



WCD
GROUP

A GALLAGHER BASSETT COMPANY

Supplemental Remedial Investigation Work Plan

1640 Flatbush Avenue

Brooklyn, NY 11210

Block 7577, Lot 60

Site ID No.: C224212

Prepared for:

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FEBRUARY 2019

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SUPPLEMENTAL REMEDIAL INVESTIGATION WORK PLAN

1.0 INTRODUCTION

This Supplemental Remedial Investigation Work Plan (RIWP) and Health and Safety Plan (HASP) have been prepared for 1640 Flatbush Avenue in Brooklyn, New York (the Site) in support of the submittal of a Brownfield Cleanup Program (BCP) application in accordance with the provisions of the New York State Department of Environmental Conservation's (NYDEC) Subpart 375-3. This Work Plan describes the proposed supplemental investigation that will fill in data gaps and areas not previously covered to determine the extent of on-site contamination, if any, beyond the limits of previous investigations. The site-specific HASP, included in Appendix A, addresses potential hazards, contaminants of concern based on past use and safety requirements associated with investigation activities in accordance with ASTM and OSHA guidelines.

1.1 Site Location and Current Usage

The Site is located in Brooklyn, New York and is identified as Block 7577 and Lot 60 on the New York City Tax Map. Figure 1 is a Site location map. The Site is 17,985-square feet and is bounded by a commercial shopping center to the north, Aurelia Court to the south, Flatbush Avenue to the east, and a mid-rise housing complex to the west. Currently, the Site is vacant. The Site was previously utilized as a gasoline filling station, including a one-story convenience store. The building occupies a footprint of approximately 1,000-square feet in the center of the lot. Surrounding the building are four pump islands and associated foundation elements covered by a canopy. Site features are shown on Figure 2. The gasoline tanks were abandoned in-place and the pump bodies were removed by the former tenant in following cessation of fueling operations in late 2017.

1.2 Description of Surrounding Property

The Site is located in a developed commercial, institutional, and residential neighborhood in Brooklyn, New York. The Brooklyn College campus is located approximately 700 feet northeast of the Site.

2.0 PREVIOUS ENVIRONMENTAL DOCUMENTATION

Summaries of environmental reports previously prepared for the Site are presented below.

2.1 Phase I Environmental Site Assessments

A Phase I Environmental Site Assessment (ESA), prepared by WCD Group, LLC (WCD) in August 2014, identified multiple recognized environmental conditions (RECs):

1. Historical uses of the Site for automotive repair, dry-cleaning, and metal working, and ongoing use as a filling station since 1950, with multiple closed former USTs (note: site operations ceased in 2017 when the most recent operating USTs were abandoned in-place);
2. Documented elevated concentrations of petroleum-related compounds in on-site groundwater;
3. Potential presence of historical fill and/or buried demolition debris; and
4. Potential impacts from adjoining/nearby properties, including a railroad facility and multiple sites with current and former USTs.

2.2 Findings from Site-Specific Environmental Investigations

Remedial Investigation Report, revised March 26, 2018, prepared by WCD Group LLC.

WCD Group LLC (WCD) conducted an interim remedial investigation at the Site. The findings of that report include the following:

1. Depth to groundwater ranges from 25.25 to 28.50 feet below top of flush-mount well casings at the Site;
2. Groundwater flow is generally from southwest to northeast beneath the Site;
3. Bedrock was not encountered during the Site investigation. Based on a review of available information the depth to bedrock on the Site is approximately 500 feet bgs;
4. The stratigraphy of the site, from the surface down, generally consists of variable texture sands with gravel, and some clay (the upper 5 to 7 feet are considered to be fill material). Finer, more uniform sands and some gravel were encountered beneath this interval. Refusal was not encountered during this Site investigation;
5. Eight soil samples were collected from four soil borings advanced to a maximum depth of 30-feet bgs on November 2 and November 3, 2017. Soil sample results were compared to NYSDEC 6NYCRR Part 375 Section 6 – Remedial Program Soil Cleanup Objectives (SCOs) and Soil Cleanup Levels (SCLs) for Fuel Oil Contaminated Soil found in Table 3 of Commissioner Policy 51 (CP-51), “Soil Cleanup Guidance”, dated October 21, 2010. No VOCs, PCBs, or Pesticides were detected above Unrestricted Use SCOs or CP-51 SCLs in any soil samples collected. One SVOC, ideno(1,2,3-cd)pyrene, was detected above the corresponding Unrestricted Use SCO and NY-CP51 SCL in SB-1 at a sampling depth between three and four feet bgs. Several metals, including cadmium, lead, nickel, and zinc, were detected above corresponding Unrestricted Use SCOs in seven of the soil samples collected. Findings are considered consistent with the presence of urban fill materials;

6. Four groundwater samples were collected from four newly installed permanent groundwater monitoring wells on November 20, 2017. Groundwater sample results were compared to NYSDEC 6NYCRR Part 703 – Ambient Water Quality Guidance Values (AWQS). Results of the analysis of groundwater samples indicate that no SVOCs were detected in any of the samples collected. Two VOCs (PCE and chloroform) were detected in exceedance of AWQS in one or more samples collected. Several metals, including iron, magnesium, manganese and sodium, were detected in one or more samples above corresponding AWQS. Metals were submitted to the laboratory for additional laboratory filtration. Dissolved metals, including magnesium and sodium, were detected in one or more samples above corresponding AWQS. The presence of naturally occurring metals is consistent with results of prior environmental investigations; and
7. Ten soil vapor samples were collected on November 2, 2017 from shallow and deep (vadose zone) temporary soil vapor points installed at the Site. Soil vapor sample results were reviewed as a whole and in conjunction with results of other environmental sampling. Soil vapor analyses indicated that low and relatively high concentrations of select chlorinated solvents (including PCE, TCE), petroleum-related compounds (including 2-butanone, 2-hexanone, acetone), and BTEX compounds were detected in shallow soil vapor samples collected between five and eight feet bgs, and deeper soil vapor samples collected from the vadose zone (approximately 25 feet bgs) at the Site.

Phase II Environmental Site Investigation Report, February 2015, prepared by WCD.

WCD conducted a Phase II Site Investigation at the Site. The findings of that report include the following:

1. Elevation of the property above mean sea level is approximately 30 feet;
2. Groundwater was encountered at approximately 27 to 29 feet bgs;
3. Bedrock was not encountered during the Site Investigation;
4. In general, soil at the Site consists of fill material consisting of red/brown/gray sand, silt, gravel, red brick, concrete, and ash encountered to a maximum depth of 25 feet bgs underlain by a native soils consisting of fine to coarse sand to 35 feet bgs, the maximum boring depth at the Site;
5. The results of the analyses of soil samples revealed VOCs, SVOCs and metals at concentrations exceeding Unrestricted Use SCOs and/or SCLs. Fifteen VOCs [1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, ethylbenzene, isopropylbenzene, n-butylbenzene, n-propylbenzene, naphthalene, o-xylene, p-isopropyltoluene, p/m-xylene, sec-butylbenzene, tetrachloroethene (PCE), and xylene (total)] and the SVOC naphthalene were detected in one or more soil samples at concentrations above their respective Unrestricted Use SCOs and/or SCLs. The metals lead, nickel, and zinc were detected at concentrations above the Unrestricted Use SCOs in one or more samples. The concentrations of VOCs and SVOCs exceeding regulatory criteria may be attributed to petroleum contamination observed at the Site and the historic use of the Site as a dry cleaner. The concentrations of metals exceeding the Unrestricted Use SCOs may be attributed to the characteristics of surficial fill material at the Site. No PCBs or pesticides/herbicides were detected in any of the soil samples at concentrations above Unrestricted Use SCOs and/or CP-51 SCLs;

6. The results of the analyses of the groundwater samples revealed that fifteen VOCs [1,2,4-trimethylbenzene; 1,3,5-trimethylbenzene; benzene; cis-1,2-dichloroethene; ethylbenzene; isopropylbenzene; n-butylbenzene; n-propylbenzene; naphthalene; o-xylene; p/m-xylene; sec-butylbenzene; tetrachloroethene (PCE); toluene; and trichloroethene (TCE)]; one SVOC (naphthalene); and four naturally occurring metals (iron, manganese, magnesium, and sodium) were detected at concentrations greater than the corresponding Class GA Values in one or more of the groundwater samples collected at the Site. The VOCs detected in groundwater above Class GA Values are attributed to petroleum contamination observed at the Site and historic use of the Site as a dry cleaner. The SVOCs detected in groundwater above the Class GA Values are attributed to petroleum contamination observed at the Site. The metals detected in groundwater above Class GA Values can be attributed to the characteristics of the aquifer. No PCBs or pesticides/herbicides were detected in any of the groundwater samples at concentrations above their respective Class GA Values; and
7. The results of analysis of the soil vapor samples revealed a total of fourteen VOCs (1,2-dichloroethane, 1,3,5-trimethylbenzene, 1,3-butadiene, 4-ethyltoluene, acetone, benzene, carbon disulfide, chloroform, ethylbenzene, n-hexane, o-xylene, p/m-xylene, trichloroethylene [TCE], and tetrachloroethene [PCE]) were detected. The compounds detected in soil vapor samples include petroleum and chlorinated solvent related compounds. The State of New York currently does not have standards, criteria or guidance values for concentrations of volatile chemicals in sub-surface vapors.

Phase II Environmental Site Assessment, February 2010, prepared by Enviroscience Consultants, Inc. (ECI)

A Phase II Environmental Site Assessment, prepared by ECI in February 2010, documented the installation of monitoring wells and collection of soil, sediment and groundwater samples. Results showed that MTBE and isopropylbenzene were detected in one or more soil samples, and MTBE was detected in one groundwater sample collected (it was not determined if the contamination was from an on-site release or from an off-site source).

3.0 ENVIRONMENTAL SITE INVESTIGATION

3.1 SUPPLEMENTAL REMEDIAL INVESTIGATION ACTIVITIES

The Supplemental Remedial Investigation scope of work is focused on filling in data gaps and investigating those areas not previously investigated due to the former tenant's operations. This final phase of the iterative RI is designed to investigate potential impacts to soil and groundwater, if any, in the area of the recently abandoned UST system. The major components of the proposed RI tasks are described in detail below. Proposed soil boring and temporary groundwater monitoring well locations are illustrated in Figure 3.

Prior to invasive work, a geophysical survey and one-call utility mark-out will be completed in accordance with local laws to locate buried electric, natural gas, telecommunication utilities, etc. Additionally, the geophysical survey will be utilized to identify the extents of each UST in an effort to install Geoprobe borings/temporary wells as close to or between the abandoned tanks.

Groundwater Monitoring Well Installation and Sampling

One permanent groundwater monitoring well (MW-5) and one temporary groundwater monitoring point will be installed to supplement the existing monitoring well network. The proposed locations of MW-5 and the temporary groundwater monitoring well are shown on Figure 3. MW-5 will provide additional information regarding groundwater elevations and groundwater quality along the western perimeter of the property, and the temporary well is positioned to investigate the potential presence of contamination beneath the tanks. Sampling will be conducted in accordance with NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, dated May 2010.

The wells will be installed using truck or track-mounted Geoprobe mechanized equipment and be constructed of threaded one-inch diameter Schedule 40 PVC well casing and 0.1-inch slotted well screen. The wells will be screened from five feet above to five feet below the observed water table (approximately 20 to 30 feet bgs). The permanent well will be installed with a flush-mount protective casing.

The four previously-installed permanent wells and the new permanent well will be sampled in conjunction with the temporary monitoring well. Prior to sampling, all monitoring wells will be purged and sampled using USEPA Low Flow methodology. Sampling will be conducted using the following protocol:

1. All field conditions and observations will be recorded in the field logbook. Groundwater sampling will begin at the assumed least contaminated well (as determined from well location and/or previous data) and proceed to the presumed most contaminated well.
2. For permanent monitoring wells: Prior to purging, headspace will be screened with the PID and the static water level (relative to the top of the casing) will be measured utilizing a decontaminated water-level meter. A submersible pump and Teflon or Teflon-lined polyethylene tubing (or equivalent equipment) will be lowered to approximately two to three feet above the bottom of the well screen.
 - a. Each well will be pumped at a low-flow rate of 100 to 500 milliliters per minute, and the water level will be measured approximately every three to five minutes to ensure that stabilization (drawdown of 0.3' or less) is maintained.

- b. During purging, water quality parameters (turbidity, temperature, specific conductance, pH, redox potential, and dissolved oxygen) will be monitored and recorded approximately every five minutes until groundwater parameters stabilize for three consecutive readings. Parameters will be considered stabilized as follows: at least three consecutive pH readings do not vary by more than 0.1 Standard Unit; and specific conductance and temperature do not vary by more than 5% for three consecutive readings.
3. For the temporary monitoring well: Prior to sampling, the well volume will be calculated and the temporary well will be purged three well volumes. If non-aqueous phase liquid (NAPL) is encountered in the groundwater sample, that water sample will not be analyzed and a sample of the NAPL will be obtained for laboratory analysis (if sufficient volume is present).
4. **Note:** Groundwater Samples from permanent monitoring wells will be analyzed for PFAS, and therefore shall be collected in accordance with the NYSDEC March 1991 Sampling Guidelines and Protocols. Acceptable materials include stainless steel, high density polyethylene (HPDE) and polypropylene.
5. All groundwater samples will be collected in a manner consistent with NYSDEC sample collection protocols. Groundwater samples will be collected in properly labeled, laboratory provided glassware. Following sample collection, glassware will be labeled, sealed, and placed into a chilled cooler for transport to the laboratory for chemical analysis.
6. All samples will be accompanied by proper chain of custody documentation and sample information will be recorded in the field logbook. Groundwater samples will be submitted for laboratory analysis by an Environmental Laboratory Accreditation Program (ELAP) certified laboratory approved by the NYSDOH. Representative groundwater samples will be analyzed for petroleum compounds (CP-51 petroleum list +30 TICs), total and dissolved TAL metals, and “emerging contaminants”, including 1,4-dioxane and per- and polyfluoroalkyl substances (PFAS).
7. Decontamination water and purge water will be drummed and staged on the Site, pending receipt of the laboratory results. If free of visible contamination, disposable PPE and sampling equipment (gloves, string, etc.) will be placed in heavy-duty plastic bags and disposed of in on-site waste containers. Contaminated PPE and/or sampling equipment will be disposed of at an appropriate off-site facility.

