, barrels, tape or other measures. 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.

C. 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 policy. 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.

D. Responsibilities

1. Corporate Health and Safety Manager

Overall responsibility for administration, implementation and auditing of this policy.

2. Office Managers

Responsible for communicating this policy to all of their employees who perform or may perform field work involving heavy equipment.

3. Office Health and Safety Managers

Providing training to office field staff in this policy.

4. Project Principals

- a. Responsible for ensuring their projects address heavy equipment exclusion zones.
- b. Approving exceptions to this policy.

5. Project Managers

- a. Responsible for incorporating this policy into their project HASPs and applicable procedures to include JSAs.

- b. Communicating to and enforcing the policy requirements for subcontractors who work on their projects.

6. Field Workers

- a. Attending training in the policy.
- b. Following the requirements of the policy.

E. Project and Site-Specific Orientation and 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.

F. Subcontractors

All subcontractors who provide heavy equipment operations to field projects must implement a policy 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.

Site-Specific Health and Safety Plan
Queens Plaza Off-Site Properties
Long Island City, New York

APPENDIX H

ACORD[®] Automobile Loss Notice Form



AUTOMOBILE LOSS NOTICE

DATE (MM/DD/YYYY)

AGENCY AJ Gallagher Risk Management Services 377 Oak Street Garden City, NY 11530		INSURED LOCATION CODE	DATE OF LOSS AND TIME AM PM
CONTACT NAME Teresa Garzla PHONE (AG, No, Ext): 516.622.2418 FAX (AG, No): E-MAIL ADDRESS: CODE: SUBCODE:		CARRIER Great Divide Insurance Company	NAIC CODE 25224
AGENCY CUSTOMER ID: ROUXASS-01		POLICY NUMBER BAP154979912	POLICY TYPE Commercial Automobile

INSURED NAME OF INSURED (First, Middle, Last) Roux Associates, Inc.		INSURED'S MAILING ADDRESS 209 Shafter Street Islandia, NY 11749	
DATE OF BIRTH	FEIN (if applicable) 11-2579482	MARITAL STATUS / CIVIL UNION (if applicable)	
PRIMARY PHONE # ☐ HOME ☒ BUS ☐ CELL 631.232.2600	SECONDARY PHONE # ☐ HOME ☐ BUS ☐ CELL	PRIMARY E-MAIL ADDRESS: legaldept@rouxinc.com SECONDARY E-MAIL ADDRESS: Fax Notice of Loss to: 631.232.1525	

CONTACT NAME OF CONTACT (First, Middle, Last) Cindy Albanese		CONTACT'S MAILING ADDRESS Cindy Albanese 209 Shafter Street Islandia, NY 11749	
PRIMARY PHONE # ☐ HOME ☒ BUS ☐ CELL	SECONDARY PHONE # ☐ HOME ☐ BUS ☐ CELL	PRIMARY E-MAIL ADDRESS: legaldept@rouxinc.com SECONDARY E-MAIL ADDRESS: Fax Notice of Loss to 631.232.1525	
WHEN TO CONTACT			

LOSS LOCATION OF LOSS STREET: CITY, STATE, ZIP: COUNTRY:		POLICE OR FIRE DEPARTMENT CONTACTED REPORT NUMBER
DESCRIBE LOCATION OF LOSS IF NOT AT SPECIFIC STREET ADDRESS:		
DESCRIPTION OF ACCIDENT (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)		

INSURED VEHICLE		VEH #		YEAR	MAKE	MODEL:	BODY TYPE	V.I.N.:	PLATE NUMBER	STATE
OWNER'S NAME AND ADDRESS (Check if same as insured)		PRIMARY PHONE # ☐ HOME ☐ BUS ☐ CELL		SECONDARY PHONE # ☐ HOME ☐ BUS ☐ CELL		PRIMARY E-MAIL ADDRESS: SECONDARY E-MAIL ADDRESS:				
DRIVER'S NAME AND ADDRESS (Check if same as owner)		PRIMARY PHONE # ☐ HOME ☐ BUS ☐ CELL		SECONDARY PHONE # ☐ HOME ☐ BUS ☐ CELL		PRIMARY E-MAIL ADDRESS: SECONDARY E-MAIL ADDRESS:				
RELATION TO INSURED (Employee, family, etc.)	DATE OF BIRTH	DRIVER'S LICENSE NUMBER			STATE			PURPOSE OF USE		USED WITH PERMISSION? (Y/N)
DESCRIBE DAMAGE										
1. WAS A STANDARD CHILD PASSENGER RESTRAINT SYSTEM (CHILD SEAT) INSTALLED IN THE VEHICLE AT THE TIME OF THE ACCIDENT?										Y/N
2. WAS THE CHILD PASSENGER RESTRAINT SYSTEM (CHILD SEAT) IN USE BY A CHILD DURING THE TIME OF THE ACCIDENT?										Y/N
3. DID THE CHILD PASSENGER RESTRAINT SYSTEM (CHILD SEAT) SUSTAIN A LOSS AT THE TIME OF THE ACCIDENT?										Y/N
ESTIMATE AMOUNT:		WHERE CAN VEHICLE BE SEEN?:			WHEN CAN VEHICLE BE SEEN?:					
OTHER INSURANCE ON VEHICLE - CARRIER:								POLICY NUMBER:		

OTHER VEHICLE / PROPERTY DAMAGED

NON - VEHICLE? ☐

AGENCY CUSTOMER ID: _____

VEH #	YEAR	MAKE:	BODY TYPE:	PLATE NUMBER	STATE
		MODEL:	V.I.N.:		
DESCRIBE PROPERTY (Other Than Vehicle)					OTHER VEH/PROP INS? (Y/N) ☐
CARRIER OR AGENCY NAME			NAIC CODE	POLICY NUMBER	
OWNER'S NAME AND ADDRESS			PRIMARY PHONE # ☐ HOME ☐ BUS ☐ CELL		SECONDARY PHONE # ☐ HOME ☐ BUS ☐ CELL
			PRIMARY E-MAIL ADDRESS:		
DRIVER'S NAME AND ADDRESS ☐ (Check if same as owner)			SECONDARY E-MAIL ADDRESS:		
			PRIMARY PHONE # ☐ HOME ☐ BUS ☐ CELL		SECONDARY PHONE # ☐ HOME ☐ BUS ☐ CELL
			PRIMARY E-MAIL ADDRESS:		
			SECONDARY E-MAIL ADDRESS:		
DESCRIBE DAMAGE					
ESTIMATE AMOUNT		WHERE CAN DAMAGE BE SEEN?			

INJURED

NAME & ADDRESS	PHONE (A/C, No)	PED	INS VEH	OTH VEH	AGE	EXTENT OF INJURY
		☐	☐	☐		
		☐	☐	☐		
		☐	☐	☐		
		☐	☐	☐		

WITNESSES OR PASSENGERS

NAME & ADDRESS	PHONE (A/C, No)	INS VEH	OTH VEH	OTHER (Specify)
		☐	☐	
		☐	☐	
		☐	☐	

REPORTED BY	REPORTED TO

REMARKS (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

APPLICABLE IN ALABAMA

Any person who knowingly presents a false or fraudulent claim for payment of a loss or benefit or who knowingly presents false information in an application for insurance is guilty of a crime and may be subject to restitution fines or confinement in prison, or any combination thereof.

APPLICABLE IN ALASKA

A person who knowingly and with intent to injure, defraud, or deceive an insurance company files a claim containing false, incomplete, or misleading information may be prosecuted under state law.

APPLICABLE IN ARIZONA

For your protection, Arizona law requires the following statement to appear on this form. Any person who knowingly presents a false or fraudulent claim for payment of a loss is subject to criminal and civil penalties.

