Remedial Action Work Plan

1731 West Farms Road

Bronx, New York 10460

NYSDEC BCP Number: TBD

Prepared for:
1731 West Farms Road LLC
35-37 36th Street, 6th Floor
Long Island City, New York 11106
Email Address: alfred@propcoholdings.com

Prepared by:
Tyll Engineering and Consulting, PC
169 Commack Road, Suite H173
Commack, NY 11725

&

Merritt Environmental Consulting Corp.
77 Arkay Drive, Suite D
Hauppauge, New York 11788
631.617.6200

FEBRARY 2020

CERTIFICATIONS

I, Karen Tyll, P.E, certify that I am currently a NYS registered professional engineer and that this Remedial Action Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

I certify that all information and statements in this certification are true. I understand that a false statement made herein is punishable as Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

079520	2/14/2020	
NYS Professional Engineer #	Date	Signature

It is a violation of Article 145 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 145, New York State Education Law.

REMEDIAL ACTION WORK PLAN

TABLE OF CONTENTS

Contents

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS

Acronym	Definition
AOC	Area of Concern
AS/SVE	Air Sparging/Soil Vapor Extraction
BOA	Brownfield Opportunity Area
CAMP	Community Air Monitoring Plan
C&D	Construction and Demolition
CEQR	City Environmental Quality Review
CFR	Code of Federal Regulations
CHASP	Construction Health and Safety Plan
COC	Certificate of Completion
CQAP	Construction Quality Assurance Plan
CSOP	Contractors Site Operation Plan
DCR	Declaration of Covenants and Restrictions
ECs/ICs	Engineering Controls and Institutional Controls
ELAP	Environmental Laboratory Accreditation Program
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations Emergency Response
IRM	Interim Remedial Measure
MNA	Monitored Natural Attenuation
NOC	Notice of Completion
NYS DEC	New York State Department of Environmental Conservation
NYC DEP	New York City Department of Environmental Protection
NYC DOHMH	New York City Department of Health and Mental Hygiene
NYC OER	New York City Office of Environmental Remediation
NYC VCP	New York City Voluntary Cleanup Program
NYCRR	New York Codes Rules and Regulations
NYS DEC	New York State Department of Environmental Conservation
NYS DEC DER	New York State Department of Environmental Conservation Division of Environmental Remediation

Acronym	Definition
NYS DOH	New York State Department of Health
NYS DOT	New York State Department of Transportation
ORC	Oxygen-Release Compound
OSHA	Occupational Safety and Health Administration
PCBs	Polychlorinated Biphenyls
PE	Professional Engineer
PID	Photo Ionization Detector
QEP	Qualified Environmental Professional
QHHEA	Qualitative Human Health Exposure Assessment
RAOs	Remedial Action Objectives
RAR	Remedial Action Report
RAWP	Remedial Action Work Plan or Plan
RCA	Recycled Concrete Aggregate
RD	Remedial Design
RI	Remedial Investigation
RMZ	Residual Management Zone
SCOs	Soil Cleanup Objectives
SCG	Standards, Criteria and Guidance
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System
SSDS	Sub-Slab Depressurization System
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
USGS	United States Geological Survey
UST	Underground Storage Tank
VCA	Voluntary Cleanup Agreement
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

Merritt Environmental Consulting Corp. ("MECC") was contracted by 1731 West Farms Road LLC to prepare a Remedial Action Work Plan (RAWP) for the residential development located at 1731 West Farms Road, Bronx, New York (the "Site"). The Applicant, 1731 West Farms Road LLC, is currently a Volunteer in the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP), and the Site is designated as Site No. XXXXXXX. The objective of the RAWP is to detail the planned remedial action at the Site.

Site Description

The Site is located at 1731 West Farms Road in the West Farms section in Bronx, New York and is identified as Block 3015 and Lot 31 on the New York City Tax Map. Figure 1 shows the Site location. The Site is 9,723 square feet and is bounded by a two-story commercial building to the north, a large commercial self-storage building to the south, West Farms Road to the east, and a single-story building containing a construction contractor to the west. A map of the Site boundary is shown in Appendix A. Currently, the Site is unoccupied but is used for vehicle parking and construction materials storage. Current Site improvements consist of a partial one-story and partial two-story commercial building and an exterior parking lot. No open unpaved areas exist at the Site. The most recent Site occupants consisted of a dry cleaning equipment sales and refurbishing operation, and an electrician. Proposed redevelopment consists of one 11-story apartment building with no basement.

Physical Setting

The Site elevation is approximately 15 feet above mean sea level and is located at the base of a low, steeply rising bedrock ridge oriented in a north to south direction (the ridge is located at the west or rear side or the Site). This ridge marks the boundary between the Bronx River flood plain and areas to the west with higher elevations and shallow bedrock. Bedrock is directly under (and in contact with) the ground floor slab of the existing building at its west (rear) side. Bedrock exposures are visible since they penetrate the floor slab at the west end of the building at two locations. Surface and near-surface bedrock exists under western one-third of the Site building. The bedrock surface slopes down to the east under the Site building, The estimated depth to bedrock is approximately 20 feet bgs at the east end of the Site at West Farms Road.

The soil stratigraphy of the Site consists of fill material above bedrock at the western one-third of the Site. Naturally occurring sediment is present at the point where the bedrock surface is below feet below ground surface (bgs) and greater. This sediment consists of medium to fine brown sand with varying amounts angular rock fragments, and fine sand and clay Based on the results of MECC's November 2019 Remedial Investigation (RI), groundwater is present at approximately 10 feet bgs at the Site. No groundwater was encountered above bedrock at the west section of the Site where the bedrock surface is above roughly nine feet to ten feet bgs. Groundwater flow at the Site is estimated to be from west to east, towards the Bronx River, which is approximately 350 feet to the east.

Site History

A phase I environmental site assessment (Phase I ESA) of the Site was completed by Federated Environmental Associates, Inc. in May 2019. The Phase I ESA states that the Site improvements were constructed in 1931. Prior to 1931, the ESA indicates that the Site contained residential buildings. Sources of historical information reviewed by the ESA show that the current Site improvements contained a marble shop/stone mason from 1931 to the 1970s and a machine shop in the 1980s. The Phase I ESA indicates that the dry cleaning and laundry equipment sales operation was present from approximately 1983 until the Site was vacated several years ago (date of vacancy is unknown). Past operators of the dry cleaning and laundry equipment sales and possibly refurbishing operations are identified by the Phase I ESA as WFR Dry Cleaning & Laundry, IPSO NY, Interstate Laundry Parts & Equipment and ASN Laundry Group, Inc. An electrician also occupied the Site concurrently with the dry cleaning equipment sales/refurbishing operation. No underground storage tanks (USTs) have been identified at the Site.

Summary of the Remedial Investigation

MECC performed an RI at the Site in October 2019. A Supplemental RI was conducted by MECC in January 2020. The purpose of the two studies was to delineate soil, groundwater, and soil vapor impact within the Site boundary and to determine what, if any, impact may have migrated off-Site. To perform this work, the following tasks were completed:

- A total of seven soil borings were installed at the Site by the RI. Borings were installed to a maximum depth of 15 feet bgs. Refusal on bedrock occurred at depths ranging from three feet to nine feet bgs in three soil borings. Shallow and deep grab soil samples were collected from all borings for laboratory analysis (a single shallow sample was collected from B3 since refusal occurred at three feet bgs). Six additional soil borings were installed by the Supplemental RI, which was implemented to locate the source of Site groundwater contamination by perchloroethylene (PCE). Shallow and deep grab soil samples were collected during the

Supplemental RI and analyzed at the laboratory for volatile organic compounds (VOCs). The principal area of concern identified in Site soil is the presence of PCE at elevated concentrations in a localized area of the Site. PCE concentrations range from undetect to 110 milligrams per kilogram (mg/kg) under a section of small Site parking lot. Laboratory analysis of a total of 12 soil samples under various parameters during the RI identified elevated concentrations of a heavy metals, pesticides and semi-volatile organic compounds (SVOCs) at several areas in shallow soil at the Site. Elevated levels of metals and pesticides were detected in deeper soil. These results are considered representative of common urban fill.

- Three temporary groundwater well points were installed at the Site during the RI and groundwater samples were collected for laboratory analysis at all well points. PCE was detected in the groundwater samples at levels ranging from 9.1 micrograms per liter (ug/l) to 610 ug/l. Further, six subsurface soil vapor samples were collected during the RI at a depth of five feet to seven feet bgs and PCE was at elevated and actionable levels. The highest PCE concentrations in groundwater and soil vapor are centered on the localized area of PCE-impacted soil, which is present under the small exterior parking lot at the east end of the Site.

Qualitative Human Health Exposure Assessment

Soil at the Site is impacted with PCE, PCE degradation products, SVOCs, pesticides and metals. Possible exposure pathways are by ingestion, inhalation, or dermal exposure by a person on the Site. The Site is secured by a locked entry gate and fence, which limits access to the Site to authorized personnel. As such potential exposures would be limited to periods when ground intrusive work is being performed.

The Site is secured by a locked perimeter fence, which limits human receptors to occasional Site visitors and workers involved in redevelopment activities. During remediation and Site development, human receptors will be limited to construction workers and related personnel. Potential off-Site receptors include workers and residents in surrounding commercial and residential properties.

Environmental Media & Exposure Route	Human Assessment
Direct contact with surface soils	• The Site is currently covered by the existing building and the small paved exterior parking lot; no potential for direct contact with surface soils exists.
Direct contact with subsurface soils	• Direct contact to subsurface soils may occur during ground intrusive work at the Site. Such contact will be managed during remediation by implementing a HASP and CAMP.
Direct contact with groundwater	• Direct contact to groundwater may occur during ground intrusive work at the Site. Such contact will be managed during remediation by implementing a HASP and CAMP.
Ingestion of groundwater	• Groundwater is not utilized for drinking water. Drinking water is supplied by the municipal water supply. • There are no known domestic water supply wells in the area.
Inhalation of air	• A vapor barrier and sub-slab depressurization system will be installed as a construction measure in the proposed new building to prevent potential future soil vapor intrusion at the Site.

Summary of the Remedy

The proposed remedy achieves the remedial action objectives established for the redevelopment project. The remedial action is protective of the public health and environment, is compliant with remedial goals, SCGs, and RAOs, demonstrates short-term and long-term effectiveness, will result in the reduction of toxicity, mobility, and volume of contaminants through treatment, is implementable, cost effective, compatible with land use, and will generally be acceptable to the surrounding community.

The proposed remedial action will consist of the following:

1. Excavation of soil/fill exceeding Track 2 Restricted Residential Use SCOs. Please note that, in connection with PCE and PCE degradation products in soil, Track 1 Unrestricted Use SCOs will be applied since the local water table is shallow and has been impacted by PCE. **Tables 1-6** list the contaminants of concern and planned cleanup goals.
2. Implementation of a Community Air Monitoring Plan during earth disturbing work.
3. Screening for indications of contamination (by visual means, odor, and monitoring with PID) of excavated soil during any intrusive Site work.