Soil Borings and Sampling

Eleven soil borings will be advanced to the groundwater table surface (approximately 25 to 28 feet bgs) to investigate the perimeter and below the invert of the on-site tanks and associated piping. Proposed soil boring locations are shown on Figure 3 (field conditions may require adjustment to the sampling locations). The proposed soil sampling protocol is described below.

1. Soil borings will be advanced to the groundwater table surface. Soil samples will be collected in four or five-foot long, two-inch diameter macro-core samplers utilizing truck or track-mounted Geoprobe mechanized equipment (or hand-held boring equipment, as necessary).
2. Prior to sample collection, soils will be screened with a PID and inspected for visual and/or olfactory indications of contamination. Geologic descriptions of the soil and field screening results will be recorded in field logs.
3. **Up to three soil samples will be collected from each soil boring as follows:**
 - One sample of surface material (generally collected from immediately beneath pavement the 0.5 foot below grade)

- If impacted soils are identified, one sample will be collected from the most impacted zone as determined by field evidence (odors, staining and/or elevated photo-ionization detector (PID) readings), and one sample will be collected from immediately above the observed water table.
 - If no apparent impacted soils are identified, one sample will be collected from below the tank invert, approximately 10 to 13 feet bgs, and one sample will be collected from immediately above the observed water table.
 - Additionally, soil samples will be collected from zero to six inches below, and within two feet of, the UST pipe run. Location and depth of the pipe run will be determined prior to field work. Pipe run samples will be collected at a rate of one per every 20 linear feet of pipe run.
4. All samples will be collected in accordance with NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, dated May 2010. Soil samples will be analyzed for samples will be analyzed for petroleum compounds (CP-51 petroleum list +30 TICs), total TAL metals (plus cyanide and hexavalent chromium), 1,4 dioxane, PFAS, PCBs and pesticides. One soil boring at the center of the tank pad will be converted to a temporary monitoring well as discussed in the previous section. Soil samples will be containerized in laboratory prepared jars, labeled, sealed, and placed in a chilled cooler for shipment to the laboratory. Soil samples will be analyzed by an ELAP-certified laboratory approved by the NYSDOH.

Investigation Derived Waste

Cuttings may be disposed at the site within the borehole that generated them to within 24 inches of the surface unless:

- Free product or grossly contaminated soil, are present in the cuttings;
- The borehole has penetrated an aquitard, aquiclude or other confining layer; or extends significantly into bedrock;
- Backfilling the borehole with cuttings will create a significant path for vertical movement of contaminants. Soil additives (bentonite) may be added to the cuttings to reduce permeability; and/or
- The soil cannot fit into the borehole.

Any soil cuttings needing to be managed on-site will be containerized in clearly labeled DOT-approved 55-gallon drums for future off-site disposal. All boreholes which require drill cuttings disposal would ultimately be filled with bentonite chips and hydrated. Decontamination water and purge water will be drummed and staged on the Site, pending receipt of the laboratory results. If free of visible contamination, disposable PPE and sampling equipment (gloves, string, etc.) will be placed in heavy-duty plastic bags and disposed of in on-site waste containers. Contaminated PPE and/or sampling equipment will be disposed of at an appropriate off-site facility.

3.2 Sample Analysis

Groundwater samples will be submitted to an ELAP-certified laboratory for the following analyses:

- Volatile Organic Compounds by EPA Method 8260;

- 1,4-Dioxane by EPA Method 8270 SIM;
- Per- and Polyfluoroalkyl Substances (PFAS) by EPA Method 537 Modified;
- Semi-volatile organic compounds by EPA Method 8270; and
- Target Analyte List metals by EPA Method 6010 (both filtered and unfiltered).

If either LNAPL and/or DNAPL are detected, appropriate samples will be collected for characterization and “fingerprint analysis” and required regulatory reporting (i.e., spills hotline) will be performed.

Soil samples will be submitted to a NYSDOH ELAP-certified laboratory for the following analyses:

- Volatile Organic Compounds by EPA Method 8260;
- 1,4-Dioxane by EPA Method 8260;
- Per- and Polyfluoroalkyl Substances (PFAS) by EPA Method 537 Modified;
- Semi-volatile Organic Compounds by EPA Method 8270;
- Metals by EPA Method 6010;
- Polychlorinated Biphenyls by EPA Method 8082A; and
- Pesticides by EPA Method 8081B.

All data generated will be submitted in an electronic data deliverable (EDD) that complies with the DEC’s Electronic Data Warehouse Standards (EDWS).

3.3 Reporting

A comprehensive Remedial Investigation Report will be prepared and submitted following receipt of the laboratory results. The report will: document the results of the current and previous sampling events, present groundwater and soil gas sampling data; present the analytical results and include comparisons of the analytical data to the appropriate guidelines and regulations, as published by the USEPA, NYSDEC and the NYSDOH. The report will provide conclusions, and recommendations for further sampling or additional actions, if appropriate. The report will also discuss the Nature and Extent of off-site contaminants and include a Qualitative Exposure Assessment. The report will also include an evaluation of the quality of the analytical data and the reliability of the data for its intended use. The résumé of the independent data validator will be provided to DER for review and approval. Draft data tables will be provided to the NYSDEC and NYSDOH prior to submission of the Remedial Investigation Report.

4.0 QUALITY ASSURANCE/QUALITY CONTROL

4.1 Quality Assurance/Quality Control Procedures

The Quality Assurance Project Plan (QAPP) is provided in **Appendix B**. QA/QC procedures will be used to provide performance information with regard to accuracy, precision, sensitivity, representation, completeness, and comparability associated with the sampling and analysis for this investigation. Field QA/QC procedures will be used (1) to document that samples are representative of actual conditions at the Site and (2) identify possible cross-contamination from field activities or sample transit. Laboratory QA/QC procedures and analyses will be used to demonstrate whether analytical results have been biased either by interfering compounds in the sample matrix, or by laboratory techniques that may have introduced systematic or random errors to the analytical process. A project-specific Analytical Methods and Quality Assurance Summary Table is provided below.

Media/ QC Parameter	Number of Collection Points (Number of Samples)	Analyte (USEPA method)
Soil	33**	VOCs and SVOCs, CP-51 (8260/8270) TAL metals (6010/7473) Pesticides/PCBs (8081/8082) 1,4-dioxane (8260) PFAS (537 modified)
Groundwater	6	VOCs and SVOCs, CP-51 (8260/8270), TAL metals (6010/7473) 1,4-dioxane (8270 SIM) PFAS (537 modified)
Field Blank	One per 20 samples collected (non-dedicated equipment)	As per the analyte list(s) for the sample type
Duplicates and MS/MSD	One per 20 samples collected	As per the analyte list(s) for the sample type
** Additional soil samples will be collected from the pipe run with one sample collected per 20 linear feet of pipe run.		

5.0 HEALTH AND SAFETY PLAN (HASP)

5.1 Health and Safety Plan (HASP)

The investigation Health and Safety Plan (HASP) is included in **Appendix A**. The Site Safety Coordinator will be determined prior to sampling. Investigative work performed under this Work Plan will be in full compliance with applicable health and safety laws and regulations, including Site and OSHA worker safety requirements and HAZWOPER requirements. Confined space entry, if any, will comply with OSHA requirements and industry standards and will address potential risks. The parties performing the investigation work will ensure that performance of work is in compliance with the HASP and applicable laws and regulations.

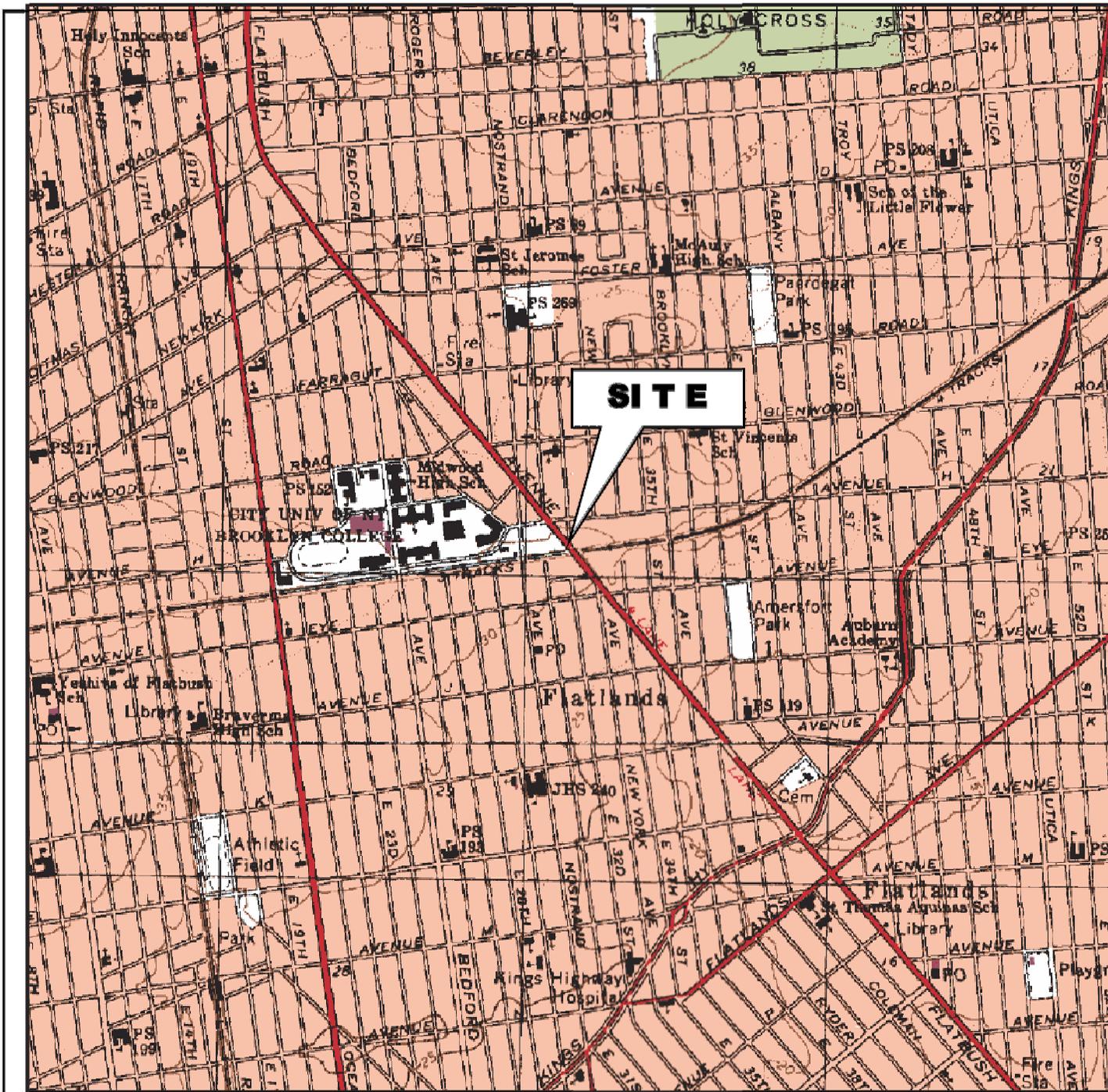
All field personnel involved in investigation activities will participate in training required under 29 CFR 1910.120, including 40-hour hazardous waste operator training and annual 8-hour refresher training. Site Safety Officer will be responsible for maintaining workers training records.

Personnel entering any exclusion zone will be trained in the provisions of the HASP and be required to sign a HASP acknowledgment. Site-specific training will be provided to field personnel. Additional safety training may be added, depending on the tasks performed. Emergency telephone numbers will be posted at the site location before any work begins. A safety meeting will be conducted before each shift begins. Topics to be discussed include task hazards and protective measures (physical, chemical, environmental), emergency procedures, PPE levels, and other relevant safety topics. Meetings will be documented in a log book or specific form. Potential on-site chemicals of concern include VOCs, SVOCs, Pesticides/PCBs, and Heavy Metals (specifically arsenic, lead, and mercury at a minimum). Information fact sheets for each contaminant group and/or MSDS' are included in the HASP.

An emergency contact sheet with names and phone numbers for all pertinent project personnel as well as regulatory hotline information is included in the HASP. That document will define the specific project contacts for use in case of emergency.

In addition, a Community Air Monitoring Program (CAMP) will be implemented during invasive work conducted at the site. The generic CAMP protocol is included with the HASP presented in Appendix A.