APPLICABLE IN ARKANSAS, DELAWARE, KENTUCKY, LOUISIANA, MAINE, MICHIGAN, NEW JERSEY, NEW MEXICO, NORTH DAKOTA, PENNSYLVANIA, RHODE ISLAND, SOUTH DAKOTA, TENNESSEE, TEXAS, VIRGINIA, AND WEST VIRGINIA

Any person who knowingly and with intent to defraud any insurance company or another person, files a statement of claim containing any materially false information, or conceals for the purpose of misleading, information concerning any fact, material thereto, commits a fraudulent insurance act, which is a crime, subject to criminal prosecution and civil penalties. In LA, ME, TN, and VA, insurance benefits may also be denied.

APPLICABLE IN CALIFORNIA

For your protection, California law requires the following to appear on this form: Any person who knowingly presents a false or fraudulent claim for payment of a loss is guilty of a crime and may be subject to fines and confinement in state prison.

APPLICABLE IN COLORADO

It is unlawful to knowingly provide false, incomplete, or misleading facts or information to an insurance company for the purpose of defrauding or attempting to defraud the company. Penalties may include imprisonment, fines, denial of insurance, and civil damages. Any insurance company or agent of an insurance company who knowingly provides false, incomplete, or misleading facts or information to a policy holder or claimant for the purpose of defrauding or attempting to defraud the policy holder or claimant with regard to a settlement or award payable from insurance proceeds shall be reported to the Colorado Division of Insurance within the Department of Regulatory Agencies.

APPLICABLE IN THE DISTRICT OF COLUMBIA

Warning: It is a crime to provide false or misleading information to an insurer for the purpose of defrauding the insurer or any other person. Penalties include imprisonment and/or fines. In addition, an insurer may deny insurance benefits, if false information materially related to a claim was provided by the applicant.

APPLICABLE IN FLORIDA

Pursuant to S. 817.234, Florida Statutes, any person who, with the intent to injure, defraud, or deceive any insurer or insured, prepares, presents, or causes to be presented a proof of loss or estimate of cost or repair of damaged property in support of a claim under an insurance policy knowing that the proof of loss or estimate of claim or repairs contains any false, incomplete, or misleading information concerning any fact or thing material to the claim commits a felony of the third degree, punishable as provided in S. 775.082, S. 775.083, or S. 775.084, Florida Statutes.

APPLICABLE IN HAWAII

For your protection, Hawaii law requires you to be informed that presenting a fraudulent claim for payment of a loss or benefit is a crime punishable by fines or imprisonment, or both.

APPLICABLE IN IDAHO

Any person who knowingly and with the intent to injure, defraud, or deceive any insurance company files a statement of claim containing any false, incomplete or misleading information is guilty of a felony.

APPLICABLE IN INDIANA

A person who knowingly and with intent to defraud an insurer files a statement of claim containing any false, incomplete, or misleading information commits a felony.

APPLICABLE IN KANSAS

Any person who, knowingly and with intent to defraud, presents, causes to be presented or prepares with knowledge or belief that it will be presented to or by an insurer, purported insurer, broker or any agent thereof, any written statement as part of, or in support of, an application for the issuance of, or the rating of an insurance policy for personal or commercial insurance, or a claim for payment or other benefit pursuant to an insurance policy for commercial or personal insurance which such person knows to contain materially false information concerning any fact material thereto; or conceals, for the purpose of misleading, information concerning any fact material thereto commits a fraudulent insurance act.

APPLICABLE IN MARYLAND

Any person who knowingly or willfully presents a false or fraudulent claim for payment of a loss or benefit or who knowingly or willfully presents false information in an application for insurance is guilty of a crime and may be subject to fines and confinement in prison.

APPLICABLE IN MINNESOTA

A person who files a claim with intent to defraud or helps commit a fraud against an insurer is guilty of a crime.

APPLICABLE IN NEVADA

Pursuant to NRS 686A.291, any person who knowingly and willfully files a statement of claim that contains any false, incomplete or misleading information concerning a material fact is guilty of a felony.

APPLICABLE IN NEW HAMPSHIRE

Any person who, with purpose to injure, defraud or deceive any insurance company, files a statement of claim containing any false, incomplete or misleading information is subject to prosecution and punishment for insurance fraud, as provided in RSA 638:20.

APPLICABLE IN NEW YORK

Any person who knowingly and with intent to defraud any insurance company or other person files an application for commercial insurance or a statement of claim for any commercial or personal insurance benefits containing any materially false information, or conceals for the purpose of misleading, information concerning any fact material thereto, and any person who in connection with such application or claim knowingly makes or knowingly assists, abets, solicits or conspires with another to make a false report of the theft, destruction, damage or conversion of any motor vehicle to a law enforcement agency, the Department of Motor Vehicles or an insurance company, commits a fraudulent insurance act, which is a crime, and shall also be subject to a civil penalty not to exceed five thousand dollars and the value of the subject motor vehicle or stated claim for each violation.

APPLICABLE IN OHIO

Any person who, with intent to defraud or knowing that he/she is facilitating a fraud against an insurer, submits an application or files a claim containing a false or deceptive statement is guilty of insurance fraud.

APPLICABLE IN OKLAHOMA

WARNING: Any person who knowingly and with intent to injure, defraud or deceive any insurer, makes any claim for the proceeds of an insurance policy containing any false, incomplete or misleading information is guilty of a felony.

APPLICABLE IN WASHINGTON

It is a crime to knowingly provide false, incomplete, or misleading information to an insurance company for the purpose of defrauding the company. Penalties include imprisonment, fines and denial of insurance benefits.

Site-Specific Health and Safety Plan
Queens Plaza Off-Site Properties
Long Island City, New York

APPENDIX I

Roux Peer Observation Form

☐ Roux Associates, Inc. ☐ Remedial Engineering, P.C.
(Check applicable company name)

ROUX PEER OBSERVATION (RPO)

Ray Fitzpatrick, Office Health and Safety Manager

Cell: (631) 484-1168; **Office:** (631) 232-2600; **Fax:** (631) 232-9898; **Email:** rfitzpatrick@rouxinc.com

Date:		Observer Name:	
Project #:		Observer Title:	SSE? Y / N
Project Name:		Observee Title:	SSE? Y / N

Peer to Peer ☐	Manager to Staff ☐	Staff to Manager ☐

ACTIVITY TYPE (Check most appropriate one.)			
☐ Demolition	☐ O&M	☐ Trenching	☐ Rigging/Lifting
☐ Dewatering	☐ Excavation	☐ AST/UST Removal	☐ Other (describe below)
☐ Drilling / Geoprobe	☐ Sampling	☐ Gauging	
☐ Driving	☐ System Start-up	☐ Pump/Pilot Test	

Description of Site Conditions & Task(s):
Describe SPSA(s) Performed for Task:
ASSESS –
ANALYZE –
ACT –

****Complete checklist on back before completing the sections below.***

Cklist #	Observation(s)	Follow-up Action(s)	Person(s) Responsible	Target Date	Completion Date

Prepared By	Title(s)	Date
Observer:		

- Provide the completed RPO to the PM for review, then submit to **Ray Fitzpatrick** for review.
- Upon completion of follow-up action(s), notify **Ray Fitzpatrick** and re-submit RPO form with Completion Date(s).

Reviewed By	Title(s)	Date
PM:		
H&S Mgr:		

- Check only one response (i.e., YES, NO, NA – Not Applicable) for each line item.
- Use the 'Comments' box for positive comments. Use the space at the bottom of the page for any additional comments.
- If there is a 'NO' response, describe the observation and determine follow-up action(s) with the PM.