4. Collection and analysis of end-point samples to evaluate the performance of the remedy with respect to attainment of Track 1 Unrestricted Use SCOs for volatile organic compounds (VOCs) and Track 2 Restricted Residential Use SCOs for SVOCs and metals.
5. Appropriate off-Site disposal of all material removed from the Site in accordance with Federal, State and local rules and regulations for handling, transport, and disposal.
6. Import of materials to be used for backfill and cover in compliance with: (1) chemical limits and other specifications included in **Table 14**, (2) all Federal, State and local rules and regulations for handling and transport of material.
7. Responsibilities associated with the Remedial Action, including permitting requirements and pretreatment requirements, will be addressed in accordance with applicable Federal, State, and local rules and regulations.
8. Installation of engineering controls to address potential volatile organic vapor intrusion into the new Site building (vapor barrier and sub-slab depressurizations system) (**Figures 12 and 13**).
9. Installation of groundwater monitoring wells to document natural attenuation of groundwater contamination after source removal.
10. Implementation of institutional controls on the Site and preparation of a Site Management Plan (SMP) to ensure the integrity of the controls over time.
11. Responsibilities associated with the Remedial Action, including permitting requirements and pretreatment requirements, will be addressed in accordance with applicable Federal, State, and local rules and regulations.

REMEDIAL ACTION WORK PLAN

1.0 INTRODUCTION

1731 West Farms Road LLC entered into a Brownfield Cleanup Agreement (BCA) with the New York State Department of Environmental Conservation (NYSDEC) in April 2020 to remediate a 9,723 square-foot property located at 1731 West Farms Road, Bronx, New York (the "Site"). 1731 West Farms Road LLC is a Volunteer in the Brownfield Cleanup Program. Residential use is proposed for the Site. When completed, the Site will contain one 11-story multi-family residential apartment building with no basement that will contain 70 rental units. The proposed building will include a community room on the third floor, including 35 bicycle spaces and 4 washers and dryers.

The proposed building will occupy 61% of the lot. The rear yard will be reserved for 2-level parking consisting of an enclosed parking area on the first floor as well as an open parking area on the second floor. The front area of the building, between the building line and the property line, will include a small planting area.

Development will involve demolition of the site and planned excavation shall consist of five feet below ground surface (bgs) at foundation walls and footings, and at the elevator pit.

Requestor will be applying for and thereafter utilizing 421-a(16) tax credits in connection with such project. The remedial program shall commence after requestor receives a notice to proceed and a building permit, which is expected to occur in June 2020. Thereafter, requestor will commence remediation and diligently pursue such activities to completion. Refer to the Brownfield Cleanup Program (BCP) application for additional details.

This Remedial Action Work Plan (RAWP) summarizes the nature and extent of contamination as determined from data gathered during the Remedial Investigation (RI) performed in October 2019 and the Supplemental RI performed in January 2020. It provides an evaluation of a Track 2 cleanup for metals, and SVOCs, and a Track 2 Cleanup for VOCs, but will also reference Track 1 standards for VOCs as the applicant will seek to achieve Track 1 standards for those contaminants. The remedy described in this document is consistent with the procedures defined in DER-10 and complies with all applicable standards, criteria and guidance. The remedy described in this document also complies with all applicable federal, state and local laws, regulations and requirements.

1.1 Site Location and Description

The Site is located in the County of The Bronx, New York, New York and is identified as Block 3015 and Lot 31 on the New York City Tax Map. A Site Location Map (**Figure 1**) shows the Site location. The Site is situated on an approximately 9,723 square-foot parcel and is bounded by a two-story commercial building to the north, a large commercial self-storage building to the south, West Farms Road to the east, and a single-story building containing a construction contractor to the west (See **Figure 2**). A boundary map is attached to the BCA as required by Environmental Conservation Law (ECL) Title 14 Section 27-1419. The 9,723 square-foot Site is fully described in **Appendix A** – Metes and Bounds.

1.2 Contemplated Redevelopment Plan

The Remedial Action to be performed under the RAWP is intended to make the Site protective of human health and the environment consistent with the contemplated end use. The proposed redevelopment plan and end use is described herein to provide the basis for this assessment. However, the Remedial Action contemplated under this RAWP may be implemented independent of the proposed redevelopment plan.

Development plans for the Site consist of the construction of one new 11-story residential building with no basement and paved exterior at-grade recreation area at the west (rear) side of the Site. The gross size of the building will be 68,781.5 square feet and contains contain 70 rental units. The proposed building will include a community room on the third floor, including 35 bicycle spaces and 4 washers and dryers. The proposed building will occupy 61% of the lot. The rear yard will be reserved for 2-level parking consisting of an enclosed parking area on the first floor as well as an open parking area on the second floor. The front area of the building, between the building line and the property line, will include a small planting area. The new building will be used for affordable housing. The Site is located partially in an R7X residential district and partially in an R7A residential district, both within an Inclusionary Housing Designated Area.

1.3 Description of Surrounding Properties

Properties adjacent to the Site contain a two-story commercial building to the north, a large commercial self-storage building to the south, West Farms Road to the east, and a single-story building containing a construction contractor to the west. There are no schools, day care facilities, hospitals, or other sensitive receptors within approximately 500 feet of the Site. No residential properties are located adjacent to the Site. Sensitive receptors identified within one-half mile of the Site include:

Schools:

- East Bronx Academy for the Future, 1716 Southern Blvd., Bronx, NY 10460, (718) 861-8641 1,500 feet west. Sarah Scrogin
- Fairmont Neighborhood School, 1550 Vyse Ave., Bronx, NY 10460, (718) 860-5210, 1,100 feet west-southwest. Monique Hibbert
- Mott Hall V High School, 1551 E. 172nd St., Bronx, NY 10472 (718) 620-8160, 1,400 feet east-southeast. Peter Oroszlansky
- Fannie Lou Hammer Freedom High School, 1021 Jennings St., Bronx, NY 10460 (718) 861-0521, 1,600 feet south. Phoebe Boyer
- The Lorraine Hansberry Academy, 1970 West Farms Rd., Bronx, NY 10460, 1,600 feet north. David Cintron
- St. Thomas Aquinas Catholic School, 1909 Daly Ave., Bronx, NY 10460 (718) 893-7600, 2,000 feet north-northwest. Jessica Perez-Maldonado
- Public School 196, 1250 Ward St., Bronx, NY 10472 (718) 328-7187, 2,100 feet southeast. Lizette Graciani
- Bronx Envision Academy High School, 1619 Boston Rd., Bronx, NY 10460, (718) 589-1590, 2,100 feet west. Emily Shu

Day Care

- First Bloom Group Family Day Care, 1553 Bryant Ave., Bronx, NY 10460, (347) 553-1904, 1,000 feet west-southwest. Mariela Eduardo
- Brightside Academy Day Care, 1778 Southern Blvd., Bronx, NY 10460, Tel: (718) 589-5900, Location: 1,400 feet west-northwest, Contact: Jack Safer

The Bronx River is the nearest surface water body to the Site and is located approximately 350 feet to the east beyond West Farms Road, Sheridan Expressway and a public park. No other bodies of water or wetlands are located within 500 feet of the Site.

2.0 DESCRIPTION OF REMEDIAL INVESTIGATION FINDINGS

The Site was investigated during the Remedial Investigation (RI) that was conducted under the approval of the New York City Office of Environmental Remediation (NYCOER). The RI was completed in October 2019 and, based on the findings of the RI, it was determined that the Site needed to be transferred to the New York State BCP. A Supplemental RI was completed in November 2019 to identify the source of the PCE in Site groundwater that was discovered by the RI.

2.1 Summary of Remedial Investigation Performed

The following table summarizes the investigation activities performed at the Site (includes both the RI and the Supplemental RI):

Sample Media	Number of Samples
Soil	23
Groundwater	3
Soil Vapor	6

2.1.1 Borings and Wells

MECC completed the RI in October 2019, which was performed under the NYCOER e-designation program. To perform this work, the following tasks were completed:

- A total of seven soil borings were installed by the RI at the Site (B1 through B7). Soil borings were installed utilizing a Geoprobe® direct-push drill rig equipped with a macro-core sampler and dedicated acetate liners. Soils were collected continuously from ground surface to 15 feet bgs unless bedrock was encountered at shallower depths. Refusal on bedrock occurred at three borings between three feet bgs and nine feet bgs in the western approximately one-third of the Site. No bedrock was encountered to a depth of 15 feet bgs in borings installed at the eastern two thirds of the Site. Non-dedicated sampling equipment was decontaminated in accordance with the procedures specified RI Work Plan approved by NYCOER. The scope of the Supplemental RI

included installation of six borings with a hydraulic direct-push drill rig to a depth of ten feet bgs in the small parking lot at the east end of the Site.

- Three temporary well points were installed into Soil Boring Nos. B2, B5 and B6 during the RI (no groundwater samples were collected during the Supplemental RI). Temporary well points were constructed of one-inch diameter, schedule 40 PVC casing and with 0.010-inch slot. Temporary wells were screened across the water table with a minimum of 10 feet of screen and solid riser to grade. A gravel pack of No. 2 Morie sand was placed in the annulus around the screens.
- Six temporary soil vapor probes (SV1 through SV7) were installed. Temporary soil vapor points were installed utilizing a Geoprobe® direct-push drill rig. At each location, a six-inch stainless-steel screen was installed at the base of the sampling point with polyethylene tubing to grade. Coarse sand was placed surrounding the screen and six inches above. The remainder of the soil vapor point annulus was sealed with bentonite grout to the surface. The depth of sample collection was five feet to seven feet bgs.

2.1.2 Samples Collected

The following samples were collected during the RI. Sample methodology was in accordance with the NYCOER-approved RIWP for the Site.

- For the RI, one shallow (0 to 2 foot) sample and one deep (varied between five to seven feet and seven feet to nine feet) sample was collected from five of the seven borings. One shallow grab sample was collected from B3 since bedrock was encountered at three feet bgs. In addition, the deep sample at B1 was collected from three feet to five feet since shallow bedrock was encountered at five feet bgs. For the Supplemental RI, which was conducted at the exterior parking lot of the Site, one shallow sample (one foot) and one deep (between seven feet and eight feet) sample was collected. All soil samples were collected directly from the acetate lines sampling rod into pre-cleaned, pre-preserved, laboratory supplied glassware.
- One groundwater sample was collected from each temporary well. Groundwater samples were collected in compliance with the USEPA Low Stress (Low Flow) Purging and Sampling Procedure for The Collection of Groundwater Samples From Monitoring Wells (September 2017). Samples were collected directly into pre-cleaned, pre-preserved, laboratory supplied glassware.
- Six temporary soil vapor probes were installed, and one soil vapor sample was collected from each probe. Since the Site building is in degraded condition and exposed to outside air, no indoor air samples were collected.