FIGURES



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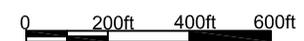
Project Location:
 1640 Flatbush Avenue
 Brooklyn, New York 11210
 Block 7577, Lot 60

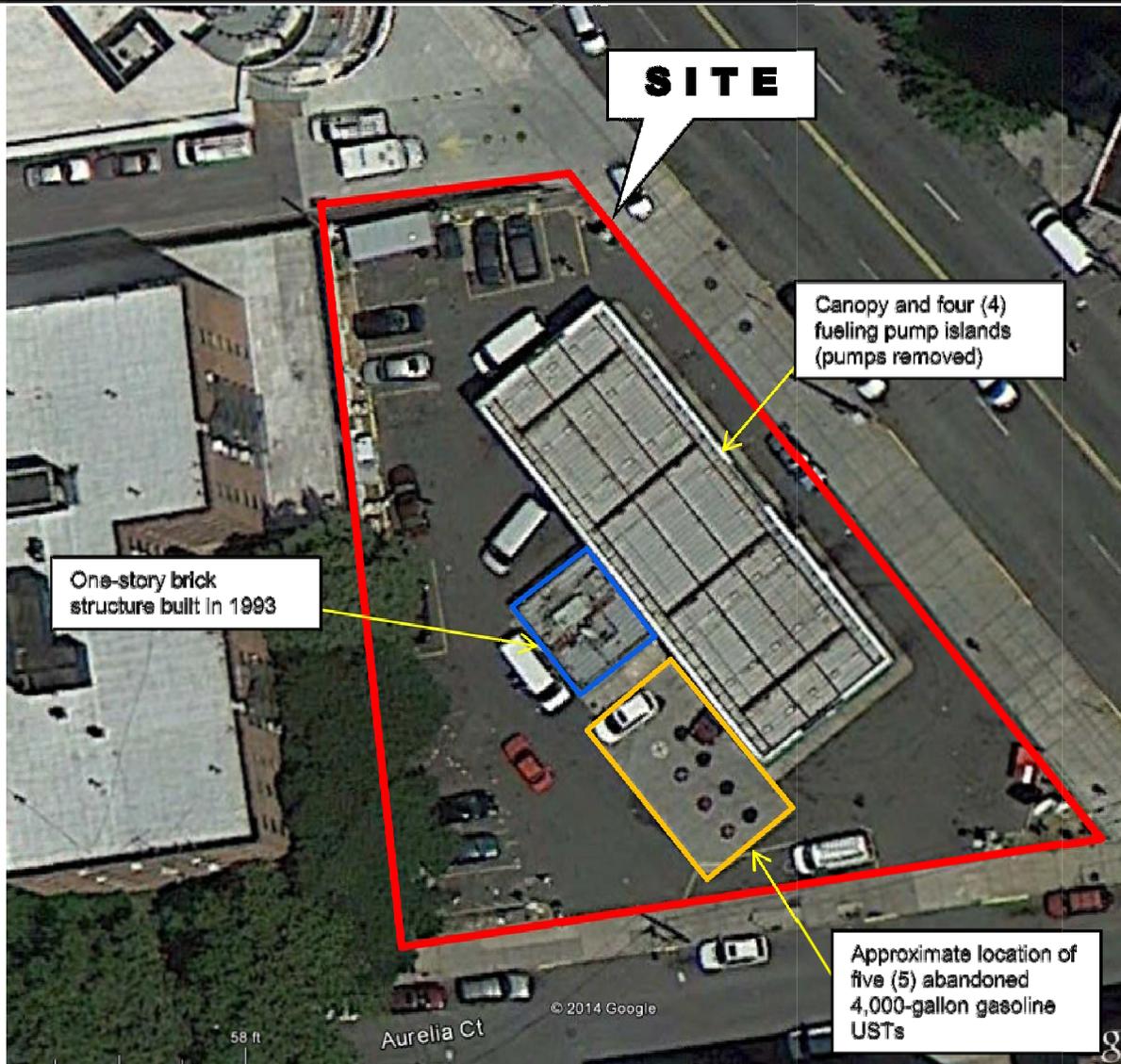
Project No.:
 16-9335

Title:
Site Location Map

FIGURE 1

Source: USGS Quadrangle, 7.5 Minute Series, Brooklyn, N.Y. 2015





SITE

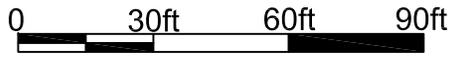
Canopy and four (4)
fueling pump islands
(pumps removed)

One-story brick
structure built in 1993

Approximate location of
five (5) abandoned
4,000-gallon gasoline
USTs

LEGEND

 - Site Boundary



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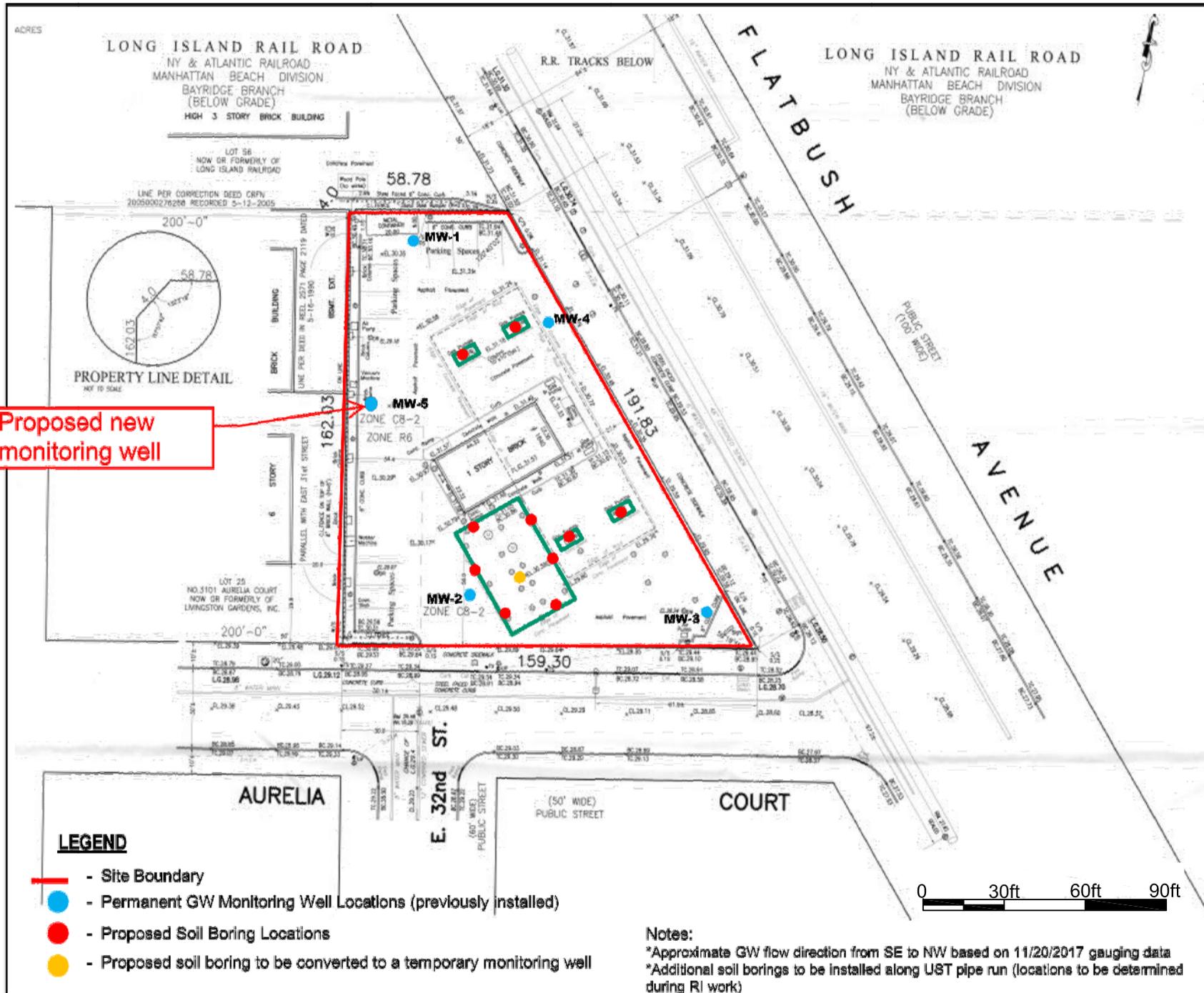
Project Location:
1640 Flatbush Avenue
Brooklyn, New York 11210
Block 7577, Lot 60

Project No.:
16-9335

Title:
Site Features

FIGURE 2

Source: Google Maps



1350 Broadway, Suite 1904
 New York, NY

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Client:
 SL Green Realty
 420 Lexington Ave,
 18th Floor
 New York, NY

Project Location:
 1640 Flatbush Ave
 Brooklyn, NY
 Block 7577, Lot 60

Project No.:
 16-9335

Title:
 Proposed and Existing
 Sample
 Locations

FIGURE 3

Source: Land Title
 Survey, 10/21/2010

Appendix A

Health and Safety Plan



A GALLAGHER BASSETT COMPANY

**Site Specific Health and Safety Plan for
Remedial Site Investigation**

Site:

1640 Flatbush Avenue
Brooklyn, New York
Block 7577, Lot 60

Prepared for:

SL Green Realty Corporation
420 Lexington Avenue, 18th Floor
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JANUARY 2019

DISCLAIMER

STRICT ADHERENCE TO THE HEALTH AND SAFETY GUIDELINES SET FORTH HEREIN WILL REDUCE, BUT NOT ELIMINATE, THE POTENTIAL FOR INJURY AT THESE SITES. THE HEALTH AND SAFETY GUIDELINES IN THIS HEALTH AND SAFETY PLAN WERE PREPARED SPECIFICALLY FOR THIS PROJECT AND SHOULD NOT BE USED ON ANY OTHER SITE OR PROJECT WITHOUT PRIOR RESEARCH AND EVALUATION BY TRAINED HEALTH AND SAFETY SPECIALISTS.

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Figure 1 — Site Plan

Appendices

Attachment A — Health and Safety Plan Acceptance

Attachment B — Daily Safety Meeting Form

Attachment C — Fact Sheets for Potential Contaminants of Concern

1.0 SITE-SPECIFIC TRAINING

WCD Group (WCD), a Division of Gallagher Bassett Services, Inc., provides training to all its employees whose work entails potential exposure to toxic chemicals or hazardous environments. The training is taught by experienced professionals and promotes safe work conditions through both classroom and field instruction.

WCD provides the following training to its employees:

1. 40-Hour Hazardous Materials Training

Supervisors receive additional training that is geared toward responsibilities and skills in project management.

2. 8-Hour Hazardous Materials Annual Refresher Training

3. Training required under specific OSHA Standards

In addition, all WCD subcontractors shall have the training required under 29 CFR 1910.120, including 40-hour hazardous waste operator training and annual 8-hour refresher training. The WCD Site Safety Officer will be responsible for maintaining workers training records. Each worker will also receive a Site Specific Orientation and will be required to sign the HASP acknowledgement form included in Attachment A.

2.0 SITE-SPECIFIC SAFETY PLAN

2.1 Introduction

This Supplemental Remedial Investigation Health and Safety Plan (SRIHASP) is for 1640 Flatbush Avenue in Brooklyn, New York (hereafter referred to as the "Site"). A Site Plan is shown in the attached Figure 1. Activities to be performed on-site consist of temporary groundwater well installation and sampling, and soil boring installation and sampling. The site-specific safety plan was developed from interim Site investigations and review of prior reports. Revisions and/or alterations to this HASP may become necessary as more information becomes available. All on-site personnel are required to read, review and strictly comply with the HASP. It is the responsibility of the Site Safety Coordinator or designee to ensure that the HASP is implemented and enforced. Each worker will also receive a Site Specific Orientation and will be required to sign the HASP acknowledgement form included in Attachment A. In addition, a daily safety meeting will be held by the Site Safety coordinator before each shift begins. The daily safety meeting will discuss task hazards and protective measures (physical, chemical, environmental); emergency procedures; PPE levels and other relevant safety topics. The daily safety meetings will be documented with the daily safety meeting form included in Attachment B.

2.2 Purpose

The Health and Safety Plan will be submitted to the NYS Department of Environmental Conservation (NYSDEC) for review and approval prior to implementation of the Supplemental Remedial Investigation Work Plan.

2.3 Site Description and Previous Site Assessments

The Site is located in Brooklyn, New York and is identified as Block 7577 and Lot 60 on the New York City Tax Map. Figure 1 is a Site location map. The Site is 17,985-square feet and is bounded by a commercial shopping center to the north, Aurelia Court to the south, Flatbush Avenue to the east, and a mid-rise housing complex to the west. Currently, the Site is vacant. The Site was previously utilized as a gasoline filling station including a one-story convenience store. The building occupies a footprint of approximately 1,000-square feet in the center of the lot. Surrounding the building are four (4) pump islands and associated foundation elements covered by a canopy. The gasoline tanks were abandoned in place and the pump bodies were removed by the former tenant in following cessation of fueling operations in late 2017.

PREVIOUS ENVIRONMENTAL DOCUMENTATION

A summary of previous environmental work plans and reports that have been prepared for the Site are presented below.

Remedial Investigation Report, revised March 26, 2018, prepared by WCD Group. WCD conducted an interim remedial investigation at 1640 Flatbush Avenue, Brooklyn, NY. The findings of that report include the following:

1. Depth to groundwater ranges from 25.25 to 28.50 feet below top of flush-mount well casings at the Site.
2. Groundwater flow is generally from southwest to northeast beneath the Site.
3. Bedrock was not encountered during the Site investigation. Based on a review of available information the depth to bedrock on the Site is approximately 500 feet bgs.
4. The stratigraphy of the site, from the surface down, generally consists of variable texture sands with gravel, and some clay (the upper 5 to 7 feet are considered to be fill material). Finer, more uniform sands and some gravel were encountered beneath this interval. Refusal was not encountered during this Site investigation.
5. Eight soil samples were collected from four soil borings advanced to a maximum depth of 30-feet bgs on November 2 and November 3, 2017. Soil sample results were compared to NYSDEC 6NYCRR Part 375 Section 6 – Remedial Program Soil Cleanup Objectives (SCOs) and Soil Cleanup Levels (SCLs) for Fuel Oil Contaminated Soil found in Table 3 of Commissioner Policy 51 (CP-51), “Soil Cleanup Guidance”, dated October 21, 2010. No VOCs, PCBs or Pesticides were detected above Unrestricted Use SCOs or CP-51 SCLs in any soil samples collected. One SVOC, ideno(1,2,3-cd)pyrene, was detected above the corresponding Unrestricted Use SCO and NY-CP51 SCL in SB-1 at a sampling depth between 3 and 4 feet bgs. Several metals, including cadmium, lead, nickel and zinc, were detected above corresponding Unrestricted Use SCOs in seven of the soil samples collected. Findings are considered consistent with the presence of urban fill materials.
6. Four groundwater samples were collected from four newly installed permanent groundwater monitoring wells on November 20, 2017. Groundwater sample results were compared to NYSDEC 6NYCRR Part 703 – Ambient Water Quality Guidance Values (AWQS). Results of the analysis of groundwater samples indicate that no SVOCs were detected in any of the samples collected. Two VOCs (PCE and chloroform) were detected in exceedance of AWQS in one or more samples collected. Several metals, including iron, magnesium, manganese and sodium, were detected in one or more samples above corresponding AWQS. Metals were submitted to

the laboratory for additional laboratory filtration. Dissolved metals, including magnesium and sodium, were detected in one or more samples above corresponding AWQS. The presence of naturally occurring metals is consistent with results of prior environmental investigations.