I. Personal Protective Equipment	YES	NO	NA	Comments
(a) PPE req't met & rated for work?	☐	☐	☐	
(b) PPE worn as req'd by the JSA, SOP, facility, etc.?	☐	☐	☐	
(c) PPE appropriate for weather, environmental & traffic conditions?	☐	☐	☐	
(d) Respirator fit tested & medically cleared work?	☐	☐	☐	
(e) Other	☐	☐	☐	
(f) Tick Prevention Measures: (repellents, light clothing, tucked pants etc.)	☐	☐	☐	
II. Tool / Equipment	YES	NO	NA	Comments
(a) Correct tool for task(s)?	☐	☐	☐	
(b) Equipment inspected & meet calibration req't?	☐	☐	☐	
(c) Heavy equipment inspection performed & rated for work?	☐	☐	☐	
(d) Loads secured if mobilizing?	☐	☐	☐	
(e) Trailers registered (if applicable)?	☐	☐	☐	
(f) Other	☐	☐	☐	
III. Body Use & Positioning	YES	NO	NA	Comments
(a) Correct techniques when lifting, pulling, pushing?	☐	☐	☐	
(b) Manageable loads?	☐	☐	☐	
(c) Assistance with >45lbs when lifting?	☐	☐	☐	
(d) Avoids reaching, twisting, overextending?	☐	☐	☐	
(e) Secure footing?	☐	☐	☐	
(f) Maintains 3-pt-of-contact?	☐	☐	☐	
(g) Avoids being caught and out of line-of-fire?	☐	☐	☐	
(h) Clear of pinch points & overhead hazards?	☐	☐	☐	
(i) Facing traffic & upwind?	☐	☐	☐	
(j) Other	☐	☐	☐	
IV. Work Environment	YES	NO	NA	Comments
(a) S/T/F, piercing and toppling hazards cleared / identified in work areas?	☐	☐	☐	
(b) Work areas and designated pathways defined & marked?	☐	☐	☐	
(c) Good housekeeping (designated areas, storage & disposal)?	☐	☐	☐	
(d) Checked for overhead & biological hazards?	☐	☐	☐	
(e) Air monitoring req't met?	☐	☐	☐	
(f) Weather conditions safe to perform task(s)?	☐	☐	☐	
(g) Other	☐	☐	☐	
V. Operating Procedures	YES	NO	NA	Comments
(a) HASP / JSA / SOP available & reviewed?	☐	☐	☐	
(b) SSE policy req't met?	☐	☐	☐	
(c) Personnel qualified for task(s)?	☐	☐	☐	
(d) Energy sources LOTO / de-energized?	☐	☐	☐	
(e) Shutdown devices identified & working?	☐	☐	☐	
(f) Parties notified & POC established?	☐	☐	☐	
(g) Used spotter when backing?	☐	☐	☐	
(h) Containers (samples, drums, etc.) marked?	☐	☐	☐	
(i) Other	☐	☐	☐	
(j) SPSA(s) performed?	☐	☐	☐	
Additional comments:				

Site-Specific Health and Safety Plan
Queens Plaza Off-Site Properties
Long Island City, New York

APPENDIX J

All One Health Responsibilities Form



**REPORT WORK-RELATED INJURIES OR A NEW ILLNESS
TO ALLONE HEALTH (AOH) IMMEDIATELY!**

Employee Responsibilities

- 1. Report the injury to your supervisor/manager**
- 2. Call AllOne Health at 1.800.350.4511, PRESS 1 to report an injury for Roux Associates, Inc.** The nurses will help determine the best type of care needed for the immediate situation, where to go for treatment, and work with you and providers on an ongoing basis.
- 3. Be ready to supply:**
 - ✓ Your name & contact information, including mobile phone
 - ✓ Your location (nearest city, town or area)
 - ✓ Supervisor/Manager name & contact information
 - ✓ Description of the injury, details of incident, and any existing medical conditions the nurse should be aware of (e.g., allergies, pacemaker...)
- 4. Follow AllOne Health instructions (e.g., first aid, go to urgent care center, or other)**
- 5. Immediately after your visit, contact the AllOne Health Nurse Care Manager at 1.800.350.4511 (press 1) or the direct number provided by the nurse to discuss your condition, treatment and any next steps.**
- 6. Follow the company protocols as communicated to you by your supervisor, CHSM or OHSM.**
- 7. Contact the AllOne Health Nurse with any questions or concerns about your condition.**
- 8. Communicate with your AllOne Health Nurse Care Manager about ALL further treatment relating to this case.** They are available to assist you in your recovery and make sure you receive the proper medical care you need!

**In case of serious injury, call 911 or head to the nearest
emergency center, calling AOH along the way!**

AllOne Health Responsibilities

- 1. AOH Nurse speaks to supervisor (if available) to gather information about employee and injury**
- 2. AOH Nurse speaks to employee about incident, level of pain, and any other medical conditions that could impact treatment**
- 3. AOH Nurse provides first aid measures to the injured employee**
- 4. When a medical evaluation is recommended, AOH calls the Roux Associates, Inc. identified facility to advise them the employee is coming and why, and faxes a release form and return-to-work form to the facility. After the visit, the Nurse reaches out to the facility to obtain the diagnosis and information on any treatment that was received and/or recommended.**
- 5. AOH Nurse contacts the employee within 24 hours to assess their condition and answer any questions**
- 6. Care management will continue until the employee returns to full duty or the care management is turned over to the Workers' Compensation provider.**
- 7. Throughout the process, AOH will communicate with the employee and his/her providers, and provide Roux Associates, Inc. management with email updates.**

Off-Site Remedial Investigation Work Plan
Queens Plaza Residential Development
Long Island City, New York

APPENDIX C

Soil Boring Logs



ROUX ASSOCIATES, INC.
Environmental Consulting
& Management

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898

Page 1 of 1

SOIL BORING LOG

WELL NO. Sewer Trench A	NORTHING Not Measured	EASTING Not Measured
PROJECT NO./NAME 2409.0001Y000 / Queens Plaza	LOCATION 28-10 Jackson Avenue Long Island City, New York	
APPROVED BY Jeff Wills	LOGGED BY Rich Crockett	
DRILLING CONTRACTOR/DRILLER JCC / JCC	GEOGRAPHIC AREA Orchard Street (northern location)	
DRILL BIT DIAMETER/TYPE NA / Excavator Bucket	BOREHOLE DIAMETER 5-feet	DRILLING EQUIPMENT/METHOD Excavator / Excavator
LAND SURFACE ELEVATION Not Measured	DEPTH TO WATER Not Measured	SAMPLING METHOD Excavator Bucket
		START-FINISH DATE 12/29/15-12/30/15
		BACKFILL Soil Cuttings

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Asphalt.			Excavated to 8 feet bls.
1		Brown, fine SAND, little medium Sand, Silt, and Gravel; moist.		0.8	
2					
3		Brown, fine SAND, some Silt, trace gravel; wet.		0.3	
4					
5					
6				0.0	Sample Orchard Sewer A (6-8) collected for VOCs, SVOCs, Pesticides, Metals, PCBs, TPH-DRO & TPH-GRO.
7					
8					Bottom of trench at 8 feet bls.

BORING/FEET 2409.0001Y000.GPJ ROUX.GDT 4/12/16



ROUX ASSOCIATES, INC.
Environmental Consulting
& Management

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898

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SOIL BORING LOG

WELL NO. Sewer Trench B	NORTHING Not Measured	EASTING Not Measured
PROJECT NO./NAME 2409.0001Y000 / Queens Plaza	LOCATION 28-10 Jackson Avenue Long Island City, New York	
APPROVED BY Jeff Wills	LOGGED BY Dave Klein	
DRILLING CONTRACTOR/DRILLER JCC / JCC	GEOGRAPHIC AREA Orchard Street (center location)	
DRILL BIT DIAMETER/TYPE NA / Excavator Bucket	BOREHOLE DIAMETER 5-feet	DRILLING EQUIPMENT/METHOD Excavator / Excavator
LAND SURFACE ELEVATION Not Measured	DEPTH TO WATER Not Measured	SAMPLING METHOD Excavator Bucket
		START-FINISH DATE 1/5/16-1/5/16
		BACKFILL Soil Cuttings

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Asphalt.			Excavated to 8 feet bls.
1		Light brown, fine SAND, little medium Sand and Silt, trace gravel; moist.		0.3	
2					
3				0.5	
4			G		
5				0.4	
6					Sample Orchard Sewer B (6-8) collected for VOCs, SVOCs, Pesticides, Metals, PCBs, TPH-DRO & TPH-GRO.
7				0.6	
8					Bottom of Trench at 8 feet bls.