A tracer gas (helium) was utilized to test the seal around the soil vapor points. Once the integrity of the seal was confirmed at each location, three volumes of air were extracted from each point prior to sample collection with a flow rate of less than 0.2 liters/minute. Soil vapor samples were collected using batch certified six-liter SUMMA vacuum canisters fitted with two-hour flow control regulators with a flow rate of less than 0.2 liters/minute.

2.1.3 Chemical Analytical Work Performed

Soil and groundwater samples obtained during the RI were collected in pre-cleaned, pre-preserved, laboratory-supplied glassware and stored in a cooler on ice for transport to the laboratory. Samples were submitted to Hampton Clarke-Veritech, a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certified laboratory. Each soil and groundwater sample was analyzed for the following:

- TCL VOCs by USEPA Method 8260
- TCL SVOCs by USEPA Method 8270
- TCL pesticides/PCBs by USEPA Method 8081/8082
- TAL metals by USEPA Method 6010/7471 (filtered and unfiltered for groundwater)
- One selected sample was analyzed for PFAS by USEPA Method 537 (Modified)

Soil vapor samples were collected during the RI using batch certified 6-liter SUMMA vacuum canisters fitted with two-hour flow control regulators with a flow rate of less than 0.2 liters/minute. Samples were submitted to Chemtech, a NYSDOH ELAP certified laboratory. Each soil vapor sample was analyzed for VOCs by USEPA Method TO-15.

The twelve (12) grab soil samples collected during the Supplemental RI were analyzed at Hampton Clarke-Veritech under EPA Method 8260 – TCL VOCs.

2.1.4 Documentation

Findings of the RI and the Supplemental RI include the following:

- Soil sample analytical results for the RI identified SVOCs, metals and pesticides concentrations exceeding their respective UUSCOs in both shallow and deep soil. Exceedances of RRUSCOs for metals and SVOC's were detected at three locations in shallow soil only. Such impact at the levels detected at the Site is commonly associated with the presence of historic fill material. While UUSCOs for these substances were exceeded in deeper soil samples, none of them exceeded RRUSCOs.

- Laboratory analysis of the 12 grab soil samples collected during the Supplemental RI has confirmed that the Site is the source of PCE contamination in groundwater. Elevated PCE and PCE degradation product concentrations are present in both shallow and deep soil under a portion of the exterior parking lot at the east end of the Site.
- PCE was detected at concentrations exceeding the NYSDEC Ambient Water Quality Standards (AWGS) in each of three collected groundwater samples. PCE concentrations detected in the samples range from 9.1 ug/l to 610 ug/l. The sample reported by the laboratory as containing the highest PCE concentration was collected from the PCE source area in soil, and at the area where the highest PCE concentration in soil vapor (east parking lot).
- Metals (manganese and sodium) were detected at concentrations exceeding their respective NYSDEC AWQS in the three collected groundwater samples. Because elevated concentrations of these metals were not detected in soils at the Site, the presence of these metals in groundwater is likely due to the chemical composition of bedrock beneath the Site and/or soils within the aquifer.
- High PCE vapor concentrations were detected in five of the six soil vapor sample collected at the Site. PCE vapor concentrations range from 746 micrograms per cubic meter (ug/m^3) of air to 679,000 ug/m^3, with the highest concentration reported in the sample collected at the PCE source area in soil. PCE degradation products were also detected at elevated concentrations in three of the six soil vapor samples and include trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE) and 1,1-dichloroethene (1,1-DCE).

2.3 Site History

2.3.1 Past Uses and Ownership

The current Site improvements were constructed in 1931. Prior to 1931, the Site contained residential buildings. The current Site improvements contained a marble shop/stone mason from 1931 to the 1970s and a machine shop in the 1980s. A dry cleaning and laundry equipment sales operation was present from approximately 1983 until the Site was vacated several years ago (date of vacancy is unknown). Past operators of the dry cleaning and laundry equipment sales and possibly refurbishing operations are WFR Dry Cleaning & Laundry, IPSO NY, Interstate Laundry Parts & Equipment and ASN Laundry Group, Inc. An electrician also occupied the Site concurrently with the dry cleaning equipment sales/refurbishing operation.

No USTs were identified on historical fire insurance maps of the Site, and no physical evidence of USTs exist.

2.3.2 Phase I and RI Reports

Phase I ESA

A Phase I ESA pertaining to the Site was prepared by Federated Environmental Associates, Inc. in May 2019. The Phase I ESA identified the following Recognized Environmental Conditions (RECs) associated with the Site:

- The Site has been assigned an E-Designation for Hazardous Materials by the New York City Department of Planning.
- Historical machine shop
- Historical dry cleaning equipment maintenance/repair.

RI (October 2019)

MECC performed the RI at the Site in October 2019 under the oversight of the NYCOER E-Designation program. The Phase RI included the installation of seven soil borings and collection with collection analysis of two grab soil samples from seven of eight borings, installation of three temporary well points with groundwater sample collection and installation of six temporary soil vapor probes and soil vapor sample collection from each probe. Samples were collected in accordance with NYCOER requirements, NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, and NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York. Soil and groundwater samples were

analyzed for VOCs, SVOCs, metals, pesticides and PCBs; soil vapor samples were analyzed for VOCs (TO-15).

Supplemental RI (February 2020)

The Supplemental RI was completed in February 2020 and consisted of installing six soil borings in a rough grid pattern at that section of the Site parking lot where the highest PCE concentrations were detected in soil, soil vapor and groundwater. These soil borings extended to ten feet bgs (top of the water table). One shallow and one deep grab soil sample was collected for VOC analysis at the laboratory.

2.3.3 Fire Insurance Maps

Historical fire insurance maps for the Site and surrounding area were reviewed for the years available which include 1897 to 2007. Review of the maps is summarized below.

Historical Sanborn Fire Insurance Map Review	
2007, 2006, 2005, 2004, 2003	**Site**: commercial building North: offices and warehouse, shop South: commercial building East: West Farms Road and Sheridan Expressway West: commercial buildings
2002, 2001,1998	**Site**: commercial building North: offices and warehouse, shop, filling station South: commercial building East: West Farms Road and Sheridan Expressway West: commercial building
1996, 1995, 1994, 1993	**Site**: commercial building, machine shop North: offices and warehouse, shop, filling station South: commercial building East: West Farms Road and Sheridan Expressway West: commercial building
1992, 1991, 1989	**Site**: commercial building, machine shop North: auto repair, filling station South: commercial building East: West Farms Road and Sheridan Expressway West: commercial building
1986, 1985, 1983, 1981, 1980, 1979	**Site**: commercial building, marble shop North: auto repair, filling station South: commercial building East: West Farms Road and Sheridan Expressway West: commercial building
1978, 1977	**Site**: commercial building, marble shop North: commercial building, filling station South: commercial building East: West Farms Road and Sheridan Expressway West: commercial building
1969	Site and adjacent are not depicted on map.

1950	**Site**: commercial building, marble shop, house North: commercial building South: houses, small buildings East: West Farms Rd., auto repair, auto junkyard, lumber West: vacant
1928, 1919	Site and adjacent are not depicted on map.
1915	**Site**: house North: iron works South: houses, small buildings East: houses West: vacant
1903, 1901, 1896	**Site**: house North: house South: houses, small buildings East: houses West: vacant

All fire insurance maps available for this Site (as found within the Phase I ESA) were reviewed prior to preparation of the RAWP.

2.4 Geological Conditions

The soil stratigraphy of the Site consists of fill material above bedrock at the western one-third of the Site. Naturally occurring sediment is present below the point where the bedrock surface is roughly eight feet to ten feet bgs and greater. This sediment consists of medium to fine brown sand with varying amounts angular rock fragments, and fine sand and clay Based on the results of MECC's November 2019 Remedial Investigation (RI), groundwater is present at approximately 10 feet bgs at the Site. No groundwater was encountered above bedrock at the west section of the Site where the bedrock surface is above roughly nine feet to ten feet bgs. Groundwater flow at the Site is estimated to be from west to east, towards the Bronx River, which is approximately 350 feet to the east. More information regarding the soils can be found within the Soil boring logs in the RI and Supplemental RI.

2.5 *Contamination Conditions*

2.5.1 Conceptual Model of Site Contamination

Laboratory analysis of soil samples identifies impact to soils throughout the Site in connection with concentrations of metals, pesticides and SVOCs exceeding NYSDEC UUSCOs and metals and SVOCs RRUSCOs. This condition is common to urban fill and, less likely, to past Site operations. The metals and SVOCs that were detected at levels exceeding RRUSCOs are limited to shallow fill at three locations as identified by the RI. PCE and PCE degradation products were detected at concentrations exceeding UUSCOs in shallow and deep samples collected by the Supplemental RI. This condition is limited to a section under the parking lot at the east end of the Site.

Laboratory analysis of the three groundwater samples collected by the RI identifies impact to groundwater, and elevated concentrations of metals (manganese and sodium) exceeding their respective NYSDEC AWQSs is reported. Identified groundwater impact by these two metals is likely related to the chemical composition of local bedrock, which is present at shallow depths. In addition, PCE and PCE degradation products were detected by the laboratory at elevated concentrations in the groundwater samples. This condition is limited to the east end of the Site under the parking lot and at the area where elevated PCE concentrations are present in soil.

Analytical data identified multiple VOCs in each soil vapor sample collected from the Site. Significantly, PCE and PCE degradation products were detected at concentrations exceeding the trigger values for each substance presented in the NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (Final Guidance) whereby mitigation is recommended.

2.5.2 Description of Areas of Concern

Areas of Concern (AOCs) at the Site consist of:

- Metals are present in soil across the Site at concentrations exceeding UUSCOs. Pesticides were also detected at levels exceeding UUSCOs at one location. Metals and SVOCs are present at levels exceeding RRUSCOs at three locations in shallow soil.
- Groundwater at the Site is contaminated by PCE and PCE degradation products
- Elevated levels of PCE in soil vapor exist under the Site as indicated on **Figure 4**.

2.5.3 Identification of Standards, Criteria and Guidance

The applicable SCGs for soil, groundwater, and soil vapor characterization and remediation for this Site include:

- 6 NYCRR Part 371 - Identification and Listing of Hazardous Wastes
- 6 NYCRR Part 375 - Inactive Hazardous Waste Disposal Sites, specifically Part 3756 Remedial Program Soil Cleanup Objectives
- 29 CFR Part 1910.120 - Hazardous Waste Operations and Emergency Response
- TOGS 1.1.1 - Ambient Water Quality Standards & Guidance Values and Groundwater Effluent Limitations
- NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York
- TAGM 3028 - "Contained In" Criteria for Environmental Media: Soil Action Levels
- 40 CFR Part 144 - Underground Injection Control Program
- 6 NYCRR Part 372 - Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities (November 1998)
- DER-23 - Citizen Participation Handbook for Remedial Programs
- OSWER Directive 9200.4-17 - Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites
- CP-43 - Groundwater Monitoring Well Decommissioning Policy
- DER Technical Guidance for Site Investigation and Remediation (DER-10)
- CP-51 – Soil Cleanup Guidance
- DER Green Remediation (DER 31)
- DER Institutional Controls (DER 33)

2.5.4 Soil/Fill Contamination

Contaminants of concern for the Site consist of VOCs, SVOCs, metals and pesticides.