7. Ten soil vapor samples were collected on November 2, 2017 from shallow and deep (vadose zone) temporary soil vapor points installed at the Site. Soil vapor sample results were reviewed as a whole and in conjunction with results of other environmental sampling. Soil vapor analyses indicated that low and relatively high concentrations of select chlorinated solvents (including PCE, TCE), petroleum-related compounds (including 2-butanone, 2-hexanone, acetone), and BTEX compounds were detected in shallow soil vapor samples collected between 5 and 8 feet bgs, and deeper soil vapor samples collected from the vadose zone (approximately 25 feet bgs) at the Site.

Phase II Environmental Site Investigation Report, February 2015, prepared by WCD Group. WCD conducted a Phase II Site Investigation at 1640 Flatbush, Brooklyn, NY. The findings of that report include the following:

1. Elevation of the property above mean sea level is approximately 30 feet.
2. Groundwater was encountered at approximately 27 to 29 feet bgs.
3. Bedrock was not encountered during the Site Investigation.
4. In general, soil at the Site consists of fill material of red/brown/gray sand, silt, gravel, red brick, concrete, and ash encountered to a maximum depth of 25 feet bgs underlain by a native soils consisting of fine to coarse sand to 35 feet bgs, the maximum boring depth at the Site.

The results of the analyses of soil samples revealed VOCs, SVOCs and metals at concentrations exceeding Unrestricted Use SCOs and/or SCLs. Thirteen (13) VOCs [1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, ethylbenzene, isopropylbenzene, n-butylbenzene, n-propylbenzene, naphthalene, o-xylene, p-isopropyltoluene, p/m-xylene, sec-butylbenzene, tetrachloroethene (PCE), and xylene].

3.0 SCOPE OF WORK

The Supplemental Remedial Investigation scope of work is focused on filling in data gaps and investigating areas not previously covered to determine the extent of on-site contamination, if any, beyond the limits of previous investigations. The details of the investigation can be found in the Supplemental Remedial Investigation Work Plan, but essentially consist of the installation of one temporary groundwater well, sampling of the temporary well and each existing monitoring well onsite, and the collection of eleven (11) soil samples to investigate around the perimeter and below the invert of the tanks and associated piping.

4.0 CONTAMINANTS OF CONCERN

Based on our understanding of the history of the Site, the following chemical hazards may be present: VOCs, SVOCs and metals.

5.0 EMERGENCY AND WCD CONTACT NUMBERS

5.1 Emergency Contact Information

Hospital: Mount Sinai Beth Israel Brooklyn Hospital

Hospital Main No.: 718.252.3000
Hospital Address: 3201 Kings Highway, Brooklyn, NY 11234
Ambulance: 911
Fire Department: 911
Police Department: 911

HOSPITAL DIRECTIONS

FOR ANY TYPE OF SERIOUS MEDICAL EMERGENCY, CALL 911 AND REQUEST AN AMBULANCE. NEW YORK CITY STREETS ARE OFTEN CONGESTED DUE TO HEAVY TRAFFIC, CONSTRUCTION AND DOUBLE-PARKED VEHICLES AND IT MAY BE DIFFICULT TO DRIVE TO THE EMERGENCY ROOM.

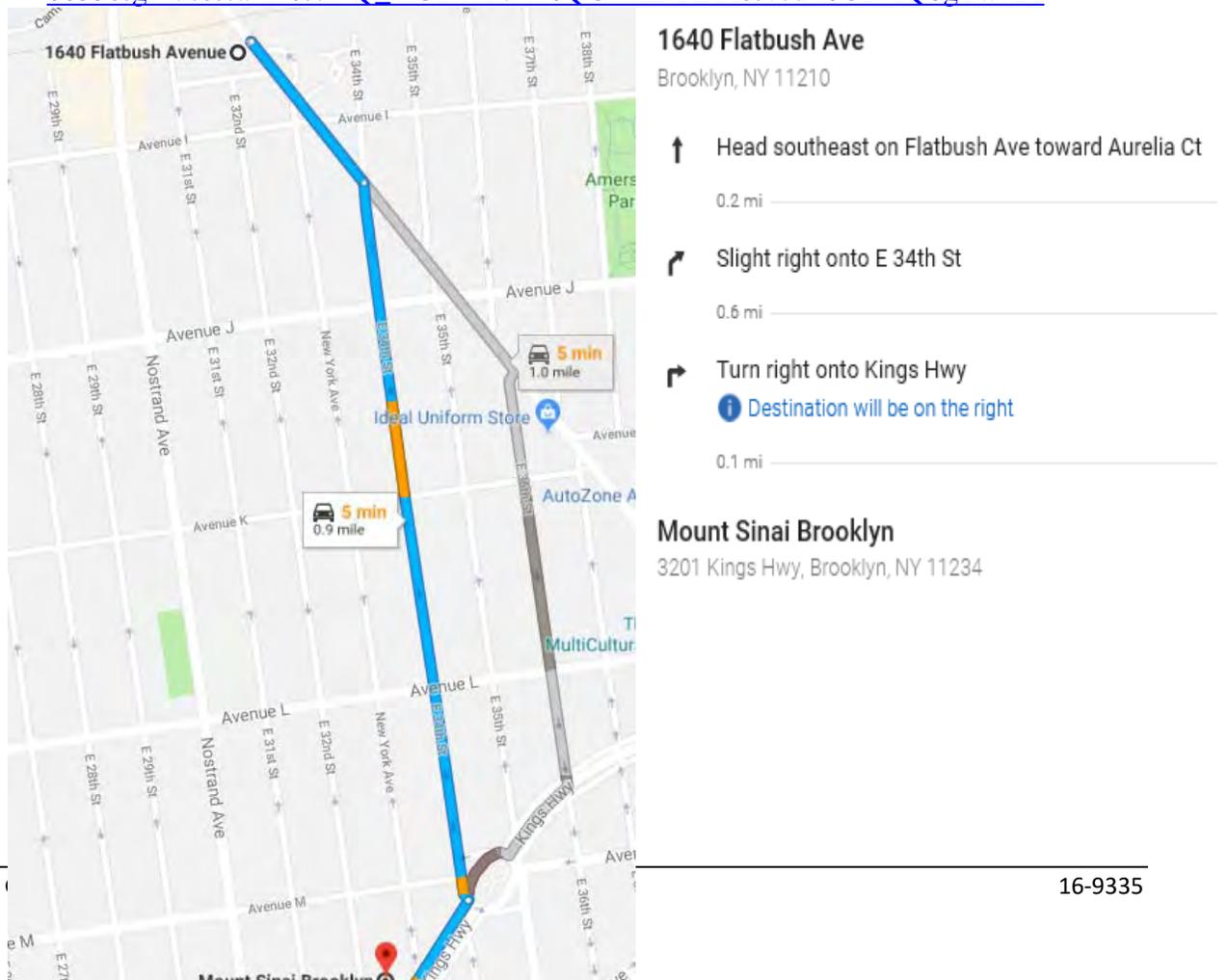
Route to Hospital

Mount Sinai Beth Israel Brooklyn Hospital
3201 Kings

Hwy. http://maps.google.com/maps?hl=en&q=2306+Third+avenue,+ny,+ny&um=1&ie=UTF-8&hq=&hnear=0x89c2f5e1df249525:0x709f99b898735fc4,2306+3rd+Ave,+New+York,+NY+10035&gl=us&sa=X&ei=Q_1iUZTIEu-K0QGArIDYDA&ved=0CDAQ8gEwAA, Brooklyn, NY 11234

Phone 718.252.3000

http://maps.google.com/maps?hl=en&q=2306+Third+avenue,+ny,+ny&um=1&ie=UTF-8&hq=&hnear=0x89c2f5e1df249525:0x709f99b898735fc4,2306+3rd+Ave,+New+York,+NY+10035&gl=us&sa=X&ei=Q_1iUZTIEu-K0QGArIDYDA&ved=0CDAQ8gEwAA



5.2 WCD Contacts

1. Site Safety Officer

Name: TBD
Office/Division: TBD
Office Telephone: TBD
Mobile Phone: TBD

2. Certified Industrial Hygienist

Name: Josh Cupriks, CIH
Office/Division: New York City
Office Telephone: 212.631.9000

5.3 Level of Protection

The Project Manager will continually evaluate levels of protection to be utilized by on-site personnel, with assistance from the Health & Safety Coordinator and the Industrial Hygienist. The levels of protection may be downgraded or upgraded, as necessary, with approval by the PM.

5.4 Personal Protective Equipment (PPE)

It is anticipated that only Level D PPE will be required. Level D protection is applicable when no respiratory protection and minimal skin protection is required. Level D can be used in the following circumstances:

- The atmosphere contains no known hazard
- Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

The Level D recommended equipment for this site includes:

- Work clothes (no shorts or cutoffs)
- Safety boots/shoes
- Safety glasses or chemical splash goggles: Eye protection will be worn when personnel are exposed to flying debris, liquids, chemical vapors or particulates.
- Hard hats: Appropriately rated hard hats will be worn by personnel for protection against overhead hazards, when present.
- Hearing protection: To be worn by all personnel exposed to at least 85 dB of sound during the workday.
- Work gloves or chemically protective gloves when potentially exposed to contaminants (i.e., during soil and groundwater sampling).

If excessive ionizable organic vapors containing volatile organic compounds (VOCs) are detected at or above the action levels (See Section 6.1), workers will cease work in the area until organic vapor levels decrease for Level D PPE.

6.0 ON-SITE OPERATION

Chemical hazards are expected to be low. These chemical hazards potentially can include VOCs and SVOCs related to fuel oil and potentially metals related to urban fill.

First Aid Procedures for Chemical Exposures

EYE: If any chemicals come in contact with eyes, immediately wash the eyes with large amounts of water, occasionally lifting lower and upper lids. Get medical attention immediately.

BREATH: If person breathes large amounts of any chemicals, remove person to fresh air. If breathing has stopped, perform artificial respiration. Keep affected person warm and rested. Get medical attention as soon as possible.

SKIN: If any chemicals except those listed below come in contact with the skin, immediately wash skin with soap and water. Get medical attention promptly. If chemical penetrates clothing, immediately remove clothing and wash with soap and water.

Soap should not be used if the following chemicals (sample preservatives) potentially encountered at the site contact skin or clothing, **water wash only:**

- Hydrochloric acid
- Nitric acid
- Sodium hydroxide
- Sulfuric acid

Special attention must be paid to not using soap with these chemicals in particular.

SWALLOW: If any chemicals are swallowed get medical attention immediately.

6.1 Air Monitoring Requirements

An organic vapor photoionization detector (PID) will be used to evaluate airborne levels of VOCs during the completion of soil borings and the collection of soil and groundwater samples. If ionizable total organic vapors are detected at 5.0 ppm or higher above ambient background levels in the breathing zone, the work will cease until the levels drop or work practices are modified to reduce the levels. If the vapor levels continue to be elevated, other air monitoring devices may be utilized to measure airborne concentrations of specific suspected contaminants of concern (see below) and to assess the need to upgrade the respiratory PPE.

OSHA Permissible Exposure Limit (PEL)

The OSHA PEL, for benzene, which will be used to determine the appropriate respiratory protection, is 1 part per million (ppm) over an 8-hour time-weighted average or 5 ppm over 15 minutes. This value is based upon the OSHA PEL for benzene, which, of the VOC constituents of petroleum compounds, has the lowest PEL.

Respiratory Protection

It is unlikely that respiratory protection will be required during implementation of the work plan. If air monitoring (e.g., Drager tube) measurements indicate that levels of benzene have reached 0.5 ppm, workers will cease work in the area until levels of benzene have decreased. If necessary, modifications to work practices will be implemented to reduce or avoid generating elevated levels of organic vapors.

6.2 Biological Hazards

No biological hazards are anticipated for any of the tasks.

6.3 Physical Hazards

The physical hazards are anticipated to be low and are outlined in Table A-1 below.

**TABLE A-1
PHYSICAL HAZARDS**

HAZARD TYPE	KNOWN	POTENTIAL
Heat Stress/Cold Stress		X
Severe Weather (lightning, snow, sleet)		X
Excessive Noise		X
Facility Operations (machinery, structures)		X
Unstable ground (wet areas)		X
Site Operations (drilling, excavation, hand and power tool use)	X	
Heavy lifting/moving	X	
Hazardous materials use & storage		X
Fire		X
Slips, trips, and falls		X
Cuts, punctures		X

WCD personnel can avoid most of the hazards listed above including hand tools, hazardous materials use, slips, trips and falls, and punctures and cuts by remaining alert and performing safe work practices during all site activities. Other proper work practices are outlined below.

1. To avoid falling objects:
 - a. Do not walk or stand under suspended/overhead loads (including scaffolding).
 - b. Be aware of falling objects in the work area.
 - c. Secure overhead objects.
2. When using hand tools:
 - a. Hand tools will meet the manufacturer's safety standards.
 - b. Hand tools will not be altered in any way.
 - c. Makeshift tools will not be used.
 - d. At a minimum, eye protection will be used when working with hand tools.
 - e. Wrenches, including adjustable, pipe, end and socket wrenches, will not be used when jaws are sprung to the point that slippage occurs.

- f. Impact tools such as drift pins, wedges and chisels, will be kept free of mushroom heads.
 - g. Wooden handles will be free of splinters or cracks and secured tightly to the tool.
3. Overhead Wires:
If contact is possible (i.e., ladder, equipment, crane lift, etc.) one or more of the following will be done:
- Power sources will be disconnected by the utility;
 - Power sources will be shielded by the utility; and
 - Object will get no closer than 12' to prevent arcing.
4. Slips, Trips and Falls:
- a. Proper lighting will be maintained at all times.
 - b. Walkways will remain clear and unobstructed at all times.
 - c. When possible, cords, hose lines, etc., will be raised to reduce or eliminate trip hazards.