BORING/FEET 2409.0001Y000.GPJ ROUX.GDT 4/12/16



ROUX ASSOCIATES, INC.
Environmental Consulting
& Management

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Islandia, NY 11749
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SOIL BORING LOG

WELL NO. Sewer Trench C	NORTHING Not Measured	EASTING Not Measured
PROJECT NO./NAME 2409.0001Y000 / Queens Plaza	LOCATION 28-10 Jackson Avenue Long Island City, New York	
APPROVED BY Jeff Wills	LOGGED BY Rich Crockett	
DRILLING CONTRACTOR/DRILLER JCC / JCC	GEOGRAPHIC AREA Orchard Street (southern location)	
DRILL BIT DIAMETER/TYPE NA / Excavator Bucket	BOREHOLE DIAMETER 5-feet	DRILLING EQUIPMENT/METHOD Excavator / Excavator
LAND SURFACE ELEVATION Not Measured	DEPTH TO WATER Not Measured	SAMPLING METHOD Excavator Bucket
	BACKFILL Soil Cuttings	START-FINISH DATE 12/14/15-1/13/16

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
1		ASPHALT			Excavated to 8 feet bls. Waste characterization sample Orchard-Sewer South (0-8)C collected for SVOCs, Metals, Pesticides, PCBs, Full TCLP, Hexavalent Chromium, Total Cyanide, RCRA Characteristics, Total Organic Halides and Paint Filter.
2		CONCRETE SUB BASE			
3		Greyish brown, fine SAND, some medium Sand, little Silt, trace coarse sand and gravel; moist		2.2	Sample Orchard Sewer C (2-3) collected for VOCs, SVOCs, Pesticides, Metals, PCBs, TPH-DRO/GRO. Sidewall samples Orchard Sewer-SE, -SS, -SN and -SW collected for VOCs, SVOCs, Pesticides, Metals, PCBs, TPH-DRO/GRO.
4		Greyish brown, fine SAND, some Silt, little medium Sand, trace coarse sand; moist	G	67.4	Odor observed. Waste characterization sample Orchard-Sewer South (4-6)G collected TCL VOCs, TCLP VOCs and TPH-DRO/GRO. Sample Orchard Sewer C B1 (4-6) and B2 (4-6) collected for VOCs, SVOCs, Pesticides, Metals, PCBs, TPH-DRO/GRO. Product-like droplets observed on soil from 4-6 feet bls.
5					
6		Grey, fine SAND, some Silt, trace medium sand; moist		15.7	Odor observed.
7					
8					Bottom of trench at 8 feet bls.

BORING/FEET 2409.0001Y000.GPJ ROUX.GDT 4/12/16



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SOIL BORING LOG

WELL NO. CP/CE	NORTHING Not Measured	EASTING Not Measured
PROJECT NO./NAME 2409.0001Y000 / Queens Plaza	LOCATION 28-10 Jackson Avenue Long Island City, New York	
APPROVED BY Jeff Wills	LOGGED BY Rich Crockett	
DRILLING CONTRACTOR/DRILLER Aquifer Drilling and Testing / David Moon	GEOGRAPHIC AREA Orchard Street Sidewalk - Crane Pad/ConEd Vault	
DRILL BIT DIAMETER/TYPE 5-in. / Sonic	BOREHOLE DIAMETER 5-inches	DRILLING EQUIPMENT/METHOD Compact C-17 / Rotosonic
LAND SURFACE ELEVATION Not Measured	DEPTH TO WATER Not Measured	SAMPLING METHOD Sonic
	BACKFILL Bentonite	START-FINISH DATE 8/3/15-8/3/15

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		CONCRETE. FILL (Brown, fine SAND, some medium Sand, little Silt, trace coarse sand, gravel and brick; moist)		12	Hand cleared to 5 feet bls. 3.5 feet recovery. Waste Characterization Sample CP/CE (0-16) collected for SVOCs, Metals, Pesticides, PCBs, EPH, Full TCLP, Hexavalent Chromium, Total Cyanide, Total Organic Halides, RCRA Characteristics and Paint Filter.
5		Light brown to brown, fine SAND, some medium Sand, little Silt, trace coarse sand and gravel; moist		0.6	3 feet recovery.
10		Dark grey, fine to medium SAND, some Silt, trace coarse sand and gravel; moist		198.5	3 feet recovery. Odor observed.
15					Waste Characterization Sample CP/CE (14-16) collected for TCL VOCs.
					Bottom of boring at 16 feet bls.

BORING/FEET 2409.0001Y000.CPJ ROUX.GDT 4/12/16

MONITORING WELL #: TW-0

PROJECT ID: Queens Plaza Residential Development	FLS PROJECT NO.: 10112
LOCATION: Orchard Street	CLIENT: Tishman Speyer
SITE LOCATION: Jackson Ave	FLS FIELD SUPERVISOR: RR
DRILLER: Aquifer Drilling and Testing	TOC Elevation: ~14' NAVD88
DRILLING METHOD: Sonic 7" diameter borehole	WELL DIAMETER: 4" stainless steel
SOIL SAMPLING METHOD: Sonic	SCREEN INTERVAL: 14-34' bg
DATE WELL INSTALLED: 4/2/15 (Drilled) 4/3/14 (Installed)	WELL COMPLETION: 34'
TOTAL DEPTH: 35' (Drilled) 34' (Installed)	DEPTH TO WATER: ~5-7' bg

DEPTH (FT) BELOW SURFACE	PID READING (PPM)	Density/Moisture	REC. (FT)	LITHOLOGIC DESCRIPTION	WELL CONSTRUCTION
0					
2				Pre-Cleared	
4					
6	0.4	Wet/Loose	3.5	1'= Light brown, wet to moist mixed SAND with some dark grey silt and some blackish clay, loose, no odor, no staining except possibly in clay; 1.5'= dark brown/olive grey fine SAND (SM), some silt, moist, loose, no odor, no staining, very low plasticity; 1'= Varved CLAY (CL) very dry & dense, coarse sand present, no odor, highly plastic when hydrated	
8	0.2	Moist/Loose			
	0.3				
	0.3	Moist-Dry/Dense			
10	0.1	Wet from drilling			
	0.2	Dry/Dense in core	4	1.5'= Varved CLAY (CL) (same as above = SAA); 0.5'= SAA (CL) trace mica flakes; 2'= TILL, coarse dark brown sand, some fine silt, trace clay, grave present, cobble at bottom, no odor, no staining	
12	0.3				
	0.0				
14					
16	0.1	Moist/Loose	3	3' = pinkish grey TILL (SW); major medium grain Sand, minor fines, trace gravel, moist, loose, no staining, slight odor, moist	
	0.2				
18	15				
20				Shelby Tube Sample 20-22' bg 2' = TILL SAA (SW)	
22	245	Moist/Loose	2.5	1'= TILL SAA (SW); staining, strong odor, moist; 1.5'= Varved CLAY (ML), dry, hard, trace sand, no staining, slight odor	
	53	Dense/Dry			
24					
26	303	Moist/Dense	2.5	*0.5' = fall-in of river stones at top of core similar to cobble @ 15' bg; 2' = Weathered BEDROCK; white soft minerals with black specks and reddish garnets, dense, strong odor, no staining; *Seen observed in drill fluids	
	117				
28	77	Dense/Dry	4	* 2.5' fall-in of coarse SAND (SW) at top of core; 1.5' = SAA weathered BEDROCK	
30	245				
		Dense/Dry		SAA weathered BEDROCK	
32	125				
		Dense/Dry		SAA weathered BEDROCK	
34	47				
36				***The recovered weathered bedrock crumbled in hand and appeared powdered/crushed. Mueser Rutledge Consulting Engineer personnel communicated to FLS personnel that refusal driving H-beams in support of excavation was encountered around 33' below grade in this location.	35' = E.O.B.
38					***Competent Bedrock

40

Legend:

- 4" Steel & PVC Riser (0-4'bg = PVC)
- 4" Stainless Steel Screen (0.02" slot)
- Sand
- Bentonite
- Bentonite & Cement Grout

MONITORING WELL LOG

DATE: 4/7/15
SCALE: NTS
FILE NAME:

DRAWN BY: JL
REV. BY: RR



Fleming-Lee Shue, Inc.