2.5.4.1 Summary of Soil/Fill Data

PCE and PCE degradation products were detected at high concentrations in both shallow and deep soil above the water table under a portion of the parking lot at the east end of the Site. In some samples, PCE is reported at levels exceeding the RRUSCO. Aside from the aforementioned substances (all of which were detected in soil samples collected by the Supplemental RI), no other VOCs were detected at levels above UUSCOs in any of the soil samples collected by the RI or the Supplemental RI.

SVOCs were detected at a single location at levels above both UUSCOs and RRUSCOs (Site parking lot at RI Soil Boring 5). These substances were detected only in the shallow soil sample and consist of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene. No other SVOCs were detected at levels exceeding UUSCOs in any of the 13 shallow and deep soil samples collected by the RI. Metals including chromium, lead copper, cadmium, zinc, nickel and mercury were detected at various levels exceeding UUSCOs is both shallow and deep soil across the Site. Lead and cadmium was detected in shallow soil samples at two locations at levels exceeding RRUSCOs. Pesticides including 4,4'-DDD, 4,4'-DDE and 4,4'-DDT were detected at levels exceeding UUSCOs at a single location in both the shallow and deep soil samples; none of these reported concentrations exceed the RRUSCO. The presence of these compounds was fairly ubiquitous in shallow soils at the Site.

2.5.4.2 Comparison of Soil/Fill with SCGs

Surface and subsurface soil throughout the Site are impacted with SVOCs, metals, and pesticides at concentrations exceeding NYSDEC UUSCOs and/or RRSCOs.

Table 1 through **Table 4** show exceedances of Track 1 Unrestricted SCOs and Track 2 RRUSCOs for all soil/fill at the Site. **Figures 4** through **Figure 6** are spider maps that show the locations and summarizes exceedances from Track 1 UUSCOs and Track 2 RRUSCOs for all soil/fill.

2.5.5 On-Site and Off-Site Groundwater Contamination

2.5.5.1 Summary of Groundwater Data

A limited number of metals (sodium, manganese) were detected above AWQS in groundwater samples collected from the Site. The only VOCs detected in Site groundwater were PCE and PCE degradation products at levels exceeding AWQS. SVOCs, pesticides and PCBs were not detected in groundwater samples collected from the Site. Off-Site groundwater samples were not collected.

2.5.5.2 Comparison of Groundwater Quality with SCGs

The AWQS for PCE is 5.0 ug/l. PCE was detected in the three groundwater samples collected by the RI at concentrations ranging from 9.1 ug/l to 610 ug/l. TCE (PCE degradation product) was detected in one groundwater sample at a concentration of 13 ug/l; the AWGS for this substance is 5.0 ug/l.

Groundwater impact by metals exceeding NYSDEC AWQS at the Site was limited to manganese and sodium. The AWQS for manganese is 300 ug/l; this metal was detected at concentrations ranging from 71 ug/l to 680 ug/l. The AWQS for sodium is 20,000 ug/l; this metal was detected at levels ranging from 61,000 ug/l to 85,000 ug/l. Because elevated concentrations of these metals were not detected in soils at the Site, the presence of these metals in groundwater is likely due to the chemical composition of bedrock beneath the Site and/or soils within the aquifer.

Tables that indicate exceedances from GA groundwater standards in monitoring wells prior to the remedy are shown in **Tables 7** through **Table 12**. A spider map that indicates the location(s) of and summarizes exceedances from GA groundwater standards prior to the remedy is shown in **Figure 6.**

2.5.6 On-Site and Off-Site Soil Vapor Contamination

Multiple VOCs were detected in each soil vapor sample collected from the Site, including compounds for which NYSDOH has established soil vapor/indoor air decision matrices. The VOCs detected in the soil vapor sample and addressed by NYSDOH Final Guidance consist of the following: carbon tetrachloride, 1,1-dichloroethene (1,1-DCE), cis-1,2-dichloroethene (cis-1,2-DCE), trichloroethene (TCE), methylene chloride, perchloroethylene (PCE), 1,1,1-trichloroethane (1,1,1-TCA) and vinyl chloride. No off-site soil vapor samples were collected.

2.5.6.1 Comparison of Soil Vapor with SCGs

Six soil vapor samples collected during the RI and laboratory analytical data were compared to the compounds listed in Table 3.1 of the Air Guideline Values derived by the Final Guidance updated in May 2017. Soil vapor samples collected show that PCE was detected at concentrations ranging from 746 ug/m³ to 679,000 ug/m³. This highest PCE vapor concentration was detected at a location roughly corresponding with that of Soil Boring B5, where the highest PCE concentrations were detected in soil and groundwater. Matrix B of the NYSDOH Final Guidance recommends "Mitigation" for PCE concentrations exceeding 1,000 ug/m³.

TCE was detected in the samples at concentrations ranging from 13.4 ug/m³ to 14,500 ug/m³. Matrix A of the Final Guidance recommends mitigation for TCE concentrations exceeding 60 ug/m³.

Further, cis-1,2-DCE was reported at concentrations ranging from 1.47 ug/m³ to 9,120 ug/m³. The highest reported VOC concentrations detected by this sampling event appear to be centered under the parking lot at the east end of the Site. This parking area is also the location where the highest PCE concentration was detected in groundwater. Matrix A of the Final Guidance recommends mitigation for cis-1,2-DCE concentrations exceeding 60 ug/m³.

Data collected during the RI is sufficient to delineate the distribution of contaminants in soil vapor at the Site. A summary table of data for chemical analyses performed on soil vapor samples is included in **Table 13**.

Figure 4 shows the location and posts the values for soil vapor samples with detected concentrations.

2.6 Environmental and Public Health Assessments

2.6.1 Qualitative Human Health Exposure Assessment

Soil at the Site is impacted with VOCs SVOCs, metals and pesticides. Possible exposure pathways are by ingestion, inhalation, or dermal exposure by a person on the Site. The Site is surrounded by a locked perimeter fence which limits access to the Site to authorized personnel. As such potential exposures would be limited to periods when ground intrusive work is being performed.

During remediation and Site development, human receptors will be limited to construction workers and related personnel. Potential off-Site receptors include workers and residents in surrounding commercial and residential properties.

Environmental Media & Exposure Route	**Human Assessment**
Direct contact with surface soils	The Site is entirely covered by the existing building and exterior asphalt paving access to the Site is restricted by fencing.
Direct contact with subsurface soils	Direct contact to subsurface soils may occur during ground intrusive work at the Site. Such contact will be managed during remediation by implementing a HASP and CAMP.
Direct contact with groundwater	Direct contact to groundwater may occur during ground intrusive work at the Site. Such contact will be managed during remediation by implementing a HASP and CAMP.
Ingestion of groundwater	Groundwater is not utilized for drinking water. Drinking water is supplied by the municipal water supply. There are no known domestic water supply wells in the area.
Inhalation of air	A vapor barrier and sub-slab depressurization system will be installed as a construction measure in the proposed new building to prevent potential future soil vapor intrusion at the Site.

2.6.2 Fish & Wildlife Remedial Impact Analysis

A Fish and Wildlife Resources Impact Analysis is not required for this Site as there are no known or potential adverse impacts to fish and wildlife resources. Due to the nature of impact at the Site, and the groundwater flow direction beneath the Site (toward the east), contamination at the Site does not appear to have the potential to migrate to, erode into or otherwise impact any on-Site or off-Site habitat of endangered, threatened or special concern species or any other fish and wildlife resource.

2.7 Interim Remedial Action

No Interim Remedial Actions (IRMs) have been performed at the Site.

2.8 Remedial Action Objectives

Based on the results of the RI and Supplemental RI, the following Remedial Action Objectives (RAOs) have been identified for this Site as set forth below.

2.8.1 Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation of, or exposure to, contaminants volatilizing from contaminated soil and groundwater.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater or surface water contamination.
- Prevent impacts to biota due to ingestion/direct contact with contaminated soil that would cause toxicity or bioaccumulation through the terrestrial food chain.

3.0 DESCRIPTION OF REMEDIAL ACTION PLAN

3.1 Evaluation of Remedial Alternatives

Each remedial alternative is summarized below. The following alternatives were developed that are designed to satisfy the Site RAOs detailed in Section 2.7:

- Alternative 1 – excavation of all soils exceeding NYSDEC UUSCOs (Track 1).
- Alternative 2 – excavation of all soils exceeding NYSDEC RRSCOs (Track 2).

Please note that under both alternatives, all soil containing PCE at concentrations exceeding UUSCOs shall be removed in order to eliminate the source of groundwater contamination and to reduce PCE vapor concentrations. Each alternative was evaluated based upon consideration of the following criteria in accordance with Part 375-1.8(f):

- Protection of human health and the environment;
- Compliance with standards, criteria, and guidelines (SCGs);
- Short-term effectiveness and impacts;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume of contaminated material;
- Implementability;
- Cost effectiveness;
- Community Acceptance; and
- Land use.

The following Remedial Action standards, criteria, and guidance were also considered in evaluating the two alternatives.

- 6 NYCRR Part 375-6 Soil Cleanup Objectives
- New York State Groundwater Quality Standards – 6 NYCRR Part 703;
- NYSDEC Ambient Water Quality Standards and Guidance Values – TOGS 1.1.1;
- NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation - December 2002 (or later version if available);
- NYSDEC Draft Brownfield Cleanup Program Guide – May 2004;

- New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan
- NYS Waste Transporter Permits – 6 NYCRR Part 364;
- NYS Solid Waste Management Requirements – 6 NYCRR Part 360 and Part 364;

3.1.1 Alternative 1 – Soil Excavation in Excess of UUSCOs (Track 1 Cleanup)

Alternative 1 is the most comprehensive and would include excavation of all soils from the Site in excess of their respective Unrestricted Use SCOs. This action would include excavation of the majority of soil above the water table across the Site with the exception of the area of shallow bedrock. Engineering controls would continue to be required due to elevated concentrations of volatile organic vapors. Groundwater monitoring for attenuation would also continue to be required under Alternative 1.

3.1.1.1 Overall Protectiveness of Public Health and the Environment

Alternative 1 would achieve the RAOs for surface soil and subsurface soil.

3.1.1.2 Compliance with Remedial Goals, SCGs, and RAOs

Alternative 1 could meet compliance with remedial goals, SCGs and RAOs for the Site by meeting Unrestricted Use SCOs.