Noise

Approved hearing protection will be required in work areas involving heavy equipment, impact tools, drilling, etc. In general, hearing protection should be worn if an individual cannot be heard in a normal speaking voice at a distance of two feet.

6.4 Electrical Utility Hazards

WCD will implement the following subsurface utility clearance procedure:

- The drilling contractor will notify the NYC One Call Center at (800) 272-4480, in accordance with Code 753, a minimum of 5 working days prior to any drilling on streets and sidewalks, as needed.

6.5 Mechanical Hazards

The mechanical hazards are anticipated to be low.

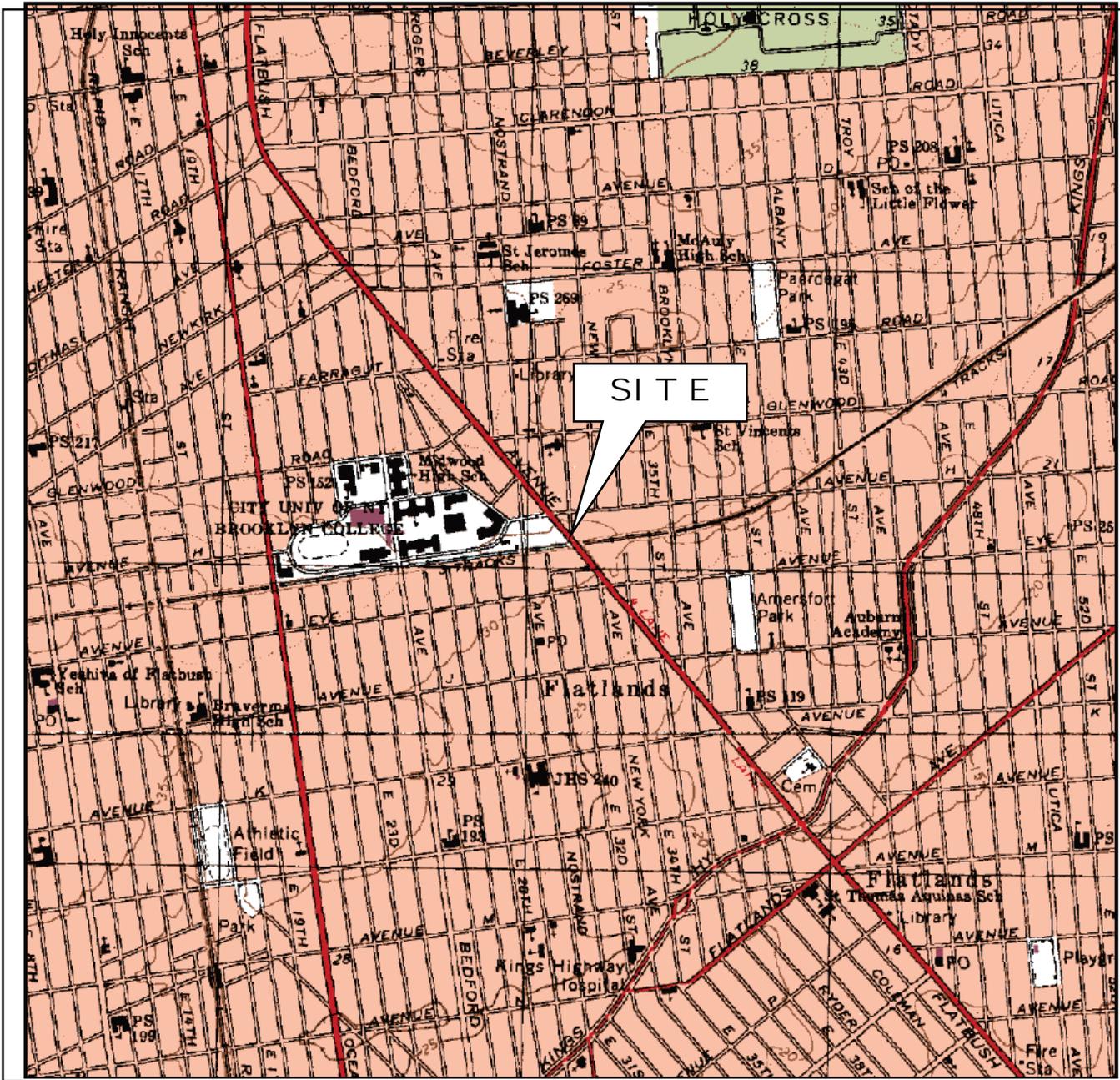
6.6 Communication

WCD team-sampling members shall be equipped with cellular telephones. If an emergency occurs, and the team members are not in close proximity to each other, communication will occur via telephone.

7.0 SITE MAPS

A Site Plan depicting the proposed soil borings locations is shown in the attached Figure 1.

Figure



WCD Group
 1350 Broadway, Suite 1904
 New York, NY 10018
 Phone: 212.631.9000
 Fax: 212.631.8066
 www.wcdgroup.com

Client:
 SL Green Realty Corporation
 420 Lexington Avenue, 18th Floor
 New York, New York 10170

Project Location:
 1640 Flatbush Avenue
 Brooklyn, New York 11210
 Block 7577, Lot 60

Project No.:
 15-7657

Title:
**SITE LOCATION
 MAP**

FIGURE 1

Source: USGS Quadrangle, 7.5 Minute Series, Brooklyn, N.Y. 2015

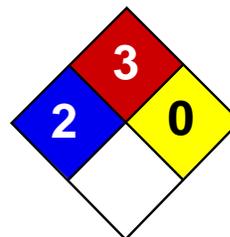
Attachment A

Health and Safety Plan Acceptance

Attachment B
Daily Safety Meeting Form

Attachment C

Fact Sheets for Potential Contaminants of Concern



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: C6-H6

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

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

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

Section 3: Hazards Identification

Potential Acute Health Effects:

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

Potential Chronic Health Effects:

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

Section 4: First Aid Measures

Eye Contact:

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

Skin Contact:

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

Serious Skin Contact:

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

Inhalation:

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

Serious Inhalation:

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

Ingestion:

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

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

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

Flammable Limits: LOWER: 1.2% UPPER: 7.8%

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

Fire Hazards in Presence of Various Substances:

Highly flammable in presence of open flames and sparks, of heat. Slightly flammable to flammable in presence of oxidizing materials. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:

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

Fire Fighting Media and Instructions:

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

Special Remarks on Fire Hazards:

Extremely flammable liquid and vapor. Vapor may cause flash fire. Reacts on contact with iodine heptafluoride gas. Dioxygenyl tetrafluoroborate is as very 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, 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.

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: 05/21/2013 12:00 PM

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2 Letter ISO country code/language code: UK/EN

BTEX Standard

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier: BTEX Standard

Stock Number: 30051

Other means of identification:

Synonyms: None Known

REACH Registration No.: None Known

Molecular formula: CH₃OH

1.2 Relevant identified uses of the substance or mixture and uses advised against:

Relevant identified uses: For Laboratory use only

Uses advised against: Uses other than recommended use.

1.3 Details of the Supplier of the Safety Data Sheet:

Manufacturer

Supplier

Restek Corporation
110 Benner Circle
Bellefonte, Pa. 16823
USA

Thames Restek UK LTD
Units 8-16, Ministry Wharf
Wycombe Road, Saunderton
Buckinghamshire
United Kingdom HP14 4HW
01494 563377

1.4 Emergency telephone number:

00 1 800-424-9300
(CHEMTREC within the US)

0870-8200418
(CHEMTREC within the UK)

Poison Centre contact information:

00 1 703-741-5970
(Outside USA)

+1 703-741-5970
(CHEMTREC International)

National Poisons Information Service (NPIS)
Email: director.birmingham.unit@npis.org
Website: <http://www.npis.org/>

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture:

Classification according to Regulation (EC) No 1272/2008 [CLP]: Specific Target Organ Systemic Toxicity (STOT) - Single Exposure Category 1
Flammable Liquid Category 2

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BTEX Standard

Acute Toxicity - Dermal Category 3

Acute Toxicity - Oral Category 3

2.2 Label elements:

Labelling according to Regulation (EC) No 1272/2008 [CLP]:

Hazard pictograms:



Signal Word:

Danger

Hazard Statements:

H225 - Highly flammable liquid and vapour

H301+H311 - Toxic if swallowed or in contact with skin

H370 - Causes damage to organs

Precautionary Statements:

P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

P233 - Keep container tightly closed.

P260 - Do not breathe dust/fume/gas/mist/vapours/spray.

P280 - Wear protective gloves/protective clothing/eye protection/face protection.

P301+P310 - IF SWALLOWED: Immediately call a POISON CENTER/doctor.

P303+P361+P353 - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.

Supplemental Hazard information (EU):

None Known

2.3 Other hazards:

This substance does not meet the PBT or vPvB criteria of REACH, Annex XIII

SECTION 3: Composition/information on ingredients

3.1 Substances:

Not applicable

3.2 Mixtures:

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Chemical Name	%	CAS #	EC No. REACH Registration No.	Classification (EC) No 1272/2008	M Factor	SCL	Acute Toxicity Estimates
methanol	99.88	67-56-1	200-659-6 None Known	Acute Tox. 3 (Dermal); H311 Acute Tox. 3 (Inh Dust/Mist); H331 Acute Tox. 3 (Oral); H301 Flam. Liq. 2; H225 STOT SE 1; H370	No data available	STOT SE 2: 3%<10% STOT SE 1: 10%	Not determined
p-xylene	0.02	106-42-3	203-396-5 None Known	Acute Tox. 4 (Dermal); H312 Acute Tox. 4 (Inh Dust/Mist); H332 Flam. Liq. 3; H226 Skin Irrit. 2; H315	No data available	No data available	Not determined
m-xylene	0.02	108-38-3	203-576-3 None Known	Acute Tox. 4 (Dermal); H312 Acute Tox. 4 (Inh Dust/Mist); H332 Flam. Liq. 3; H226 Skin Irrit. 2; H315	No data available	No data available	Not determined
Toluene	0.02	108-88-3	203-625-9 None Known	Asp. Tox. 1; H304 Flam. Liq. 2; H225 Repr. 2; H361d Skin Irrit. 2; H315 STOT RE 2; H373 STOT SE 3; H336	No data available	No data available	Not determined
o-xylene	0.02	95-47-6	202-422-2 None Known	Acute Tox. 4 (Dermal); H312 Acute Tox. 4 (Inh Dust/Mist); H332 Flam. Liq. 3; H226 Skin Irrit. 2; H315	No data available	No data available	Not determined
Benzene	0.02	71-43-2	200-753-7 None Known	Asp. Tox. 1; H304 Carc. 1A; H350 Eye Irrit. 2; H319 Flam. Liq. 2; H225 Muta. 1B; H340 Skin Irrit. 2; H315	No data available	No data available	Not determined

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				STOT RE 1; H372			
Ethylbenzene	0.02	100-41-4	202-849-4 None Known	Asp. Tox. 1; H304 Acute Tox. 4 (Inh Dust/Mist); H332 Flam. Liq. 2; H225 STOT RE 2; H373	No data available	No data available	Not determined

For full text of H-statements see Section 16.

SECTION 4: First aid measures

4.1 Description of first aid measures:

Inhalation:

Remove to fresh air. If breathing is difficult, have a trained individual administer oxygen. If not breathing, give artificial respiration and have a trained individual administer oxygen. Get medical attention immediately

Eye contact:

Flush eyes with plenty of water for at least 20 minutes retracting eyelids often. Tilt the head to prevent chemical from transferring to the uncontaminated eye. Get immediate medical attention.

Skin Contact:

Wash with soap and water. Remove contaminated clothing and launder. Get medical attention if irritation develops or persists.

Ingestion:

Do not induce vomiting and seek medical attention immediately. Drink two glasses of water or milk to dilute. Provide medical care provider with this SDS.

Self protection of the first aider:

No data available

4.2 Most important symptoms and effects, both acute and delayed:

Coma and death

4.3 Indication of any immediate medical attention and special treatment needed:

IF exposed or concerned: Call a POISON CENTER/doctor. Call a POISON CENTER/doctor if you feel unwell.

SECTION 5: Firefighting measures

5.1 Extinguishing media:

Suitable extinguishing media:

Use alcohol resistant foam, carbon dioxide, or dry chemical extinguishing agents. Water may be ineffective but water spray can be used to extinguish a fire if swept across the base of the flames. Water can absorb heat and keep exposed material from being damaged by fire.

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Unsuitable extinguishing media:	None Known
5.2 Special hazards arising from the substance or mixture:	Vapors may be ignited by sparks, flames or other sources of ignition if material is above the flash point giving rise to a fire (Class B). Vapors are heavier than air and may travel to a source of ignition and flash back.
Hazardous Combustion Products:	Carbon dioxide, Carbon monoxide
5.3 Advice for firefighters:	Do not enter fire area without proper protection including self-contained breathing apparatus and full protective equipment. Fight fire from a safe distance and a protected location due to the potential of hazardous vapors and decomposition products. Flammable component(s) of this material may be lighter than water and burn while floating on the surface.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures:

Non-emergency personnel:

Non-emergency personnel should be kept clear of the area

Emergency responders:

Exposure to the spilled material may be severely irritating or toxic. Follow personal protective equipment recommendations found in Section 8 of this SDS. Personal protective equipment needs must be evaluated based on information provided on this sheet and the special circumstances created by the spill including; the material spilled, the quantity of the spill, the area in which the spill occurred, and the expertise of employees in the area responding to the spill. Never exceed any occupational exposure limits.

6.2 Environmental precautions:

No data available

6.3 Methods and material for containment and cleaning up:

Small spills:

Refer to information provided for large spills

Large spills:

Prevent the spread of any spill to minimize harm to human health and the environment if safe to do so. Wear complete and proper personal protective equipment following the recommendation of Section 8 at a minimum. Dike with suitable absorbent material like granulated clay. Gather and store in a sealed container pending a waste disposal evaluation.