158 West 29th Street, 9th Floor
New York, New York 10001
(212) 675-3225

MONITORING WELL #: TW-1

PROJECT ID: Queens Plaza Residential Development	FLS PROJECT NO.: 10112
LOCATION: Orchard Street	CLIENT: Tishman Speyer
SITE LOCATION: Jackson Ave	FLS FIELD SUPERVISOR: GB(Roux)/RR(FLS)
DRILLER: Aquifer Drilling and Testing	TOC Elevation: ~14' NAVD88
DRILLING METHOD: Sonic 5" diameter borehole	WELL DIAMETER: 2" PVC
SOIL SAMPLING METHOD: Sonic	SCREEN INTERVAL: 24-29' bg
DATE WELL INSTALLED: 4/3/15	WELL COMPLETION: 29'
TOTAL DEPTH: 30'	DEPTH TO WATER: ~5-7' bg

DEPTH (FT) BELOW SURFACE	PID READING (PPM)	Density/Moisture	REC. (FT)	LITHOLOGIC DESCRIPTION	WELL CONSTRUCTION
0					
2				Pre-cleared	
4					
6	0.0		5	5-6: Green + gray silty CLAY (CL), dry, no odor/staining; 6-7: grayish brown fine SAND (SM), some silt, micaceous, moist, no odor/staining;	
8	2.5				
	0.0			7-10: Green and light brown CLAY (MH), some silt, trace fine Sand, micaceous, dry, no odor, no staining	
10	1.7				
12			4	10-12: Same as above = SAA; CLAY (MH) 12-15: Reddish-brown fine to coarse SAND (SP), trace gravel and cobbles, moist, no odor, no staining	
14					
16			5	15-17: SAA; SAND (SP) 17-20: Pinkish-gray medium grain SAND (SW), gravel and cobbles present, moist, no odor, no staining	
18	0.0				
20			5	20-22.5: SAA; SAND (SW) odor present 22.5-23.75: Green and brown SILT (ML), trace fine sand, dry, slight staining, strong odor;	
22	27			23.75-25: SAA; SILT (ML); black staining, strong odor, sheen on water	
24	169		5	25-30: Weathered BEDROCK; various colors, readily breaks into medium grain SAND (SM) sized particles, trace gravel, moist to dry, no staining, odor present	
26	109				
28	9				
	455				
	124				
	50				
30				E.O.B. = 30' bg	
32					
34					
36					
38					
40					

Legend:

2" PVC Riser

2" PVC Screen (Sch. 40-0.02" slot)

Sand

Bentonite

Bentonite & Cement Grout

MONITORING WELL LOG

DATE: 4/7/15
SCALE: NTS
FILE NAME:

DRAWN BY: JL
REV. BY: RR



Fleming-Lee Shue, Inc.

158 West 29th Street, 9th Floor
New York, New York 10001
(212) 675-3225

MONITORING WELL #: TW-2

PROJECT ID: Queens Plaza Residential Development	FLS PROJECT NO.: 10112
LOCATION: Orchard Street	CLIENT: Tishman Speyer
SITE LOCATION: Jackson Ave	FLS FIELD SUPERVISOR: GB(Roux)RR(FLS)
DRILLER: Aquifer Drilling and Testing	TOC Elevation: ~14' NAVD88
DRILLING METHOD: Sonic 5" diameter borehole	WELL DIAMETER: 2" PVC
SOIL SAMPLING METHOD: Sonic	SCREEN INTERVAL: 24-29' bg
DATE WELL INSTALLED: 4/3/15	WELL COMPLETION: 29'
TOTAL DEPTH: 31'	DEPTH TO WATER: ~5-7' bg

DEPTH (FT) BELOW SURFACE	PID READING (PPM)	Density/Moisture	REC. (%)	LITHOLOGIC DESCRIPTION	WELL CONSTRUCTION
0					
2					
4					
6	4.3			5-10: Orange-brown to green-grey Silty CLAY (CH), slightly micaceous, moist, no staining, slight odor	
8	1.3	Moist	5		
10	0.0			10-14: Brown-orange and green Silty CLAY (CH), no odor/staining, moist;	
12	0.0	Moist to Dry	5	14-15: Gray CLAY (CL), some coarse sand, red gravel, dry, no odor, no staining	
14					
16					
18			NR	No Recovery	
20					
22			NR	No Recovery	
24					
26	317	Dry		25-28: Gray and white Silty CLAY (CL), major fine sand, dry, no staining, slight odor;	
28	325		5	28-30: (SW) Weathered granite, feldspar biotite, garnets, coarse sand, dry, no staining, slight odor	
30	124			30-31: 2' Shelby tube sample of Decomposed Bedrock (1' Recovery)	
32	42			E.O.B. @ 31 ft-bg.	
34					
36					
38					
40					

Legend:

- 2" PVC Riser
- 2" PVC Screen (Sch. 40-0.02" slot)
- Sand
- Bentonite
- Bentonite & Cement Grout

MONITORING WELL LOG

DATE: 4/7/15
SCALE: NTS
FILE NAME:

DRAWN BY: JL
REV. BY: RR



Fleming-Lee Shue, Inc.

158 West 29th Street, 9th Floor
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MONITORING WELL #: TW-3

PROJECT ID: Queens Plaza Residential Development
LOCATION: Orchard Street
SITE LOCATION: Jackson Ave
DRILLER: Aquifer Drilling and Testing
DRILLING METHOD: Sonic 5" diameter borehole
SOIL SAMPLING METHOD: Sonic
DATE WELL INSTALLED: 4/3/15
TOTAL DEPTH: 31'

FLS PROJECT NO.: 10112
CLIENT: Tishman Speyer
FLS FIELD SUPERVISOR: RR
TOC Elevation: ~14' NAVD88
WELL DIAMETER: 2" PVC
SCREEN INTERVAL: 25-30' bg
WELL COMPLETION: 30'
DEPTH TO WATER: ~5-7' bg