3.1.1.3 Short-Term Impacts and Effectiveness

The short-term adverse impacts and exposure to the public and the environment during the implementation of Alternative 1 are minimal. Short-term exposure to on-Site workers during excavation and loading activities will be addressed with a HASP and mitigated through the use of personal protective equipment, monitoring and engineering controls employed during remedial and construction activities. Potential short-term exposure to the surrounding community will be addressed through the use of odor and dust-suppression techniques and through the implementation of a CAMP which will require air monitoring activities during excavation and soil disturbance activities.

3.3.1.4 Long-Term Effectiveness and Permanence

Alternative 1 achieves long term effectiveness and permanence by removing soils affected by Site contaminants above Unrestricted Use SCOs. Under this alternative, risk from soil impact is eliminated for future on-Site residents and off-Site residents. This alternative will continue to meet RAOs for soil in the future, providing a permanent long-term solution for the Site.

3.1.1.5 Reduction of Toxicity, Mobility or Volume through Treatment

Alternative 1 will permanently eliminate the toxicity, mobility, and volume of contaminants from on-Site surface soil, and subsurface soil by meeting UUSCOs.

3.1.1.6 Implementability

Alternative 1 can be implemented using readily available and proven technologies. Both the technical and non-technical aspects of implementing this alternative are feasible, although substantial shoring of buildings at adjoining properties to the north and south of the Site may be necessary.

3.1.1.7 Cost-Effectiveness,

The estimated costs associated with the implementation of Alternative 1 range from approximately $500,000 in capital costs (dependent on the actual total volume of impacted soil to be removed and disposed). The capital costs for this estimate include the construction, equipment, materials, waste disposal, and indirect capital costs such as engineering and design expenses, and legal and administrative costs. Additional costs of up to $100,000 may be incurred for foundation shoring at buildings in properties adjoining the Site. Post-remedial Site control (PRSC) costs will be incurred since PCE-contaminated groundwater and soil vapor is present. Implementation of an SMP, planned installation of engineering controls, groundwater monitoring wells and annual certifications for 20 years estimated at $250,000.

3.1.1.8 Compatibility with Land Use,

The proposed future land use is multi-family residential. Alternative 1 is compatible with respect to the proposed land use and to land uses in the vicinity of the Site. The alternative is consistent with NYSDEC BCP goals for cleanup of contaminated land and brings the Site into productive use. The alternative is protective of natural and cultural resources.

3.1.2 Alternative 2 – Soil Excavation in Excess of RRSCOs (Track 2 Cleanup)

Alternative 2 would include excavation of all soils from the Site in excess of their respective Restricted Residential Use SCOs. This alternative does include removing all soil containing PCE at levels exceeding UUSCOs. The approximate excavation areas for Alternative 2 are illustrated in **Figure 7**.

3.1.2.1 Overall Protectiveness of Public Health and the Environment

Alternative 2 would achieve the RAOs for surface soil and subsurface soil.

3.1.2.2 Compliance with Remedial Goals, SCGs, and RAOs

Alternative 2 could meet compliance with remedial goals, SCGs and RAOs for the Site by meeting Restricted Residential Use SCOs and by removing the source of PCE contamination in groundwater.

3.1.2.3 Short-Term Impacts and Effectiveness

The short-term adverse impacts and exposure to the public and the environment during the implementation of Alternative 2 are minimal. Short-term exposure to on-Site workers during excavation and loading activities will be addressed with a HASP and mitigated through the use of personal protective equipment, monitoring and engineering controls. Potential short-term exposure to the surrounding community will be addressed through the use of odor and dust-suppression techniques and through the implementation of a CAMP which will require air monitoring activities during excavation and soil disturbance activities.

3.1.2.4 Long-Term Effectiveness and Permanence

Alternative 2 achieves long term effectiveness and permanence by removing soils affected by Site contaminants above RRUSCOs. Under this alternative, risk from soil impact is eliminated for future on-Site residents and off-Site residents. This alternative will continue to meet RAOs for soil in the future, providing a permanent long-term solution for the Site.

3.1.2.5 Reduction of Toxicity, Mobility or Volume through Treatment

Alternative 2 will permanently eliminate the toxicity, mobility, and volume of contaminants from on-Site surface soil and subsurface soil by meeting RRUSCOs and by meeting UUSCOs for the PCE-impacted soil area.

3.1.2.6 Implementability

Alternative 2 can be implemented using readily available and proven technologies. Both the technical and non-technical aspects of implementing this alternative are feasible.

3.1.2.7 Cost-Effectiveness

The estimated cost associated with the implementation of Alternative 2 is approximately $230,000 in capital costs (range is dependent on the actual total volume of impacted soil to be removed and disposed). The capital costs for this estimate include the construction, equipment, materials, waste disposal, and indirect capital costs such as engineering and design expenses, and legal and administrative costs. Implementation of an SMP, planned installation of engineering controls, groundwater monitoring wells and annual certifications for 20 years estimated at $250,000.

3.1.2.8 Compatibility with Land Use

The proposed future land use is multi-family residential. Alternative 2 is compatible with respect to the proposed land use and to land uses in the vicinity of the Site. The alternative is consistent with NYSDEC BCP goals for cleanup of contaminated land and brings the property into productive use. The alternative is protective of natural and cultural resources.

3.2 Selection of the Preferred Remedy

Based upon the findings of the RI, the location and depth of soil impact, the lithology and hydrogeologic conditions at the Site, green remediation guidelines, and the proposed schedule for the future redevelopment of the Site, the applicant proposes to implement Alternative 2 as the remedial action.

3.2.1 Zoning

The Site is located partially in an R7X residential district and partially in an R7A residential district, both within an Inclusionary Housing Designated Area.

3.2.2 Applicable Comprehensive Community Master Plans or Land Use Plans

There are no current comprehensive community master plans or land use plans pertaining to or in the vicinity of the Site.

3.2.3 Surrounding Property Uses

Adjoining properties are used for commercial purposes and a public park is located to the east across West Farms Road and Sheridan Expressway. Residential properties are located farther to the west beyond commercial properties and Boone Avenue.

3.2.4 Citizen Participation;

In accordance with DER-23, a 45-day comment period will be open to the community following submission of this RAWP to the NYSDEC.

3.2.5 Environmental Justice Concerns

There are no environmental justice concerns related to the proposed redevelopment of the Site as the redevelopment will not reasonably be expected to cause or increase a disproportionate burden on the community in which the Site is located, including low-income minority communities, or to result in a disproportionate concentration of commercial or industrial uses in what has historically been a mixed use or residential community.

3.2.6 Land Use Designations

There are no federal or state land use designations for the Site.

3.2.7 Population Growth Patterns

The proposed use of the Site conforms to recent development patterns in the area.

3.2.8 Accessibility to Existing Infrastructure;

The Site is accessible to existing infrastructure, such as the Metropolitan Transit Authority MTA subway lines and bus routes.

3.2.9 Proximity to Cultural Resources;

There are no important cultural resources, including federal or state historic heritage sites or Native American sites located within $^{1}/_{2}$ mile of the Site.

3.2.10 Proximity to Natural Resources

The Site lies approximately 350 feet from the Bronx River. No habitats of endangered, threatened or special concern species or other fish and wildlife resource were identified on the NYS Environmental Resource Mapper in the vicinity of the Site.

3.2.11 Off-Site Groundwater Impacts

No off -Site groundwater samples were collected. Since PCE was detected in groundwater at the east end of the Site, and because groundwater flow is estimated to be towards the east, it is possible that PCE-contaminated groundwater extends beyond the east Site border to a limited distance. The Site is bordered to the east by West Farms Road followed by the Sheridan Expressway followed by a public park. Bronx River is present approximately 350 feet east of the Site beyond these features.

Based on the nature of remaining groundwater impact identified on-Site (i.e., metals that appear to be related to the chemical composition of the weathered bedrock/soils), off-Site groundwater impact by metals does not appear to be a concern.

3.2.12 Proximity to Floodplains

Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) show that the eastern edge of the Site is located in Zone X – Area of Minimal Flood Hazard, 0.2% Annual Chance Flood Hazard (FEMA Map Panel ID: 3604970084F). The remainder of the Site is classified as Zone X – Area of Minimal Flood Hazard.

3.2.13 Geography and Geology of the Site

The Site elevation is roughly 15 feet above mean sea level and borders the west edge of the Bronx River flood plain. Refusal on shallow bedrock occurred before the water table was encountered at borings installed during the RI at the west section of the Site building. Specifically, shallow refusal occurred at 5.5 feet bgs in B1 and at three feet bgs in B3. Borings were initially attempted at the west end of the Site building interior but bedrock was confirmed to be in direct contact with the floor slab. The bedrock surface was encountered at 15 feet bgs in B2 which is below the water table. MECC believes that the bedrock surface rises above the water table in a roughly north to south line between the locations of B1 and B2 (see **Figure 4** for RI boring locations). Bedrock surface slope is therefore estimated to dip down to the east from the exposed rock penetrating the west end of the building floor slab to the east towards West Farms Road. Aside from B1 and B3, all borings extended to below the water table. The shallow aquifer flows above bedrock in unconsolidated sediment; the estimated direction of groundwater flow is from east to west. Bedrock rises steeply to a height of roughly ten feet to 15 feet above surface at the west perimeter of the Site and forms a low ridge oriented in a north to south direction.

The soil stratigraphy of the Site consists of fill material above bedrock at the approximate western half of the Site. Naturally occurring sediment is present below the point where the bedrock surface is roughly five feet bgs and greater. This sediment consists of medium to fine brown sand with angular rock fragments. During the RI, deeper soil below five feet bgs was observed to consist of fine sand with varying amounts of clay.

3.2.14 Current Institutional Controls

There are no institutional controls currently implemented at the Site.

3.3 Summary of Selected Remedial Actions

The proposed remedy achieves the remedial action objectives established for the redevelopment project. The remedial action is protective of the public health and environment, is compliant with remedial goals, SCGs, and RAOs, demonstrates short-term and long-term effectiveness, will result in the reduction of toxicity, mobility, and volume of contaminants through treatment, is implementable, cost effective, compatible with land use, and will generally be acceptable to the surrounding community.