6.4 Reference to other sections:

Refer to section 13 for disposal information

SECTION 7: Handling and storage

7.1 Precautions for safe handling:

Toxic or severely irritating material. Avoid contacting and avoid breathing the material. Use only in a well ventilated area. Use spark-proof tools and explosion-proof equipment

7.2 Conditions for safe storage, including

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any incompatibilities:

Conditions for safe storage:

Store in a cool dry ventilated location. Isolate from incompatible materials and conditions. Keep container(s) closed. Keep away from sources of ignition

Materials to Avoid/Chemical Incompatibility:

Strong oxidizing agents

7.3 Specific end use(s):

For Laboratory use only

SECTION 8: Exposure controls/personal protection

8.1 Control parameters:

Occupational Exposure limit values:

Chemical Name	United Kingdom - Workplace Exposure Limits (WELs) - TWAs	United Kingdom - Workplace Exposure Limits (WELs) - STELs	United Kingdom - Biological Monitoring Guidance Values
methanol	200 ppm TWA; 266 mg/m ³ TWA	250 ppm STEL; 333 mg/m ³ STEL	No data available
p-xylene	50 ppm TWA; 220 mg/m ³ TWA	100 ppm STEL; 441 mg/m ³ STEL	650 mmol/mol creatinine Medium: urine Time: post shift Parameter: Methyl hippuric acid
m-xylene	50 ppm TWA; 220 mg/m ³ TWA	100 ppm STEL; 441 mg/m ³ STEL	650 mmol/mol creatinine Medium: urine Time: post shift Parameter: Methyl hippuric acid
Toluene	50 ppm TWA; 191 mg/m ³ TWA	100 ppm STEL; 384 mg/m ³ STEL	No data available
o-xylene	50 ppm TWA; 220 mg/m ³ TWA	100 ppm STEL; 441 mg/m ³ STEL	650 mmol/mol creatinine Medium: urine Time: post shift Parameter: Methyl hippuric acid
Benzene	1 ppm TWA; 3.25 mg/m ³ TWA	3 ppm STEL (calculated); 9.75 mg/m ³ STEL (calculated)	No data available

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Ethylbenzene	100 ppm TWA; 441 mg/m ³ TWA	125 ppm STEL; 552 mg/m ³ STEL	No data available
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DNEL: None Known

PNEC: None Known

8.2 Exposure controls:

Appropriate engineering controls: Local exhaust ventilation is recommended when generating excessive levels of vapours from handling or thermal processing.

Individual protection measures, such as personal protective equipment:

Eye and face protection: Wear chemically resistant safety glasses with side shields when handling this product. Do not wear contact lenses.

Skin Protection:

Hand protection: No information available

Other skin protection: Wear protective gloves. Inspect gloves for chemical break-through and replace at regular intervals. Clean protective equipment regularly. Wash hands and other exposed areas with mild soap and water before eating, drinking, and when leaving work

Respiratory Protection:

Respiratory protection may be required to avoid overexposure when handling this product. General or local exhaust ventilation is the preferred means of protection. Use a respirator if general room ventilation is not available or sufficient to eliminate symptoms. If an exposure limit is exceeded or if an operator is experiencing symptoms of inhalation overexposure as explained in Section 3, provide respiratory protection.

Respirator Type(s):

None required where adequate ventilation is provided. If airborne concentrations are above the applicable exposure limits, use NIOSH/MSHA approved respiratory protection.

Thermal Hazards: Not applicable

Environmental exposure controls: No data available

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties:

Appearance: No data available

Colour: No data available

Odour: Mild

Odour threshold: No data available

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pH:	Not applicable
Melting Point/Freezing Point (°C):	
Melting point (°C):	No data available
Freezing point (°C):	No data available
Initial boiling point and boiling range (°C):	65
Flash point (°C):	11
Evaporation Rate (water = 1):	No data available
Flammability (solid, gas):	No data available
Upper/lower flammability or explosive limits:	
Upper flammable or explosive limit, % in air:	36
Lower flammable or explosive limit, % in air:	6
Vapour pressure:	No data available
Vapor Density (Air=1):	1.1
Relative density (water = 1):	0.800
Solubility(ies):	Moderate; 50-99%
Partition coefficient: n-octanol/water:	No data available
Auto-ignition temperature (°C):	464
Decomposition temperature (°C):	No data available
Viscosity:	No data available
Explosive properties:	No data available
Oxidizing properties:	No data available
9.2 Other information:	
Volatile Organic Chemicals:	0
Bulk density:	6.676

SECTION 10: Stability and reactivity

10.1 Reactivity:	Not expected to be reactive
10.2 Chemical stability:	Stable under normal conditions.
10.3 Possibility of hazardous reactions:	None expected under standard conditions of storage
10.4 Conditions to avoid:	No data available

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10.5 Incompatible materials: Strong oxidizing agents

10.6 Hazardous decomposition products: Carbon dioxide, Carbon monoxide

SECTION 11: Toxicological information

11.1 Information on toxicological effects:

Acute toxicity:

Chemical Name	ORAL LD50 (rat)	DERMAL LD50 (rabbit)	INHALATION LC50 (rat)
methanol	No data available	No data available	INHALATION LC50-8H Rat 22500 ppm

Classification has been based on toxicological information of the components in Section 3.

Skin corrosion/irritation:

Based on available data, the classification criteria are not met.

Serious eye damage/irritation:

Based on available data, the classification criteria are not met.

Respiratory or skin sensitisation:

Based on available data, the classification criteria are not met.

Germ cell mutagenicity:

Based on available data, the classification criteria are not met.

Carcinogenicity:

Based on available data, the classification criteria are not met.

Reproductive toxicity:

Based on available data, the classification criteria are not met.

STOT-single exposure:

Classification has been based on toxicological information of the components in Section 3.

STOT-repeated exposure:

Based on available data, the classification criteria are not met.

Aspiration hazard:

Based on available data, the classification criteria are not met.

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BTEX Standard

SECTION 12: Ecological information

12.1 Toxicity: Moderate ecological hazard. This product may be dangerous to plants and/or wildlife.

Ecological Toxicity Data:

Chemical Name	CAS #	Aquatic EC50 Crustacea	Aquatic ERC50 Algae	Aquatic LC50 Fish
No data available				

12.2 Persistence and degradability: Biodegrades slowly.

12.3 Bioaccumulative potential: No data available

12.4 Mobility in soil: No data available

12.5 Results of PBT and vPvB assessment: No data available

12.6 Other adverse effects: None Known

12.7 Additional information: No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods:

Disposal methods: Spent or discarded material is a hazardous waste. Dispose of by incineration following Federal, State, Local, or Provincial regulations.

Waste codes / waste designations according to LoW: No data available

SECTION 14: Transport information

International carriage of dangerous goods by road (ADR), rail or inland waterways:

14.1 UN number: UN1230

14.2 UN proper shipping name: Methanol

14.3 Transport hazard class(es): 3(6.1)

14.4 Packing group: II

International carriage of dangerous goods by air (IATA):

14.1 UN number: UN1230

14.2 UN proper shipping name: Methanol

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14.3 Transport hazard class(es): 3(6.1)
14.4 Packing group: II
14.5 Environmental hazards: No
14.6 Special precautions for user: No data available
14.7 Transport in bulk according to Annex II of MARPOL and the IBC Code: No data available

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture:

Chemical Name	EINECS	SVHC
methanol	Yes	No
p-xylene	Yes	No
m-xylene	Yes	No
Toluene	Yes	No
o-xylene	Yes	No
Benzene	Yes	No
Ethylbenzene	Yes	No

15.2 Chemical Safety Assessment No Chemical Safety Assessment has been carried out for this substance/mixture by the supplier.

SECTION 16: Other information

Revision Date: 26-03-2018

Indication of changes: Any changes to the SDS compared to previous versions are marked by a vertical line in front of the concerned paragraph.

Abbreviations and acronyms: CAS = Chemical Abstract Service
DNEL= Derivative No Effect Level
EC= European Community
EINECS = European Inventory of Existing Chemical Substances
MSHA = Mine Safety Health Administration

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NIOSH = National Institute of Occupational Safety & Health
OEL = Occupational Exposure Limit
PBT= Persistent, Bioaccumulative, Toxic
PNEC= Predicted No Effect Concentration
SCOEL= Scientific Committee on Occupational Exposure Limits
TLV = Threshold Limit Value
TWA= Time Weighted Average
vPvB= Very Persistent, Very Bioaccumulative
Wt.% = Weight Percent

Key literature references and sources for data:

No data available

Hazard phrase(s) referenced in section 3

H340 - May cause genetic defects.
H350 - May cause cancer.
H225 - Highly flammable liquid and vapour
H226 - Flammable liquid and vapour
H301+H311+H331 - Toxic if swallowed, in contact with skin or if inhaled
H304 - May be fatal if swallowed and enters airways
H312+H332 - Harmful in contact with skin or if inhaled
H315 - Causes skin irritation
H319 - Causes serious eye irritation
H332 - Harmful if inhaled
H336 - May cause drowsiness or dizziness
H361d - Suspected of damaging the unborn child.
H370 - Causes damage to organs
H372 - Causes damage to organs through prolonged or repeated exposure
H373 - May cause damage to organs through prolonged or repeated exposure

Precautionary Statements:

Prevention:

P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P233 - Keep container tightly closed.
P240 - Ground/bond container and receiving equipment.
P241 - Use explosion-proof electrical/ventilating/lighting equipment.
P242 - Use only non-sparking tools.

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Response:

P243 - Take precautionary measures against static discharge.
P260 - Do not breathe dust/fume/gas/mist/vapours/spray.
P264 - Wash thoroughly after handling.
P270 - Do not eat, drink or smoke when using this product.
P280 - Wear protective gloves/protective clothing/eye protection/face protection.
P301+P310 - IF SWALLOWED: Immediately call a POISON CENTER/doctor.
P302+P352 - If on skin: Wash with plenty of water.
P303+P361+P353 - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P308+P311 - IF exposed or concerned: Call a POISON CENTER/doctor.
P312 - Call a POISON CENTER/doctor if you feel unwell.
P321 - Specific treatment (see Sections 4 to 8 on this SDS and any additional information on this label).
P330 - Rinse mouth.
P361+P364 - Take off immediately all contaminated clothing and wash it before reuse.
P370+P378 - In case of fire: Use an appropriate extinguisher (see section 5) to extinguish.
P233 - Keep container tightly closed.
P403+P235 - Store in a well-ventilated place. Keep cool.
P405 - Store locked up.
P501 - Dispose of contents/container to a suitable disposal site in accordance with local/national/international regulations.

Storage:

Disposal:

Disclaimer of Liability:

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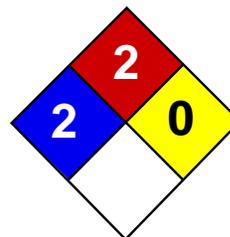
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Health	2
Fire	2
Reactivity	0
Personal Protection	E

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) 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.

Created: 10/11/2005 01:30 PM

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

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SAFETY DATA SHEET

Creation Date 10-Dec-2009

Revision Date 23-Jan-2018

Revision Number 5

1. Identification

Product Name Tetrachloroethylene

Cat No. : AC445690000; ACR445690010; AC445690025; AC445691000

CAS-No 127-18-4
Synonyms Perchloroethylene

Recommended Use Laboratory chemicals.
Uses advised against Not for food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company

Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number

For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US**:001-201-796-7100 / **Europe**: +32 14 57 52 99
CHEMTREC Tel. No. **US**:001-800-424-9300 / **Europe**:001-703-527-3887

2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Skin Sensitization	Category 1
Carcinogenicity	Category 1B
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney, Liver, Blood.	

Label Elements

Signal Word

Danger

Hazard Statements

Causes skin irritation
Causes serious eye irritation
May cause an allergic skin reaction
May cause drowsiness or dizziness
May cause cancer
May cause damage to organs through prolonged or repeated exposure

**Precautionary Statements****Prevention**

Obtain special instructions before use
 Do not handle until all safety precautions have been read and understood
 Use personal protective equipment as required
 Wash face, hands and any exposed skin thoroughly after handling
 Contaminated work clothing should not be allowed out of the workplace
 Do not breathe dust/fume/gas/mist/vapors/spray
 Use only outdoors or in a well-ventilated area
 Wear protective gloves/protective clothing/eye protection/face protection

Response

IF exposed or concerned: Get medical attention/advice

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing

Skin

IF ON SKIN: Wash with plenty of soap and water
 Take off contaminated clothing and wash before reuse
 If skin irritation or rash occurs: Get medical advice/attention

Eyes

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
 If eye irritation persists: Get medical advice/attention

Storage

Store locked up
 Store in a well-ventilated place. Keep container tightly closed

Disposal

Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

Toxic to aquatic life with long lasting effects

WARNING. Cancer - <https://www.p65warnings.ca.gov/>.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Tetrachloroethylene	127-18-4	>95

4. First-aid measures

General Advice	If symptoms persist, call a physician.
Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.
Skin Contact	Wash off immediately with plenty of water for at least 15 minutes. If skin irritation persists, call a physician.
Inhalation	Move to fresh air. If not breathing, give artificial respiration. Get medical attention if symptoms occur.
Ingestion	Clean mouth with water and drink afterwards plenty of water.

Most important symptoms and effects	None reasonably foreseeable. May cause allergic skin reaction. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Unsuitable Extinguishing Media	No information available
Flash Point	No information available
Method -	No information available
Autoignition Temperature	No information available
Explosion Limits	
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical

Thermal decomposition can lead to release of irritating gases and vapors. Containers may explode when heated.