DEPTH (FT) BELOW SURFACE	PID READING (PPM)	Density/Moisture	REC. (FT)	LITHOLOGIC DESCRIPTION	WELL CONSTRUCTION
0	0.0	Wet from drill water		6"=FILL; gravel, sand, fines;	
2	0.0	Moist	1'	6"= Blackish-gray to light olive brown silty SAND (SM), fine grain, trace organics, loose, soft, moist-wet, slight plasticity, organic odor, no staining	
4		Loose			
6	0.0	Moist	3'	1'=Olive gray clayey SAND (SC), some fines, minor clay, trace gravel, loose, soft, no odor, no staining;	
8	0.0	Loose		2'= Yellowish-orange CLAY, minor fine sand, highly plastic, moist, medium stiff, no odor, no staining	
10				2' Shelby tube sample of CLAY	
12	0.0	Moist/Soft	4'	2'= Light brown silty CLAY (OL), some fines, siltier at top of core, denser at bottom, medium plasticity, medium stiff, no odor, no staining;	
14	0.0	Moist/Medium Dense		2'=Light grey CLAY (CH), minor fine sand, minor silt, moist, medium stiff, highly plastic, no odor, no staining	
16	0.0				
18	0.0	Dense/Wet	3.5'	1'=SAA CLAY (CH); Varved, wet, very stiff	
20	0.0	Moist/Loose		2.5'= Pinkish-gray TILL, medium to coarse sand, trace gravel, cobbles present, loose, moist, no odor, no staining	
22	0.0	Moist/Loose	3'	3'= SAA TILL	
24	0.0	*Loose from drill rod ejection			
26	0.0			2' Shelby tube sample of TILL	
28	1.4	Loose	1'	8'= SAA TILL;	
30	30	Moist		4'= SAA TILL; Strong odor, blackish staining; Bedrock below	
32				E.O.B. @ 31 ft-bg.	
34					
36					
38					

Legend:

- 2" PVC Riser
- 2" PVC Screen (Sch. 40-0.02" slot)
- Sand
- Bentonite
- Bentonite & Cement Grout

MONITORING WELL LOG

DATE: 4/7/15
SCALE: NTS
FILE NAME:

DRAWN BY: JL
REV. BY: RR



Fleming-Lee Shue, Inc.

158 West 29th Street, 9th Floor
New York, New York 10001
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MONITORING WELL #: TW-4

PROJECT ID: Queens Plaza Residential Development	FLS PROJECT NO.: 10112
LOCATION: Orchard Street	CLIENT: Tishman Speyer
SITE LOCATION: Jackson Ave	FLS FIELD SUPERVISOR: GB(Roux)/RR(FLS)
DRILLER: Aquifer Drilling and Testing	TOC Elevation: ~14' NAVD88
DRILLING METHOD: Sonic 5" diameter borehole	WELL DIAMETER: 2" PVC
SOIL SAMPLING METHOD: Sonic	SCREEN INTERVAL: 20-25' bg
DATE WELL INSTALLED: 4/3/15	WELL COMPLETION: 25'
TOTAL DEPTH: 32'	DEPTH TO WATER: ~5-7' bg

DEPTH (FT) BELOW SURFACE	PID READING (PPM)	Density/Moisture	REC. (%)	LITHOLOGIC DESCRIPTION	WELL CONSTRUCTION
0					
2			4	0'-5' mix of sand, silt, and clay from pre-clearing	
4					
6			NR	No Recovery	
8					
10	0.0	Moist	2.5	10-12.5: Olive-Gray medium SAND (SP), gravel present, trace cobbles, moist, no staining, no odor;	
12			NR	No Recovery	
14					
16	0.0	Moist		15-17: Gray course SAND (GP), some gravel, no stain, no odor;	
18	0.0	Dry	4	17-18.5: Gray CLAY (CL), some cobbles, no stain, no odor;	
18	16.8	Moist		18.5-20: Dark gray medium to coarse grain SAND (SW), some gravel, no staining, slight odor	
20	518.5	Wet		20-22: (Same as above = SAA) SAND (SW); strong odor, staining present;	
22	263.3		1	22-25: Gray/olive CLAY (ML), trace fine sand, moist no staining, odor present, product, product gobules present in drilling fluids	
24	561.5				
26	115.8		3	25-27: Grey CLAY and SILT (ML), trace fine sand, wet, no staining, odor present;	
26	67.8			27-28: SAA (ML); Greenish Gray, strong Odor	
28	329.0			28-31.5: Banded gneiss and weathered bedrock in irregular intervals, some staining, strong odor	
30			1		
32				E.O.B. @ 32 ft-bg.	
34				*Bedrock Core collected for observation from 28-31.5'bg; 1.5' recovery of bedrock chunks and 11" of solid bedrock core at bottom; minor staining and odorous sediment caked onto chunks at top of core. No evidence of DNAPL intrusion into solid rock core.	
36					
38					
40					

Legend:

- 2" PVC Riser
- 2" PVC Screen (Sch. 40-0.02" slot)
- Sand
- Bentonite
- Bentonite & Cement Grout

MONITORING WELL LOG

DATE: 4/7/15
SCALE: NTS
FILE NAME:

DRAWN BY: JL
REV. BY: RR



Fleming-Lee Shue, Inc.

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SOIL BORING LOG

WELL NO. RC-11	NORTHING Not Measured	EASTING Not Measured
PROJECT NO./NAME 2409.0001Y000 / Queens Plaza	LOCATION 28-10 Jackson Avenue Long Island City, New York	
APPROVED BY Jeff Wills	LOGGED BY Dave Klein	
DRILLING CONTRACTOR/DRILLER Aquifer Drilling and Testing / Tony Palomeque	GEOGRAPHIC AREA ORchard Street Sidewalk	
DRILL BIT DIAMETER/TYPE 5-in. / Tri-Cone	BOREHOLE DIAMETER 5-inches	DRILLING EQUIPMENT/METHOD CME-75 / Mud Rotary
LAND SURFACE ELEVATION 14.18(FT.)	DEPTH TO WATER Not Measured	SAMPLING METHOD 2" Core
	BACKFILL Bentonite	START-FINISH DATE 1/8/16-1/8/16

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		FILL (Grey, fine to medium SAND, some Silt, little coarse Sand and Gravel, trace asphalt; very moist)		139.8	Hand cleared to 5 feet bls. Odor observed.
		Grey, fine SAND, some Silt, little medium Sand, trace gravel and clay; very moist		11275	
5		Grey to greyish brown, SILT, little fine Sand, trace clay; moist		15000	4 feet recovery. Odor observed.
				15000	
10		NO RECOVERY			Obstruction (Cobble/Boulder) encountered at 9 feet bls. Used roller bit to drill through obstruction to 14 feet bls.
15		Greyish brown, coarse SAND, some medium Sand, little fine Sand, trace silt and gravel; wet		219	3 feet recovery. Odor observed.
		Greyish brown, medium SAND, some fine Sand, little Silt, trace coarse sand and gravel; wet		1954	
20				522	4 feet recovery. Odor observed.
				9671	Bedrock encountered at ~23 feet bls.