The proposed remedial action will consist of the following:

1. Excavation of soil/fill exceeding Track 2 Unrestricted Use SCOs for SVOCs and metals as listed in **Table 2 and Table 4.**

2. Excavation of soil impacted by PCE and PCE degradation products to levels that are below Track 1 UUSCOs as listed in **Table 1A.**
3. Implementation of a Community Air Monitoring Plan during earth disturbing work.
4. Screening for indications of contamination (by visual means, odor, and monitoring with PID) of excavated soil during any intrusive Site work.
5. Collection and analysis of end-point samples to evaluate the performance of the remedy with respect to attainment of Track 1 and Track 2 SCOs.
6. Appropriate off-Site disposal of all material removed from the Site in accordance with Federal, State and local rules and regulations for handling, transport, and disposal with approvals to accept the material.
7. Import of materials to be used for backfill and cover in compliance with: (1) chemical limits and other specifications included in **Table 14**, (2) all Federal, State and local rules and regulations for handling and transport of material.
8. Responsibilities associated with the Remedial Action, including permitting requirements and pretreatment requirements, will be addressed in accordance with applicable federal, state, and local rules and regulations.
9. Installation of engineering controls to address potential volatile organic vapor intrusion into the new Site building (vapor barrier and sub-slab depressurizations system).
10. Installation of groundwater monitoring wells to document natural attenuation of groundwater contamination after source removal.
11. Implementation of institutional controls on the Site and preparation of a site management plan to ensure the integrity of the controls over time.
12. Responsibilities associated with the Remedial Action, including permitting requirements and pretreatment requirements, will be addressed in accordance with applicable Federal, State, and local rules and regulations.

Remedial activities will be performed at the Site in accordance with this NYSDEC-approved RAWP. Deviations from the RAWP will be promptly reported to NYSDEC for approval and fully explained in the FER.

4.0 REMEDIAL ACTION PROGRAM

4.1 Governing Documents

4.1.1 Standards, Criteria and Guidance

The standards, criteria, and guidance (SQG) for the Site are specified in Section 2.4.2.

4.1.2 Site Specific Health & Safety Plan (HASP)

The HASP has been included as **Appendix B**. The HASP outlines the requirements for training, medical surveillance, daily tailgate meetings, emergency response, and accident and injury reporting.

The MECC Field Team Leader will be responsible for implementing the HASP, completing the daily tailgate safety meetings and performing necessary Industrial Hygiene monitoring as specified in the HASP during excavation work.

MECC and/or the Volunteer's subcontractors will have the option of adopting this HASP or developing their own Site-specific document. If a subcontractor chooses to prepare their own HASP, it must meet the minimum requirements as detailed in the Site HASP prepared by MECC and must be made available to MECC and NYSDEC.

Remedial work performed under this plan will be in full compliance with governmental requirements, including Site and worker safety requirements mandated by United States Occupational Safety and Health Administration (OSHA). Modifications to the HASP may be made with the approval of the MECC Health and Safety Manager and/or Project Manager.

The Volunteer and associated parties preparing the remedial documents submitted to the State and those performing the construction work, are completely responsible for the preparation of an appropriate Health and Safety Plan and for the appropriate performance of work according to that plan and applicable laws.

The HASP and requirements defined in this Remedial Action Work Plan pertain to all remedial and invasive work performed at the Site until the issuance of a Certificate of Completion.

The Site Safety Coordinator will be identified prior to the start of remedial construction, and a resume will be provided to NYSDEC prior to the start of remedial construction.

Confined space entry will comply with all OSHA requirements to address the potential risk posed by combustible and toxic gases.

4.1.3 Quality Assurance Project Plan (QAPP)

The quality assurance project plan (QAPP), included as **Appendix C**, presents the objectives, functional activities, methods, and quality assurance / quality control (QA/QC) requirements associated with sample collection and laboratory analysis for remedial activities. The QAPP follows requirements detailed in DER-10, Section 2.

The components of the QAPP include:

- Project Organization,
- Sampling requirements, including methodology, identification, quantity, volumes, locations, frequency, chain of custody procedures, and sample packaging,
- Field/Laboratory data control requirements,
- Equipment decontamination, and
- Field documentation.

4.1.4 Soil/Materials Management Plan (SoMP)

A Soil/Materials Management Plan (SoMP), further detailed in Section 5.4 of this RAWP, includes detailed plans for managing all soils/materials that are disturbed as the Site, including excavation, handling, storage, transport, and disposal. The SoMP will also include the controls that will be applied to these efforts to assure effective, nuisance-free performance in compliance with all applicable federal, state, and local laws and regulations.

4.1.5 Storm-Water Pollution Prevention Plan (SWPPP)

Applicable laws and regulations pertaining to storm-water pollution prevention will be addressed during remedial activities. Erosion and sediment controls will be in conformance with requirements presented in the New York State Guidelines for Urban Erosion and Sediment Control.

4.1.6 Community Air Monitoring Plan (CAMP)

A Site-specific Community Air Monitoring Plan has been prepared and included as **Appendix D** to provide measures for protection for the downwind community (i.e., off-Site receptors including residences, businesses, and on-Site workers not directly involved in the remedial work) from potential airborne contaminants as a direct result of the remedial activities. The primary concerns for this Site are VOCs, SVOCs, metals, pesticides and dust particulates. A CAMP Figure showing monitoring stations has been included as **Figure 10.**

The CAMP will be implemented and executed in accordance with the NYSDOH Generic CAMP.

4.1.7 Contractors Site Operations Plan (SOP)

The Remedial Engineer has reviewed all plans and submittals for this remedial project (including those listed above and contractor and sub-contractor document submittals) and confirms that they are in compliance with this RAWP. The Remedial Engineer is responsible to ensure that all later document submittals for this remedial project, including contractor and sub-contractor document submittals, are in compliance with this RAWP. All remedial documents will be submitted to NYSDEC and NYSDOH in a timely manner and prior to the start of work.

4.1.8 Citizen Participation Plan

A certification of mailing will be sent by the Volunteer to the NYSDEC project manager following the distribution of all Fact Sheets and notices that includes: (1) certification that the Fact Sheets were mailed, (2) the date they were mailed; (3) a copy of the Fact Sheet, (4) a list of recipients (contact list); and (5) a statement that the repository was inspected on (specific date) and that it contained all of applicable project documents.

No changes will be made to approved Fact Sheets authorized for release by NYSDEC without written consent of the NYSDEC. No other information, such as brochures and flyers, will be included with the Fact Sheet mailing.

The approved Citizen Participation Plan for this project is attached in **Appendix E.**

Document repositories have been established at the following locations and contain all applicable project documents:

Morrisania Library
610 E. 169th St.
Bronx, New York 10466
718-589-9268

Mr. Colbert Nembhard

colbertnembhard@nypl.org.

Hours: Monday – Thursday: 10AM to 7PM

Friday – Saturday: 10AM to 5PM

Sunday: Closed

West Farms Library

2085 Honeywell Ave.

Bronx, New York 10466

718-367-5376

Virginia Quinones

virginiaquinones@nypl.org

Hours: Monday – Thursday: 10AM to 7PM

Friday – Saturday: 10AM to 5PM

Sunday: Closed

4.2 Project Organization

The Remedial Engineer (RE) and Qualified Environmental Professional (QEP) for this project are Karen Tyll, PE and Frank Galdun, respectively. Principal personnel who will participate in the remedial action include an on-Site environmental scientist or engineer (name TBD). The on-Site environmental scientist/engineer will document that the remedial actions are implemented in accordance with this RAWP, HASP, SoMP, and supporting documents, and promptly report any deviations from these documents to the appropriate team members, the RE, and the QEP so that the issue can be rectified in a timely manner. The environmental scientist/engineer will report directly to the QEP and RE and will provide daily summary reports of the Site remedial activities.

An organization chart is included in **Figure 8**.

Resumes of key personnel involved in the Remedial Action are included in **Appendix F**.

4.2.1 Remedial Engineer

The Remedial Engineer for this project will be Karen Tyll, PE. The Remedial Engineer is a registered professional engineer licensed by the State of New York. The Remedial Engineer will have primary direct responsibility for implementation of the remedial program for the Site. The Remedial Engineer will certify in the Final Engineering Report that the remedial activities were observed by qualified environmental

professionals under her supervision and that the remediation requirements set forth in the Remedial Action Work Plan and any other relevant provisions of ECL 27-1419 have been achieved in full conformance with that Plan. Other Remedial Engineer certification requirements are listed later in this RAWP.

The Remedial Engineer will coordinate the work of other contractors and subcontractors involved in all aspects of remedial construction, including soil excavation, stockpiling, characterization, removal and disposal, air monitoring, emergency spill response services, import of back fill material, and management of waste transport and disposal. The Remedial Engineer will be responsible for all appropriate communication with NYSDEC and NYSDOH.

The Remedial Engineer will review all pre-remedial plans submitted by contractors for compliance with this Remedial Action Work Plan and will certify compliance in the Final Engineering Report.

The Remedial Engineer will provide the certifications listed in Section 10.1 in the Final Engineering Report.

4.2.2 Remedial Action Construction Schedule

The estimated duration to complete soil excavation and backfill is approximately 20 business days. A generalized timeline has been prepared to illustrate the proposed schedule starting with the approval of this RAWP and is included as **Table 15**. Following approval of this RAWP by the NYSDEC, a revised timeline with actual dates will be submitted.

4.2.3 Work Hours

The hours for operation of remedial construction will conform to the New York City Department of Buildings construction code requirements or according to specific variances issued by that agency. NYSDEC will be notified by the Volunteer of any variances issued by the Department of Buildings. NYSDEC reserves the right to deny alternate remedial construction hours.

4.2.4 Site Security

Site security will be maintained by utilizing and maintaining the existing six-foot high chain link fence surrounding the property. The fence will be maintained throughout the project and access gates will be kept closed during daily operations and closed and locked at all other times.

4.2.5 Traffic Control

Drivers of trucks leaving the Site with soil/fill will be instructed to proceed without stopping in the vicinity of the Site to prevent neighborhood impacts.

4.2.6 Contingency Plan

This contingency plan is developed for the remedial construction to address the discovery of unknown structures or contaminated media during excavation. Identification of unknown contamination source areas during invasive Site work will be promptly communicated to the NYSDEC Project Manager. Petroleum spills will be reported to the NYSDEC Spill Hotline. These findings will be included in the daily report. If previously unidentified contaminant sources are found during on-Site remedial excavation or development related excavation, sampling will be performed on contaminated source material and surrounding soils and reported to NYSDEC. Chemical analytical testing will be performed for Full List volatiles and semi-volatiles, pesticides/PCBs, and TAL/TCLP metals, as appropriate.

4.2.7 Worker Training and Monitoring

Remedial Site workers will be required, at a minimum, to have completed 29 CFR 1910.120 HAZWOPER, Site safety training, and medical monitoring for Site workers. HAZWOPER training completion certificates will be submitted to the Remediation Engineer before commencement of Site work. Once soils in excess of Unrestricted Use SCOs (for VOCs) and Restricted Residential Use SCOs (for remaining contaminants) have been removed, HAZWOPER training will not be required of Site construction workers.

4.2.8 Agency Approvals

The Volunteer has addressed all SEQRA requirements for this Site. All permits or government approvals required for remedial construction have been, or will be, obtained prior to the start of remedial construction.

The planned end use for the Site is in conformance with the current zoning for the Site as determined by New York City Department of Planning. A Certificate of Completion will not be issued for the project unless conformance with zoning designation is demonstrated.