Hazardous Combustion Products

Chlorine Hydrogen chloride gas Phosgene

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	0	0	N/A

6. Accidental release measures

Personal Precautions	Use personal protective equipment. Ensure adequate ventilation.
Environmental Precautions	Do not flush into surface water or sanitary sewer system.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling	Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Ensure adequate ventilation. Avoid ingestion and inhalation.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from sunlight.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Tetrachloroethylene	TWA: 25 ppm STEL: 100 ppm	(Vacated) TWA: 25 ppm (Vacated) TWA: 170 mg/m ³ Ceiling: 200 ppm TWA: 100 ppm	IDLH: 150 ppm	TWA: 100 ppm TWA: 670 mg/m ³ TWA: 200 ppm TWA: 1250 mg/m ³ STEL: 200 ppm STEL: 1340 mg/m ³

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

OSHA - Occupational Safety and Health Administration

NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures

Use only under a chemical fume hood. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection

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 and body protection

Long sleeved clothing.

Respiratory Protection

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.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	Characteristic, sweet
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-22 °C / -7.6 °F
Boiling Point/Range	120 - 122 °C / 248 - 251.6 °F @ 760 mmHg
Flash Point	No information available
Evaporation Rate	6.0 (Ether = 1.0)
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	18 mbar @ 20 °C
Vapor Density	No information available
Density	1.619
Specific Gravity	1.625
Solubility	0.15 g/L water (20°C)
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	> 150°C
Viscosity	0.89 mPa s at 20 °C
Molecular Formula	C ₂ Cl ₄
Molecular Weight	165.83

10. Stability and reactivity

Reactive Hazard	None known, based on information available
Stability	Stable under normal conditions.
Conditions to Avoid	Incompatible products. Excess heat. Exposure to moist air or water.
Incompatible Materials	Strong acids, Strong oxidizing agents, Strong bases, Metals, Zinc, Amines, Aluminium
Hazardous Decomposition Products	Chlorine, Hydrogen chloride gas, Phosgene
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Tetrachloroethylene	LD50 = 2629 mg/kg (Rat)	LD50 > 10000 mg/kg (Rat)	LC50 = 27.8 mg/L (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Tetrachloroethylene	127-18-4	Group 2A	Reasonably Anticipated	A3	X	A3

IARC: (International Agency for Research on Cancer)

IARC: (International Agency for Research on Cancer)

Group 1 - Carcinogenic to Humans

Group 2A - Probably Carcinogenic to Humans

Group 2B - Possibly Carcinogenic to Humans

NTP: (National Toxicity Program)

Known - Known Carcinogen

Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

A1 - Known Human Carcinogen

A2 - Suspected Human Carcinogen

A3 - Animal Carcinogen

ACGIH: (American Conference of Governmental Industrial Hygienists)

ACGIH: (American Conference of Governmental Industrial Hygienists)

Mexico - Occupational Exposure Limits - Carcinogens

Mexico - Occupational Exposure Limits - Carcinogens

A1 - Confirmed Human Carcinogen

A2 - Suspected Human Carcinogen

A3 - Confirmed Animal Carcinogen

A4 - Not Classifiable as a Human Carcinogen

A5 - Not Suspected as a Human Carcinogen

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Central nervous system (CNS)

STOT - repeated exposure Kidney Liver Blood

Aspiration hazard No information available

Symptoms / effects, both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Endocrine Disruptor Information

Component	EU - Endocrine Disruptors Candidate List	EU - Endocrine Disruptors - Evaluated Substances	Japan - Endocrine Disruptor Information
Tetrachloroethylene	Group II Chemical	Not applicable	Not applicable

Other Adverse Effects Tumorigenic effects have been reported in experimental animals.

12. Ecological information

Ecotoxicity

Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Tetrachloroethylene	EC50: > 500 mg/L, 96h (Pseudokirchneriella subcapitata)	LC50: 4.73 - 5.27 mg/L, 96h flow-through (Oncorhynchus mykiss) LC50: 11.0 - 15.0 mg/L, 96h static (Lepomis macrochirus) LC50: 8.6 - 13.5 mg/L, 96h static (Pimephales promelas) LC50: 12.4 - 14.4 mg/L, 96h flow-through (Pimephales promelas)	EC50 = 100 mg/L 24 h EC50 = 112 mg/L 24 h EC50 = 120.0 mg/L 30 min	EC50: 6.1 - 9.0 mg/L, 48h Static (Daphnia magna)

Persistence and Degradability Insoluble in water Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility . Is not likely mobile in the environment due its low water solubility. Will likely be mobile in the environment due to its volatility.

Component	log Pow
Tetrachloroethylene	2.53 - 2.88

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Tetrachloroethylene - 127-18-4	U210	-

14. Transport information

DOT

UN-No UN1897
Proper Shipping Name TETRACHLOROETHYLENE
Hazard Class 6.1
Packing Group III

TDG

UN-No UN1897

Proper Shipping Name	TETRACHLOROETHYLENE
Hazard Class	6.1
Packing Group	III
IATA	
UN-No	UN1897
Proper Shipping Name	TETRACHLOROETHYLENE
Hazard Class	6.1
Packing Group	III
IMDG/IMO	
UN-No	UN1897
Proper Shipping Name	TETRACHLOROETHYLENE
Hazard Class	6.1
Subsidiary Hazard Class	P
Packing Group	III

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Tetrachloroethylene	X	X	-	204-825-9	-		X	X	X	X	X

Legend:

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B)).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Tetrachloroethylene	127-18-4	>95	0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Tetrachloroethylene	-	-	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Tetrachloroethylene	X		-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Tetrachloroethylene	100 lb 1 lb	-

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Tetrachloroethylene	127-18-4	Carcinogen	14 µg/day	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Tetrachloroethylene	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
 DOT Marine Pollutant Y
 DOT Severe Marine Pollutant N

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By Regulatory Affairs
 Thermo Fisher Scientific
 Email: EMSDS.RA@thermofisher.com

Creation Date 10-Dec-2009

Revision Date 23-Jan-2018

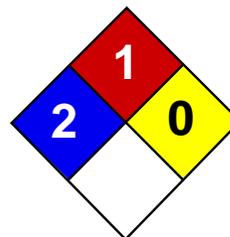
Print Date 23-Jan-2018

Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The 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, unless specified in the text

End of SDS



Health	2
Fire	1
Reactivity	0
Personal Protection	H

Material Safety Data Sheet Trichloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Trichloroethylene

Catalog Codes: SLT3310, SLT2590

CAS#: 79-01-6

RTECS: KX4560000

TSCA: TSCA 8(b) inventory: Trichloroethylene

CI#: Not available.

Synonym:

Chemical Formula: C₂HCl₃

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
Trichloroethylene	79-01-6	100

Toxicological Data on Ingredients: Trichloroethylene: ORAL (LD50): Acute: 5650 mg/kg [Rat]. 2402 mg/kg [Mouse]. DERMAL (LD50): Acute: 20001 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: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH.

MUTAGENIC EFFECTS: Not available. **TERATOGENIC EFFECTS:** Not available. **DEVELOPMENTAL TOXICITY:** Not available. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract. 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 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: May be combustible at high temperature.

Auto-Ignition Temperature: 420°C (788°F)

Flash Points: Not available.

Flammable Limits: LOWER: 8% UPPER: 10.5%

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

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: 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:

Keep locked up 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 gas/fumes/ vapour/

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

Storage:

Keep container dry. Keep in a cool place. Ground all equipment containing material. Carcinogenic, teratogenic or mutagenic materials should be stored in a separate locked safety storage cabinet or room.

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 STEL: 200 (ppm) from ACGIH (TLV) TWA: 269 STEL: 1070 (mg/m³) from ACGIH 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: 131.39 g/mole

Color: Clear Colorless.

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

Boiling Point: 86.7°C (188.1°F)

Melting Point: -87.1°C (-124.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.4649 (Water = 1)

Vapor Pressure: 58 mm of Hg (@ 20°C)

Vapor Density: 4.53 (Air = 1)

Volatility: Not available.

Odor Threshold: 20 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; log(oil/water) = 0

Ionicity (in Water): Not available.

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

Solubility:

Easily soluble in methanol, 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: Not available.

Incompatibility with various substances: Not available.

Corrosivity:

Extremely corrosive in presence of aluminum. 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): 2402 mg/kg [Mouse]. Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract.

Other Toxic Effects on Humans: 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: Passes through the placental barrier in human. Detected in maternal milk in human.

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 6.1: Poisonous material.

Identification: : Trichloroethylene : UN1710 PG: III

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: Trichloroethylene 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: Trichloroethylene Pennsylvania RTK: Trichloroethylene Florida: Trichloroethylene Minnesota: Trichloroethylene Massachusetts RTK: Trichloroethylene New Jersey: Trichloroethylene TSCA 8(b) inventory: Trichloroethylene CERCLA: Hazardous substances.: Trichloroethylene

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

Other Classifications:

WHMIS (Canada):

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

DSCL (EEC):

R36/38- Irritating to eyes and skin. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

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

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Appendix 1A

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.

December 2009

Appendix 1B

Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.
2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.
3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:
 - (a) Objects to be measured: Dust, mists or aerosols;
 - (b) Measurement Ranges: 0.001 to 400 mg/m³ (1 to 400,000 :ug/m³);
 - (c) Precision (2-sigma) at constant temperature: +/- 10 :g/m³ for one second averaging; and +/- 1.5 g/m³ for sixty second averaging;
 - (d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);
 - (e) Resolution: 0.1% of reading or 1g/m³, whichever is larger;
 - (f) Particle Size Range of Maximum Response: 0.1-10;
 - (g) Total Number of Data Points in Memory: 10,000;
 - (h) Logged Data: Each data point with average concentration, time/date and data point number
 - (i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;
 - (j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;
 - (k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;
 - (l) Operating Temperature: -10 to 50° C (14 to 122° F);
 - (m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.
4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.
5. The action level will be established at 150 ug/m³ (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m³, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m³ above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m³ continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM₁₀ at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

- (a) Applying water on haul roads;
- (b) Wetting equipment and excavation faces;
- (c) Spraying water on buckets during excavation and dumping;
- (d) Hauling materials in properly tarped or watertight containers;
- (e) Restricting vehicle speeds to 10 mph;
- (f) Covering excavated areas and material after excavation activity ceases; and
- (g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m³ action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

Appendix B
Quality Assurance Project Plan



A GALLAGHER BASSETT COMPANY

**QUALITY ASSURANCE PROJECT PLAN
FOR
REMEDIAL INVESTIGATION**

Site:

**1640 Flatbush Avenue
Brooklyn, New York
NY BCP Site No: C224212**

Prepared for:

**SL Green Realty Corporation
420 Lexington Avenue, 18th Floor
New York, NY 10170**

Prepared By:

**WCD Group
1350 Broadway, Suite 1904
New York, NY 10018**

WCD File: 16-9335

January 2019

Environmental & Construction Risk Management

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1.0 PROJECT MANAGEMENT

1.1 Project/Task Organization

The following individuals are major participants in the project. Following each project participant is their specific responsibilities and authorities for the project.

Jared Donaldson/New York State Department of Environmental Conservation (NYSDEC)

Jared Donaldson is the Project Manager for the NYSDEC. Mr. Donaldson is responsible for review and approval of all project submittals.

Henry Gold/Project Director, WCD Group (WCD)

Henry Gold, a Qualified Environmental Professional (QEP), will be responsible for overview of all project activities, including overall project management and allocation of staff and other resources required to complete the project within the specified schedule and budget. Mr. Gold will oversee the investigation and certify that the investigation was completed in accordance with the RIWP and DER-10.

TJ Motley/Project Manager, WCD

TJ Motley will act as Project Manager on behalf of the Volunteer, and will be responsible for managing all project activities in consultation with the Remedial Engineer. Mr. Motley will review all project documents and ensure that project plans are followed, manage day-to-day project operations and administrative aspects, and will function as the client and regulatory contact for the project. Mr. Motley has authority to direct the activities of the field team (OSC and drilling subcontractor).

TJ Motley/Quality Assurance Officer, WCD

TJ Motley will be responsible for reviewing all sampling procedures and certifying that the data was collected and analyzed using the appropriate procedures.

To be Determined/On-Site Coordinator (OSC), WCD

The OSC will be responsible for the completion of all on-site fieldwork, collection of all samples, completion of the field log, and chains of custody. The OSC will have authority over all on-site subcontractors.

Drilling Subcontractor

The drilling subcontractor will be responsible for the operation of drilling equipment.

Laboratory Subcontractor

The laboratory subcontractor will be responsible for the analysis of samples. The laboratory subcontractor will be New York State Department of Health Environmental Laboratory Approved Program (ELAP) certified in the appropriate categories.

Data Validator (TBD)

An independent, third-party data validator will be responsible for reviewing and evaluating all analytical data packages and preparing Data Usability Reports in accordance with DER-10. A current resume outlining education and experience of the data validator will be provided to DER for review and approval (once the data validator has been selected).

1.2 Principal Data Users

The principal users of the generated data in this project are listed below.

- Residents of Brooklyn, New York, especially those residing in the vicinity of the Site;
- SL Green Realty Corp. (Volunteer); and
- NYSDEC and NYSDOH.

1.3 Problem Definition/Background

The Site is a 17,985-square foot parcel located at 1640 Flatbush Avenue, Borough of Brooklyn, Kings, County, New York, which has been enrolled in the NYSDEC Brownfield Cleanup Program (BCP). Previous environmental investigations documented the presence of urban-fill soils containing elevated concentrations of SVOCs and metals, groundwater contamination by VOCs, SVOCs and metals, and soil-vapor contamination by VOCs. Proposed additional environmental investigation consists of the installation of soil borings and monitoring wells, and collection of soil and groundwater samples to evaluate environmental conditions in the area of the recently abandoned underground storage tanks (USTs).

1.4 Project/Task Description

The project will meet its objective through the following actions:

- Compliance with NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, dated May 3, 2010; and
- Compliance with the Remedial Investigation Work Plan (RIWP).

1.5 Quality Objectives and Criteria

The data collected in this project will be used to evaluate environmental conditions in all on-site media.