BORING/FEET 2409.0001Y000.GPJ ROUX.GDT 4/12/16



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WELL CONSTRUCTION LOG

WELL NO. CW-1		NORTHING Not Measured		EASTING Not Measured																																																							
PROJECT NO./NAME 2409.0001Y000 / Queens Plaza				LOCATION 28-10 Jackson Avenue																																																							
APPROVED BY Jeff Wills		LOGGED BY Ed Ryan		Long Island City, New York																																																							
DRILLING CONTRACTOR/DRILLER Aquifer Drilling and Testing / Dave Moon				GEOGRAPHIC AREA Orchard Street Sidewalk																																																							
DRILL BIT DIAMETER/TYPE 7-in. / Sonic		BOREHOLE DIAMETER 7-inches		DRILLING EQUIPMENT/METHOD Compact C-17 / Rotosonic																																																							
CASING MAT./DIA. Stainless Steel / 4-inch		SCREEN: TYPE V-Wire		START-FINISH DATE 3/5/16-3/5/16																																																							
		MAT. Stainless Steel		TOTAL LENGTH 35.0ft																																																							
				DIA. 4-inch																																																							
				SLOT SIZE 10-Slot																																																							
ELEVATION OF: (Feet)		GROUND SURFACE 15.00		TOP OF WELL CASING 14.50																																																							
				TOP & BOTTOM SCREEN 10.0 / -25.0																																																							
				GRAVEL PACK SIZES #1																																																							
12-inch flushmount curb box 4-inch j-plug Concrete Grout 5 ft of 4-inch diameter, stainless steel riser Bentonite GROUND WATER LEVEL #1 Sand 35 ft of 4-inch diameter, 10-slot, continuously wrapped, stainless steel screen Graphic Log Visual Description Blow Counts per 6" PID Values (ppm) REMARKS <tr><td colspan="6"> NO RECOVERY. No Recovery. </td></tr><tr><td colspan="6"> 5 5 3 ft recovery. </td></tr><tr><td colspan="6"> 10 10 3.8 ft recovery. </td></tr><tr><td colspan="6"> 15 15 3.7 ft recovery. </td></tr><tr><td colspan="6"> 20 20 4 ft recovery. </td></tr><tr><td colspan="6"> 25 25 3 ft recovery. </td></tr><tr><td colspan="6"> 30 30 3.5 ft recovery. </td></tr><tr><td colspan="6"> 35 35 2.5 ft recovery. </td></tr><tr><td colspan="6"> 40 Product sheen/NAPL observed on soil from 39-40 ft (directly above bedrock). Bedrock encountered ~40 ft b/s </td></tr>						NO RECOVERY. No Recovery.						5 5 3 ft recovery.						10 10 3.8 ft recovery.						15 15 3.7 ft recovery.						20 20 4 ft recovery.						25 25 3 ft recovery.						30 30 3.5 ft recovery.						35 35 2.5 ft recovery.						40 Product sheen/NAPL observed on soil from 39-40 ft (directly above bedrock). Bedrock encountered ~40 ft b/s					
NO RECOVERY. No Recovery.																																																											
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BORING/FEET 2409.0001Y000.GPJ ROUX.GDT 6/29/16



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SOIL BORING LOG

WELL NO. CW-2	NORTHING Not Measured	EASTING Not Measured
PROJECT NO./NAME 2409.0001Y000 / Queens Plaza	LOCATION 28-10 Jackson Avenue Long Island City, New York	
APPROVED BY Jeff Wills	LOGGED BY Rich Crockett	
DRILLING CONTRACTOR/DRILLER Aquifer Drilling and Testing / Dave Moon	GEOGRAPHIC AREA Orchard Street Sidewalk	
DRILL BIT DIAMETER/TYPE 7-in. / Sonic	BOREHOLE DIAMETER 7-inches	DRILLING EQUIPMENT/METHOD Compact C-17 / Rotosonic
LAND SURFACE ELEVATION 14.50(FT.)	DEPTH TO WATER Not Measured	SAMPLING METHOD Sonic
	BACKFILL Grout	START-FINISH DATE 8/31/15-1/16/16

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
5		Greyish brown, fine SAND, some Silt, little medium Sand, trace coarse sand and gravel ; moist.		4.2	Odor observed.
10		Greyish brown, SILT, some fine Sand, little medium Sand, trace coarse sand and gravel; moist.		6.2	Odor and staining observed.
15		Brown, SILT, little fine Sand, trace medium sand; very moist.		3.2	
20		Brownish grey, SILT, some fine Sand, little medium sand, trace coarse sand and gravel; very moist.		2.7	Odor observed.
				23.8	
				52.6	Odor and staining observed.
					Bedrock encountered at 20' bls.

BORING/FEET 2409.0001Y000.GPJ ROUX.GDT 4/6/16



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WELL CONSTRUCTION LOG

WELL NO. CW-3/RC-11	NORTHING Not Measured	EASTING Not Measured
PROJECT NO./NAME 2409.0001Y000 / Queens Plaza		LOCATION 28-10 Jackson Avenue
APPROVED BY Jeff Wills	LOGGED BY Valerie Sabatasso	Long Island City, New York
DRILLING CONTRACTOR/DRILLER Aquifer Drilling and Testing / Dave Moon		GEOGRAPHIC AREA Orchard Street Sidewalk
DRILL BIT DIAMETER/TYPE 7-in. / Sonic	BOREHOLE DIAMETER 7-inches	DRILLING EQUIPMENT/METHOD Compact C-17 / Rotosonic
CASING MAT./DIA. Stainless Steel / 7-inch	SCREEN: TYPE V-Wire	SAMPLING METHOD Sonic
TOTAL LENGTH 20.0ft		START-FINISH DATE 3/5/16-3/5/16
ELEVATION OF: (Feet)	GROUND SURFACE 14.18	TOP OF WELL CASING 13.91
TOP & BOTTOM SCREEN 8.2 / -11.8		GRAVEL PACK SIZES #1

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0	12-inch flushmount curb box 4-inch j-plug	Reinforced concrete.		7.3	Hand cleared to 5 feet bls.
5	Concrete Grout 6 ft of 4-inch diameter, stainless steel riser Bentonite #1 Sand	Dark brown, fine to coarse SAND, some Gravel, little Silt; dry. Dark grey, fine to coarse SAND, some Silt, trace gravel; moist. Olive grey and black, SILT, some fine Sand; moist. Olive grey, SILT, some fine to coarse Sand; moist.		365.7 612.5 547.8 689.2	Odor observed. Odor observed.
10		Brown to grey, fine SAND; moist.		10.9 13.8 18.9 20.1 21.1	
15		Brown to grey, fine SAND, trace gravel; wet.		33.8 42.1 27.9 38.9 40.1	Product observed on soil from 10-15 ft bls.
20	20 ft of 4-inch diameter, 10-slot, continuously wrapped, stainless steel screen	No Recovery			No Recovery
25		Grey, fine SAND, trace gravel; moist. Grey, fine SAND; moist. BEDROCK (Gneiss).		22.8 25.9 33.4 38.6 33.5	Odor observed. Bedrock encountered at 25 feet bls.

BORING/FEET 2409.0001Y000.GPJ ROUX.GDT 4/6/16



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WELL CONSTRUCTION LOG

WELL NO. CW-3A		NORTHING Not Measured		EASTING Not Measured		
PROJECT NO./NAME 2409.0001Y000 / Queens Plaza				LOCATION 28-10 Jackson Avenue		
APPROVED BY Jeff Wills		LOGGED BY Rich Crockett		Long Island City, New York		
DRILLING CONTRACTOR/DRILLER Aquifer Drilling and Testing / Tony Palomeque				GEOGRAPHIC AREA Orchard Street Sidewalk		
DRILL BIT DIAMETER/TYPE 7-in / Sonic		BOREHOLE DIAMETER 7-inches		DRILLING EQUIPMENT/METHOD Compact C-17 / Rotosonic	SAMPLING METHOD Sonic	
CASING MAT./DIA. Stainless Steel / 4-inch		SCREEN: TYPE V-Wire		TOTAL LENGTH 40.0ft		
ELEVATION OF: (Feet)		GROUND SURFACE		TOP & BOTTOM SCREEN		
				GRAVEL PACK SIZES #1		
Depth, feet	12-inch flushmounted curb box	4-inch j-plug	Graphic Log	Visual Description	Blow Counts per 6"	
					PID Values (ppm)	
					REMARKS	
5			Concrete	CONCRETE	1.7	Hand cleared to 8' bls.
			7 ft of 4-inch diameter, stainless steel riser	FILL (Dark grey, fine SAND, some Silt, little medium Sand, trace coarse sand and gravel; moist).		
			Bentonite	Grey to brown, SILT, some fine Sand, little medium Sand trace coarse sand and gravel; moist.	1.4	Odor observed.
10				Brown, fine SAND, some Silt, little medium Sand, trace coarse sand and gravel; wet	3.6	4 ft recovery. Water table observed at ~8 ft bls. Odor observed.
15			#1 Sand	Grey, medium SAND, some fine Sand, little coarse Sand, trace silt and gravel; wet	21	4.3 ft recovery. Odor observed.
20					788.7	Odor observed.
25				BEDROCK (Gneiss)	1604	Sample CW-3A (17-18) collected for TCL VOCs, SVOCs, Pesticides, PCBs, TAL Metals and TPH DRO/GRO. 3.8 ft recovery. Odor observed Sample CW-3A (22-23) collected for TCL VOCs, SVOCs, Pesticides, PCBs, TAL Metals and TPH DRO/GRO. Bedrock encountered at 23 ft bls. (See CW-3A bedrock log for bedrock details).
30			40 ft of 4-inch diameter, 10-slot, continuously wrapped, stainless steel screen			
35						
40						
45						
						Bottom of boring at 47' bls.