A complete list of all local, regional and national governmental permits, certificates or other approvals or authorizations required to perform the remedial and development work is attached in **Table 16**. This list includes a citation of the law, statute or code to be complied with, the originating agency, and a contact name and phone number in that agency. This list will be updated in the Final Engineering Report.

All planned remedial or construction work in regulated wetlands and adjacent areas will be specifically approved by the NYSDEC Division of Natural Resources to ensure that it meets the requirements for substantive compliance with those regulations prior to the start of construction. Nothing

in the approved Remedial Action Work Plan or its approval by NYSDEC should be construed as an approval for this purpose.

4.2.9 Pre-Construction Meeting with NYSDEC

A pre-construction meeting will take place with the NYSDEC, the Volunteer, MECC, and the contractor prior to the start of Site mobilization.

4.2.10 Emergency Contact Information

An emergency contact sheet with names and phone numbers is included in **Table 17**. That document will define the specific project contacts for use by NYSDEC and NYSDOH in the case of a day or night emergency.

4.2.11 Remedial Action Costs

The total estimated cost of the Remedial Action is $480,000. An itemized and detailed summary of estimated costs for all remedial activity is attached as Appendix G. This will be revised based on actual costs and submitted as an Appendix to the Final Engineering Report.

4.3 Site Preparation

4.3.1 Mobilization

Mobilization will include the delivery of construction equipment and materials to the Site. Site workers will receive Site orientation and training in accordance with the Site-specific HASP, CAMP, and established policies and procedures to be followed during the implementation of remedial activities. The remediation contractor and all associated subcontractors will each receive a copy of the RAWP, HASP, and CAMP and will be briefed on document contents.

4.3.2 Monitoring Well / Vapor Probe Decommissioning

All previously installed temporary wells and vapor probes were decommissioned during the RI.

4.3.3 Erosion and Sedimentation Controls

Erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff will be placed to protect the excavation work and adjacent areas during excavation activities. Storm water control measures, such as straw hay bales or silt fence, may be utilized during excavation activities to prevent storm water runoff from impacting excavation areas and neighboring sites.

4.3.4 Stabilized Construction Entrance(s)

During Site remediation, continuity will be achieved between the truck wash and the stone-based egress path by placing the truck wash system right before the egress path of the Site. Egress points for truck and equipment transport will be kept clean of dirt and other materials during Site remediation and development, so that trucks will be decontaminated prior to departure from the Site.

4.3.5 Utility Marker and Easements Layout

The Volunteer and its contractors are solely responsible for the identification of utilities that might be affected by work under the RAWP and implementation of all required, appropriate, or necessary health and safety measures during performance of work under this RAWP. The Volunteer and its contractors are solely responsible for safe execution of all invasive and other work performed under this RAWP. The Volunteer and its contractors must obtain any local, State or Federal permits or approvals pertinent to such work that may be required to perform work under this RAWP. Approval of this RAWP by NYSDEC does not constitute satisfaction of these requirements.

The presence of utilities and easements on the Site has been investigated by the Remedial Engineer. It has been determined that no risk or impediment to the planned work under this Remedial Action Work Plan is posed by utilities or easements on the Site.

4.3.6 Sheeting and Shoring

Appropriate management of structural stability of on-Site or off-Site structures during on-Site activities include excavation is the sole responsibility of the Volunteer and its contractors. The Volunteer and its contractors are solely responsible for safe execution of all invasive and other work performed under this Plan. The Volunteer and its contractors must obtain any local, state or federal permits or approvals that may be required to perform work under this Plan. Further, the Volunteer and its contractors are solely responsible for the implementation of all required, appropriate, or necessary health and safety measures during performance of work under the approved Plan.

4.3.7 Equipment and Material Staging

Equipment and materials staging areas will be designated during the remediation activities, in coordination with the Construction Manager to facilitate remediation work and prevent cross-contamination.

4.3.8 Decontamination Area

A temporary decontamination area lined with polyethylene sheeting will be constructed for steam-cleaning or washing excavation and drilling equipment, when appropriate. The location of the decontamination area will be coordinated with the Construction Manager. At a minimum, the decontamination pad will have a 30-mil low-permeability liner, be bermed and sloped to a collection sump to contain and collect fluids, and have side walls to mitigate, to the extent practicable, errant overspray, especially when decontaminating large equipment.

4.3.9 Site Fencing

Site security will be maintained by utilizing and maintaining the existing six-foot high chain link fence surrounding the property. The fence will be maintained throughout the project and access gates will be kept closed during daily operations and closed and locked at all other times.

4.3.10 Demobilization

Following the completion of remedial activities at the Site, equipment and remedial structures will be decontaminated and dismantled and removed from the Site. Sediment and erosion control measures and solid wastes generated during remedial activities (i.e., polyethylene sheeting) will be properly disposed of.

4.4 Reporting

All daily and monthly Reports will be included in the Final Engineering Report.

4.4.1 Daily Reports

Daily reports will be submitted to NYSDEC and NYSDOH Project Managers by the end of each day following the reporting period and will include:

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

Daily reports are not intended to be the mode of communication for notification to the NYSDEC of emergencies (accident, spill), requests for changes to the RAWP or other sensitive or time critical

information. However, such conditions must also be included in the daily reports. Emergency conditions and changes to the RAWP will be addressed directly to NYSDEC Project Manager via personal communication.

Daily Reports will include a description of daily activities keyed to an alpha-numeric map for the Site that identifies work areas. These reports will include a summary of air sampling results, odor and dust problems and corrective actions, and all complaints received from the public.

A Site map that shows a predefined alpha-numeric grid for use in identifying locations described in reports submitted to NYSDEC is attached in **Figure 9**.

The NYSDEC assigned project number will appear on all reports.

4.4.2 Monthly Reports

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

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

4.4.3 Other Reporting

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

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

4.4.4 Complaint Management Plan

Complaints from the public regarding nuisance or other Site conditions will be reported directly to the NYSDEC project manager and included in the daily reports.

4.4.5 Deviations from the Remedial Action Work Plan

In the event that remedial activities require deviation from the RAWP due to unforeseen Site conditions, a detailed description of the conditions and required deviations from the RAWP will be submitted to the NYSDEC project manager. The description will include the reasons that dictate deviation from the RAWP, any changes/editions to the RAWP, and how the proposed remedy is affected.

5.0 REMEDIAL ACTION: MATERIAL REMOVAL FROM SITE

Elevated concentrations of PCE and PCE degradation products are present in a localized area of soil under the Site parking lot; this material will be removed to achieve UUSCOs. SVOCs, metals and pesticide-impact are present within other localized soils at the Site. Soil impacted by these substances at concentrations exceeding RRUSCOs will be excavated and removed from the Site. The total volume to be excavated for off-Site disposal is estimated at approximately 1,200 to 1,500 tons. The final limits of the excavations will be determined in the field based upon confirmatory endpoint soil sample analytical results. The proposed excavation area and depths are illustrated in **Figure 7**.

5.1 Soil Cleanup Objectives

The Soil Cleanup Objectives for this Site are listed in **Table 14** and consist of Unrestricted Use SCOs for PCE and PCE degradation products and RRUSCOs for SVOCs and metals.

Soil and materials management on-Site and off-Site will be conducted in accordance with the Soil Management Plan as described below.

Tables 1 through **Table 6** summarize all soil samples that exceed the SCOs proposed for this Remedial Action. A spider map that shows all soil samples that exceed the SCOs proposed for this Remedial Action is shown in **Figure 4** through **Figure 6**.

UST closures (if any USTs are discovered) will, at a minimum, conform to criteria defined in DER-10.

5.2 Remedial Performance Evaluation (Post-Excavation Endpoint Sampling)

Following removal of impacted soils from the Site, confirmatory endpoint soil samples will be collected from the excavation area to confirm the effectiveness of remedial activities. Endpoint soil samples will be collected in accordance with NYSDEC DER-10. Laboratory analytical data will be compared to NYSDEC UUSCOs and RRUSCOs.

5.2.1 End-Point Sampling Frequency

As specified in NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, verification sampling will consist of collecting endpoint soil samples from within each excavation area. DER-10 specifies a sampling frequency of one bottom sample from the excavation for every 900 square feet of bottom, and one sidewall sample for every 30 linear feet of sidewall. Based on the anticipated excavation areas (**Figure 7**), a minimum of four (4) bottom samples and fourteen (14) sidewall samples would be required based on DER-10. However, at several locations, the excavation area may extend to the bedrock surface. In areas where bedrock is encountered, no bottom endpoint samples will be collected. Additionally, in areas where the excavation extends to the property line, sidewall endpoint samples will not be collected.

Endpoint soil samples will be submitted to a NYSDOH Environmental Laboratory Approval Program (ELAP) certified laboratory and analyzed for:

- TCL SVOCs by USEPA Method 8270
- TAL Metals by USEPA Method 6010/7471
- TCL Pesticides by USEPA Method 8081

5.2.2 Methodology

Excavation soil endpoint samples will be collected when the limits of the remediation excavation have been reached. Endpoint samples will be collected utilizing a properly decontaminated stainless-steel hand auger.

5.2.3 Reporting of Results

Data collected during the remediation will be tabulated and reviewed. The criteria used to identify and quantify the analytes will be those specified for the applicable methods in the USEPA SW-846 and subsequent updates. The data package provided by the laboratory will contain all items specified in the USEPA SW-846 appropriate for the analyses to be performed and be reported in standard format. Data

will also be submitted to NYSDEC Environmental Information Management System in the standardized electronic data deliverable format.

5.2.4 QA/QC

Each set of samples will be analyzed concurrently with calibration standards, method blanks, matrix spikes (MS), matrix spike duplicates (MSD) or laboratory duplicates, and QC check samples (if required by the protocol). MS/MSD samples, as applicable, will be designated by the field personnel. QA/QC protocols are further detailed in the QAPP included as **Appendix C**.

5.2.5 DUSR

Data usability and validation are performed on analytical data sets, primarily to confirm that sampling and chain-of- custody documentation are complete, sample IDs can be tied to specific sampling locations, samples were analyzed within the required holding times, and analyses are reported in conformance to NYSDEC ASP, Category 2 data deliverable requirements as applicable to the method utilized.

Independent third-party data validation will be performed on 5% of the sample data, or on one sample from each sample delivery group, whichever is greater. Data validation will be performed by a qualified subcontractor independent of the project and a Data Usability Summary Report will be included in the FER.

5.2.6 Reporting of End-Point Data in FER

Chemical labs used for all end-point sample results and contingency sampling will be NYSDOH ELAP certified.

End point sampling, including bottom and side-wall sampling, will be performed in accordance with DER-10 sample frequency requirements. Side-wall samples will be collected a minimum of every 30 linear feet. Bottom samples will be collected at a rate of one for every 900 square feet. The FER will provide a tabular and map summary of all end-point sample results and exceedances of SCOs.