In order to meet the data quality objectives of precision, accuracy, representation, comparability and completeness the following actions will be taken:

- Duplicate samples will be collected and analyzed in order to determine the degree to which measurements obtained under the same protocols are consistent and reproducible;
- Matrix spike samples will be collected and analyzed in order to determine accuracy for the samples;

- A trip blank sample will also be analyzed in order to detect potential contamination during sample transport of VOC samples;
- A field blank will be prepared and analyzed for each non-dedicated piece of sampling equipment, as applicable; and
- Data generated during the completion of the RIWP will be submitted for review by a third party, independent data validator.

Prior to field activities, the Project Manager and the OSC will review the RIWP to ensure that the data quality objectives of precision, accuracy, representation, comparability and completeness will be met during the field activities. At the completion of field activities, the Project Manager will review field logs and chains of custody to ensure that field activities met the intent of the RIWP. If a problem is identified, Mr. Henry Gold and the Project Manager will meet to determine corrective measures necessary to meet data quality objectives.

1.6 Documents and Records

Electronic and paper copies of all field documentation will be retained by WCD. Documentation of sufficient quality and quantity to represent environmental conditions at the Site will be provided to the NYSDEC in the Remedial Investigation Report (RIR), which will document all findings and results of the implementation of the RIWP.

2.0 SAMPLING AND ANALYSIS PLAN

This section of the QAPP details sampling and analysis of all field parameters and media (soil and groundwater samples), and identifies methods for sample collection and handling.

2.1 Sampling Overview

Borings will be installed in order to recover representative soil samples at various depths. One boring will be converted to a temporary groundwater well point to allow for the collection of a groundwater sample beneath the tank field.

2.2 Sampling Methods

2.2.1 General Methodology

Field parameters (i.e., volatile vapors) will be measured at boring locations and at well points using properly calibrated precision instruments operated according to manufacturer's instructions. All media sampling will be conducted in a manner consistent with NYSDEC and/or NYSDOH sample collection protocols. All samples will be properly characterized and field screened, and findings will be recorded in logbooks.

Samples will be collected into appropriately-sized and preserved laboratory-supplied containers, using either disposable or properly decontaminated sampling equipment. The field technician will wear a new pair of disposable gloves during the collection of each sample, and will handle samples such that the potential for cross-contamination, and contamination of exterior surfaces of collection containers, is minimized (placement of media into containers will take place in a clean area remote from contaminant sources, as possible). PPE and sampling equipment will be decontaminated (as warranted) between sampling locations.

2.2.2 Soil



At least 11 mechanical soil borings will be advanced to investigate around the perimeter and below the invert of the tanks and associated piping. Soil borings will be advanced to the groundwater table surface, approximately 25 to 30 feet bgs. If impacted soils are identified, one sample will be collected from the most impacted zone as determined by field evidence (odors, staining and/or PID readings), and a second sample will be collected from immediately above the observed water table. If no apparent impacted soils are identified, one sample will be collected from below the tank invert, approximately 10 to 13 feet bgs.

Soil sampling will be conducted using equipment lined with disposable acetate sleeves. Samples will be collected directly from the freshly cut open sleeve, using disposable plastic trowels or properly decontaminated stainless steel instruments, or directly by the fieldwork technician using dedicated disposable latex gloves.

Soil sampling for VOC analysis will be conducted following USEPA Method 5035 protocols, using disposable 5 gram Terra Core samplers (or similar equipment) to place material into laboratory-supplied glass vials with appropriate preservatives and stir bars.

2.2.3 Groundwater

One temporary groundwater well point will be installed to investigate the potential presence of contamination beneath the tanks. If non-aqueous phase liquid (NAPL) is encountered in the groundwater sample, that water sample will not be analyzed (a sample of the NAPL will be obtained for laboratory analysis, if sufficient volume is present). Before sampling, groundwater will be purged three well volumes.

Additionally, four existing groundwater monitoring wells (MW-1 to MW-4) will be sampled. All groundwater monitoring wells will be sampled using USEPA Low Flow methodology, as follows:

- Basic climatological data (e.g., temperature, precipitation, etc.) and all field observations will be recorded in a field logbook. Groundwater sampling will begin at the potentially least contaminated well (as determined from well location and/or previous data) and proceed to the potentially most contaminated well. New latex gloves will be worn by the sampler at each well location.
- The protective casing on the well will be unlocked, the air in the well head will be screened with a photoionization detector (PID), and the static water level (relative to the top of the casing) will be measured with a decontaminated water-level meter. The water level meter will be decontaminated with Alconox solution after gauging each well.
- A peristaltic pump and Teflon or Teflon-lined polyethylene tubing (or equivalent) will be used to sample the well. The tubing will be slowly lowered until reaching two to three feet off of the bottom to prevent disturbance and re-suspension of any residual sediment. Dedicated disposable tubing will be used at each monitoring well to eliminate the potential for cross contamination.
- The water level will be measured before the pump is started. Each well will be pumped at a rate of 200 to 500 milliliters per minute. The water level will be measured approximately every three to five minutes to ensure that stabilization (drawdown of 0.3' or less) is achieved.

- A Horiba U-50 series water quality analyzer with flow-through cell (or similar equipment) will be used during pumping to measure field indicator parameters (turbidity, temperature, specific conductance, pH, redox potential, and dissolved oxygen), which will be monitored and recorded approximately every three to five minutes. The well will be considered stabilized when the indicator parameters have stabilized for three consecutive readings.
- Sampling will occur following stabilization of parameters by directing a gentle flow of water from the tubing directly into the sample container.

2.2.5 Other Materials

Any non-soil solid materials requiring laboratory analysis will be placed into laboratory supplied glassware when possible, or will alternatively be placed into double locking plastic bags and then boxed in order to prevent a tear or other breach in the bags.

2.3 Sample Handling and Custody

2.3.1 Sample Containers

The following laboratory-supplied containers will be used for sample collection (as applicable):

Media Sample	Collection Container
Soil – Petroleum Compounds (CP-51 +30), TAL metals, pesticides, PCBs	USEPA 5035 VOA kit (4, 40-ml glass vials) 1, 8-oz glass jar
Soil – duplicate and MS/MSD samples	1 additional 8-oz glass jar
Water – Petroleum Compounds (CP-51 +30), TAL metals (total and dissolved), 1,4-dioxane, PFAS	3, 40-ml glass vials (HCl) – VOCs 1, 1-liter amber glass – SVOCs, pesticides/PCBs 1, 250-ml plastic (HNO ₃) – metals, total 1, 250-ml plastic – metals, dissolved 2, 250-ml plastic – PFAS 2, 1-liter amber glass – 1,4-dioxane
Water – trip blank	3, 40-ml prepared glass vials (HCl)

2.3.2 Sampling Frequency

All boring locations will be sampled for soil. Based on at least eleven soil boring locations and the potential collection of samples from both the interval intercepting the groundwater table and a potential interval exhibiting peak field evidence of contamination, soil samples will be submitted for laboratory analysis of petroleum compounds (CP-51 petroleum list +30 TICs), TAL metals, pesticides and PCBs.

All groundwater monitoring wells will be sampled at least once (existing wells MW-1 through MW-4, new well MW-5 and one temporary well) for analysis of petroleum compounds (CP-51 petroleum list +30 TICs), total and dissolved TAL metals, and “emerging contaminants”, including 1,4-dioxane and per- and polyfluoroalkyl substances (PFAS).

The proposed number of soil borings and construction of temporary wells is summarized below (the actual number of borings and wells installed may be higher, based on encountered field conditions).

Quantity	Fieldwork Element	Purpose
~11	Advance Soil Borings	Collect soil samples to investigate the tanks, associated piping and pump islands
1	Install Temporary Well Points	Collect groundwater sample to investigate the tanks and associated piping
4	Sample Existing Wells	Collect Groundwater Samples from Permanent Locations
1	Install New Permanent Monitoring Well	Collect Groundwater Samples from Permanent Locations

The estimated number of samples to be collected is outlined below (the actual number of samples may vary based on conditions encountered during the investigation).

Media/QC Parameter	Number of Collection Points (Number of Samples)	Analyte (USEPA method)
Soil	33**	VOCs and SVOCs, CP-51 (8260/8270) TAL metals (6010/7473) Pesticides/PCBs (8081/8082) 1,4-dioxane (8260) PFAS (537 modified)
Groundwater	6	VOCs and SVOCs, CP-51 (8260/8270), TAL metals (6010/7473) 1,4-dioxane (8270 SIM) PFAS (537 modified)
Field Blank	One per 20 samples collected (non-dedicated equipment)	As per the analyte list(s) for the sample type
Duplicates & MS/MSD	One per 20 samples collected	As per the analyte list(s) for the sample type
** Additional soil samples will be collected from the pipe run with one sample collected per 20 linear feet of pipe run.		

2.3.3 Sample Custody

Samples will be handled by the OSC. All soil and groundwater samples will be placed in a sample cooler that is maintained at 4 (+/-2) °C.

For each sampling day, field personnel will be required to complete a sampling custody worksheet indicating all pertinent information about the samples collected, handling methods, name of the collector, and chain of custody (which will require a Category B Data Deliverable). Upon the completion of each day of sample collection activities, all samples will be shipped via either courier or overnight delivery (per laboratory requirements) to a NYSDOH ELAP certified laboratory. Laboratory personnel will record the cooler temperature upon receipt and analyze the samples prior to the expiration of the hold times as specified in the NYSDEC Analytical Service Protocol.

2.4 Quality Control

Accuracy and precision will be determined by repeated analysis of laboratory standards, and matrix effects and recovery will be determined through use of spiked samples. With each sample run, standards, blanks and spiked samples will be run.

One duplicate sample will be collected for every 20 matrix samples (or one per week). One in 20 samples will also be submitted for Matrix spike (MS) and Matrix Spike Duplicate (MSD) analysis. One field blank will be prepared for each non-dedicated piece of sampling equipment for every 20 analytical samples collected using non-dedicated equipment. For each day of sampling, a trip blank will be included with each sample cooler (analyzed for VOCs). Equipment blanks and duplicate samples will be analyzed for all parameters.

Samples will be identified using a unique ID number. This ID will be recorded on the sampling log and/or field record and the sampling container. Samples for each day of fieldwork will be assigned to a Sample Delivery Group (SDG) for that day and will be shipped via either courier or overnight delivery to the laboratory following proper chain of custody procedure, as described above.

3.0 QUALITY ASSURANCE

3.1 Instrument/Equipment, Testing, Inspection, and Maintenance

Field measurements will be conducted using monitoring equipment specialized for each task, including use of a PID during all fieldwork events to screen for volatile organic vapors. All instruments will be stored at WCD offices when not in use. All instruments will be calibrated (as warranted) in accordance with the manufacturer's instructions. Instrument malfunction is normally apparent during calibration. In the event of malfunction, equipment will be cleaned and tested. Equipment testing, inspection and maintenance will be the responsibility of the Project Manager and OSC for the project. Any other equipment selected for field measurements will be similarly managed.

3.2 Inspection/Acceptance of Supplies and Consumables

All supplies and consumables will be inspected and tested (if necessary) by either the Project Manager or the OSC upon receipt. The following supplies and consumables will be used:

- Soil samples: laboratory supplied glass vials (terracore kits) and clear glass jars will be used for each soil sample collected;
- Water samples: laboratory supplied glass vials (preserved with HCL), amber glass jars and plastic containers (unpreserved and preserved with HNO₃) will be used for each groundwater sample collected;
- Disposable gloves (nitrile or equivalent); and
- Distilled/Deionized (DI) water (for decontamination and the preparation of blanks).

3.3 Data Management

For the purpose of data management, the data can be divided into field and laboratory data. Field data will be recorded at the time of measurement on written field logs. Laboratory data will be reviewed upon receipt and summarized in data summary tables.

4.0 DATA VALIDATION AND USABILITY

4.1 Data Review, Verification and Validation

Data generated by this project will be reviewed, verified and validated as follows:

4.1.1 Field Measurements

If field instruments are determined to be functioning correctly through calibration and measurements of standards, and if there are no inconsistencies between written records and logged data, the data will be assumed to be valid and will be accepted as an indication of field conditions. If instruments malfunction prior to field measurement, they will be restored to proper function prior to re-use. If they malfunction immediately after field measurements are taken, the measurements will be retaken as soon as possible. Inconsistencies between written records and logged data will be resolved by re-testing the material, if possible. If re-testing is not possible, (e.g., a sample has been shipped to the laboratory), the inconsistency will be described in the final RIR and the laboratory analysis will be utilized to classify the material. In addition, all field data will be reviewed by the Project Manager for consistency and plausibility.

4.1.2 Laboratory Analysis

A NYSDOH ELAP-certified laboratory will provide a NYSDEC ASP Category B data package for sample analyses, as described in Section 2 of DER-10 and the NYSDEC ASP.

4.1.3 Soil Cleanup Objectives (SCOs)

The SCOs for this BCP Site are provided in 6 NYCRR Subpart 375, Table 375-6.8(b) Restricted-Residential Use SCOs, and in Supplemental SCOs and Soil Cleanup Levels presented in NYSDEC CP-51 (Soil Cleanup Guidance, October 2010), Tables 1 through 3.

4.2 Verification and Validation Methods

4.2.1 Verification Method

Once collected, all data will go to the Project Manager for review and verification. Review will involve determining that all data has been collected at the proper locations by the proper persons and that all field and laboratory logs are complete. In addition, a Data Usability Summary Report (DUSR) in accordance with DER-10, Appendix 2B, will be prepared by a third party, independent data validator, who maintains NYSDOH ELAP CLP Certification (the DUSR will also include a current resume for the person who prepared it).

4.2.2 Authority for Verification

Authority for verification, validation and resolution of data issues will be distributed among the investigators. Authority to resolve issues regarding verification of field measurements will rest with the Project Manager and Mr. Henry Gold.

4.2.3 Project Reports

Following review, validation and verification, all data will be conveyed to users via a final RIR documenting the findings and results of the implementation of the RIWP. This report will include the following:

- All laboratory analytical results obtained from the sampling event(s), summarized in tables and provided in NYSDEC EDD format (EquiS).
- A detailed account of any deviations from field procedures specified in the RIWP.
- A complete set of field notes and/or Field Observation Tables.
- Results of the DUSR review of all laboratory results.