BORING/FEET 2409.0001Y000.GPJ ROUX.GDT 6/22/16



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WELL CONSTRUCTION LOG

WELL NO. CW-4/RC-12	NORTHING Not Measured	EASTING Not Measured
PROJECT NO./NAME 2409.0001Y000 / Queens Plaza	LOCATION 28-10 Jackson Avenue Long Island City, New York	
APPROVED BY Jeff Wills	LOGGED BY Lauren Dolginko	
DRILLING CONTRACTOR/DRILLER Aquifer Drilling and Testing / Dave Moon	GEOGRAPHIC AREA Orchard Street Sidewalk	
DRILL BIT DIAMETER/TYPE 7-in. / Sonic	BOREHOLE DIAMETER 7-inches	DRILLING EQUIPMENT/METHOD Compact C-17 / Rotosonic
CASING MAT./DIA. Stainless Steel / 7-inch	SCREEN: TYPE V-Wire	SAMPLING METHOD Sonic
ELEVATION OF: (Feet)	GROUND SURFACE 14.18	TOP OF WELL CASING 9.2 / -30.8
		START-FINISH DATE 3/10/16-3/10/16
		GRAVEL PACK SIZES #1
		TOTAL LENGTH 40.0ft DIA. 7-inch SLOT SIZE 10-Slot

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
	12-inch flushmount curb box 4-inch j-plug Concrete	Brown to dark brown, fine SAND, trace silt and gravel; moist.		1.5	Hand cleared to 5 ft bls.
	5 ft of 4-inch diameter, stainless steel riser			1.0	
	Bentonite			0.9	
	#1 Sand	Brown, fine SAND, trace gravel; moist.		1.0	
5		CONCRETE.		0.0	
		Brown, fine SAND, trace gravel; moist.		0.1	
				0.0	
				0.1	
				0.2	
10		Brown to grey, fine SAND, trace gravel; wet.		33.5	
				45.6	
				100.8	
	40 ft of 4-inch diameter, 10-slot, continuously wrapped, stainless steel screen	Dark grey, fine SAND; wet.		246.7	Odor observed.
15		BEDROCK (Gneiss)		255.9	Bedrock encountered at 14 ft bls. Cored into bedrock to 45 ft bls. Well screen installed to screen both overburden and bedrock zones.
20					

BORING/FEET 2409.0001Y000.GPJ ROUX.GDT 4/6/16



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WELL CONSTRUCTION LOG

WELL NO. CW-4/RC-12	NORTHING Not Measured	EASTING Not Measured
PROJECT NO./NAME 2409.0001Y000 / Queens Plaza		LOCATION 28-10 Jackson Avenue
APPROVED BY Jeff Wills	LOGGED BY Lauren Dolginko	Long Island City, New York

Depth, feet	Graphic Log	Visual Description (continued)	Blow Counts per 6"	PID Values (ppm)	REMARKS
		BEDROCK (continued)			
25	40 ft of 4-inch diameter, 10-slot, continuously wrapped, stainless steel screen				25
30					30
35					35
40					40
45					Bottom of boring at 45 ft bls. 45

BORING/FEET 2409.0001Y000.CPJ ROUX.GDT 4/6/16



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WELL CONSTRUCTION LOG

WELL NO. CW-5/RC-14		NORTHING Not Measured		EASTING Not Measured	
PROJECT NO./NAME 2409.0001Y000 / Queens Plaza				LOCATION 28-10 Jackson Avenue	
APPROVED BY Jeff Wills		LOGGED BY Rich Crockett		Long Island City, New York	
DRILLING CONTRACTOR/DRILLER Aquifer Drilling and Testing / Tony Palomeque				GEOGRAPHIC AREA Orchard Street Sidewalk	
DRILL BIT DIAMETER/TYPE 7-in. / Sonic		BOREHOLE DIAMETER 7-inches		DRILLING EQUIPMENT/METHOD Compact C-17 / Rotosonic	
CASING MAT./DIA. Stainless Steel / 4-inch		SCREEN: TYPE V-Wire		TOTAL LENGTH 40.0ft	
ELEVATION OF: (Feet)		GROUND SURFACE		TOP & BOTTOM SCREEN	
				GRAVEL PACK SIZES #1	
Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
.....	12-inch flushmount curb box	FILL (Brown, medium to coarse SAND, some Gravel, little Brick and Lumber, trace plastic; moist).		4.5	Hand cleared to 5' bls.
.....	4-inch j-plug	CONCRETE.		1.4	
.....	8 ft of 4-inch diameter, stainless steel riser	FILL (Brown, fine to coarse SAND, some Silt and Gravel, little Brick and Concrete; moist).		0.5	
5	Bentonite	Brown, fine SAND and SILT, some medium / to coarse Sand and Gravel; moist.		0.7	Odor observed.
.....		Dark grey, fine SAND and SILT, little Gravel; moist.		151	Odor, sheen, and product observed.
.....		Grey, fine SAND and SILT, little Gravel and coarse Sand; wet.		413.6	Sample RC-14 (7.5-8.5) collected for TCL VOCs, TCL
10		Grey, fine to medium SAND and SILT, some Gravel; wet.		482	SVOCs, TCL Pest, TAL
.....				561	Metals, TPH GRO/DRO.
.....				147	Odor and sheen observed.
.....				314.8	Sample "RC-14 (12-13)" collected for TCL VOCs, TCL
15	#1 Sand	BEDROCK (Gneiss).			SVOCs, TCL Pest, TAL
.....					Metals, TPH GRO/DRO.
.....					Bedrock encountered 13' bls.
.....					Cored through bedrock to 48'
.....					bls. (See RC-14 bedrock log for bedrock details).
20					
.....					
25					
.....					
.....					
30	40 ft of 4-inch diameter, 10-slot, continuously wrapped, stainless steel screen				
.....					
35					
.....					
40					
.....					
45					
.....					
Bottom of boring at 48' bls.					

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SOIL BORING LOG

WELL NO. RC-13	NORTHING Not Measured	EASTING Not Measured
PROJECT NO./NAME 2409.0001Y000 / Queens Plaza	LOCATION 28-10 Jackson Avenue	
APPROVED BY Jeff Wills	LOGGED BY Edward Ryan (FLS)	Long Island City, New York
DRILLING CONTRACTOR/DRILLER Aquifer Drilling and Testing / Tony Palomeque	GEOGRAPHIC AREA Orchard Street Sidewalk	
DRILL BIT DIAMETER/TYPE 2-in. / Core Bit	BOREHOLE DIAMETER 5-inches	DRILLING EQUIPMENT/METHOD CME-75 / Mud Rotary
LAND SURFACE ELEVATION 14.00(FT.)	DEPTH TO WATER Not Measured	SAMPLING METHOD Core Tube
	BACKFILL Grout	START-FINISH DATE 3/6/16-3/6/16

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
1		Brown, fine SAND, some Silt, trace brick and metal; slightly moist.			Hand cleared to 5 ft bls.
2				0.9	
3				1.3	
4				2.2	
5		Light brown, fine SAND; slightly moist.		2.1	Bedrock encountered at 5 ft bls.

BORING/FEET 2409.0001Y000.GPJ ROUX.GDT 4/6/16