5.3 Estimated Material Removal Quantities

The estimated quantity of soil/fill to be removed from the Site is 1,200 to 1,500 tons. The estimated quantity of soil to be imported into the Site for backfill and cover soil will be determined by the actual total volume of material removed as part of remediation.

5.4 Soil/Materials Management Plan

This section presents the approach to managing, disposing, and reusing soil, fill, and debris excavated from the Site. This plan is based on the current knowledge of Site conditions and will be augmented with

additional data collected during remediation, as needed. The Remediation Engineer will monitor and document the handling and transporting of material removed from the Site to a proper disposal facility as a regulated waste or as an unregulated waste, as applicable. The Remediation Engineer will assist the remedial contractor in identifying impacted materials during excavation, determining materials suitable for direct load out versus temporary on-Site stockpiling, selection of samples for waste characterization, and determining the proper off-Site disposal facility.

Stockpiling of impacted soil is not anticipated; however, if stockpiles become necessary, separate stockpile areas will be constructed as needed for the various materials to be excavated or generated, with the intent to most efficiently manage and characterize the materials and to avoid co-mingling impacted materials with non-impacted soil.

5.4.1 Soil Screening Methods

Visual, olfactory and PID soil screening and assessment will be performed by a qualified environmental professional or experienced field technician/geologist under the direction of the Remedial Engineer during all remedial and development excavations into known or potentially contaminated material. Soil screening will be performed regardless of when the invasive work is done and will include all excavation and invasive work performed during the remedy and during development phase, such as excavations for foundations and utility work, prior to issuance of the COC.

Screening will be performed by qualified environmental professionals. Resumes will be provided for all personnel responsible for field screening (i.e. those representing the Remedial Engineer) of invasive work for unknown contaminant sources during remediation and development work.

5.4.2 Stockpile Methods

Stockpiling of impacted soils is not anticipated during the Remedial Action. If the necessity for stockpiling impacted soils arises, the following procedures will be followed.

Stockpiles will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by NYSDEC.

Stockpiles will be kept covered at all times when not actively in use with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced.

Soil stockpiles will be continuously encircled with silt fences. Hay bales will be used as needed near catch basins, surface waters and other discharge points.

Water will be available on-Site at suitable supply and pressure for use in dust control.

5.4.3 Materials Excavation and Load Out

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

The Volunteer and its contractors are solely responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the Site has been investigated by the Remedial Engineer. It has been determined that no risk or impediment to the planned work under this Remedial Action Work Plan is posed by utilities or easements on the Site.

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

Vehicles leaving the Site will not be overloaded. The Remedial Engineer's representative will make reasonable efforts to ensure that vehicles are not loaded beyond their NYSDOT weight rating and that all material is secured beneath the truck bed cover.

A truck wash will be operated on-Site. The Remedial Engineer will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the Site until the remedial construction is complete.

Locations where vehicles enter or exit the Site shall be inspected daily for evidence of off-Site sediment tracking.

The Remedial Engineer will be responsible for ensuring that all egress points for truck and equipment transport from the Site will be clean of dirt and other materials derived from the Site during Site remediation and development. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to Site -derived materials.

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

The Remedial Engineer will ensure that Site development activities will not interfere with, or otherwise impair or compromise, remedial activities proposed in this Remedial Action Work Plan.

Each hotspot and structure to be remediated (USTs, vaults and associated piping, transformers, etc.) will be removed and end-point remedial performance sampling completed before excavations related to Site development commence proximal to the hotspot or structure.

Development-related grading cuts and fills will not be performed without NYSDEC approval and will not interfere with, or otherwise impair or compromise, the performance of remediation required by this plan.

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

5.4.4 Materials Transport Off-Site

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

Truck transport routes are as follows:

- Left (north) on West Farms Road from the Site entrance
- Proceed north on West Farms Road for 3,000 feet
- Turn right (east) on East Tremont Avenue
- Proceed 500 feet to the entry ramp to U.S. Route 95 South.

All trucks loaded with Site materials will exit the vicinity of the Site using only these approved truck routes, unless traffic, road work, or other conditions necessitate alternate routing. Truck operators are responsible for traffic signs and detours.

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

Trucks will be prohibited from stopping and idling in the neighborhood outside the Site.

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

Queuing of trucks will be performed on-Site in order to minimize off-Site disturbance. Off-Site queuing will be prohibited.

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

All trucks will be washed prior to leaving the Site. Truck wash waters will be collected and disposed of off-Site in an appropriate manner.

A Truck Route Map has been included as **Figure 14.**

5.4.5 Materials Disposal Off-Site

The disposal locations are to be determined. Disposal location established at a later date will be reported to the NYSDEC Project Manager.

The total quantity of material expected to be disposed off-Site is estimated at 1,100 tons of PCE-contaminated soil as hazardous waste and 400 tons of nonhazardous soil impacted by SVOCs, metals and pesticides. The total disposal volume will be dependent on the final excavation depths necessary to achieve satisfactory endpoint sample results.

All soil/fill/solid waste excavated and removed from the Site will be treated as contaminated and regulated material and will be disposed in accordance with all local, state (including 6NYCRR Part 360) and federal regulations. If disposal of soil/fill from this Site is proposed for unregulated disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to NYSDEC Project Manager. Unregulated off-Site management of materials from this Site is prohibited without formal NYSDEC approval.

Material that does not meet Track 1 unrestricted SCOs is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

The following documentation will be obtained and reported by the Remedial Engineer for each disposal location used in this project to fully demonstrate and document that the disposal of material derived from the Site conforms with all applicable laws: (1) a letter from the Remedial Engineer or BCP Volunteer, or designee to the receiving facility describing the material to be disposed and requesting formal written acceptance of the material. This letter will state that material to be disposed is contaminated material generated at an environmental remediation Site in New York State. The letter will provide the project identity and the name and phone number of the Remedial Engineer. The letter will include as an attachment a summary of all chemical data for the material being transported (including Site Characterization data); and (2) a letter from all receiving facilities stating it is in receipt of the

correspondence (above) and is approved to accept the material. These documents will be included in the FER.

Non-hazardous historic fill and contaminated soils taken off-Site will be handled, at minimum, as a Municipal Solid Waste per 6 NYCRR Part 360-1.2. All PCE-impacted soil will be classified as hazardous waste.

Historical fill and contaminated soils from the Site are prohibited from being disposed at Part 360-16 Registration Facilities (also known as Soil Recycling Facilities).

Soils that are contaminated but non-hazardous and are being removed from the Site are considered by the Division of Materials Management (DMM) in NYSDEC to be Construction and Demolition (C/D) materials with contamination not typical of virgin soils. These soils may be sent to a permitted Part 360 landfill. They may be sent to a permitted C/D processing facility without permit modifications only upon prior notification of NYSDEC Region 2 DMM. This material is prohibited from being sent or redirected to a Part 360-16 Registration Facility. In this case, as dictated by DMM, special procedures will include, at a minimum, a letter to the C/D facility that provides a detailed explanation that the material is derived from a DER remediation Site, that the soil material is contaminated and that it must not be redirected to on-Site or off-Site Soil Recycling Facilities. The letter will provide the project identity and the name and phone number of the Remedial Engineer. The letter will include as an attachment a summary of all chemical data for the material being transported.

The Final Engineering Report will include an accounting of the destination of all material removed from the Site during this Remedial Action, including excavated soil, contaminated soil, historic fill, solid waste, and hazardous waste, non-regulated material, and fluids. Documentation associated with disposal of all material must also include records and approvals for receipt of the material. This information will also be presented in a tabular form in the FER.

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

Hazardous wastes derived from on-Site will be stored, transported, and disposed of in full compliance with applicable local, state, and federal regulations.

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

Waste characterization will be performed for off-Site disposal in a manner suitable to the receiving facility and in conformance with applicable permits. Sampling and analytical methods, sampling frequency, analytical results and QA/QC will be reported in the FER. All data available for soil/material to be disposed at a given facility must be submitted to the disposal facility with suitable explanation prior to shipment and receipt.

5.4.6 Materials Reuse On-Site

Materials reuse on-Site is not anticipated. In the event that materials will be reused, NYSDEC will be notified in advance and provided with details regarding the material's origin, volumes and sampling data. Such material will not be reused on-Site without approval from the NYSDEC project manager.

Concrete crushing or processing on-Site is prohibited.

Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the Site is prohibited for reuse on-Site.

Contaminated on-Site material, including historic fill and contaminated soil, removed for grading or other purposes will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines. This will be expressed in the final Site Management Plan.

5.4.7 Fluids Management

All liquids to be removed from the Site, including dewatering fluids, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Liquids discharged into the New York City sewer system will be addressed through approval by NYCDEP. Construction design of the new Site building is not anticipated to intersect the water table.

Dewatered fluids will not be recharged back to the land surface or subsurface of the Site. Dewatering fluids will be managed off-Site.

Discharge of water generated during remedial construction to surface waters (i.e. a local pond, stream or river) is prohibited without a SPDES permit.

5.4.8 Demarcation

In the event that a Track 1/Track2 Cleanup cannot be achieved, a demarcation layer will be established; if Track 1/Track 2 is achieved, demarcation will not be necessary. Should demarcation be necessary, after the completion of soil removal and any other invasive remedial activities and prior to backfilling, a land survey will be performed by a New York State licensed surveyor. The survey will define the top elevation of residual contaminated soils. A physical demarcation layer, consisting of orange

snow fencing material or equivalent material will be placed on this surface to provide a visual reference. This demarcation layer will constitute the top of the 'Residuals Management Zone', the zone that requires adherence to special conditions for disturbance of contaminated residual soils defined in the Site Management Plan. The survey will measure the grade covered by the demarcation layer before the placement of cover soils, pavement and sub-soils, structures, or other materials. This survey and the demarcation layer placed on this grade surface will constitute the physical and written record of the upper surface of the 'Residuals Management Zone' in the Site Management Plan. A map showing the survey results will be included in the Final Engineering Report and the Site Management Plan.

5.4.9 Backfill from Off-Site Sources

All materials proposed for import onto the Site will be approved by the Remedial Engineer and will be in compliance with provisions in this RAWP prior to receipt at the Site.

Material from industrial sites, spill sites, other environmental remediation sites or other potentially contaminated sites will not be imported to the Site.

If sampling of material imported to the Site is required, sampling will be conducted in accordance with DER-10 Section 5.4. The NYSDEC will be consulted prior to importation of any fill material.

The Final Engineering Report will include the following certification by the Remedial Engineer: "I certify that all import of soils from off-Site, including source evaluation, approval and sampling, has been performed in a manner that is consistent with the methodology defined in the Remedial Action Work Plan".

All imported soils will meet NYSDEC approved backfill or cover soil quality objectives for this Site. These NYSDEC approved backfill or cover soil quality objectives are the Unrestricted Use Soil Cleanup Objectives as set forth in Table 375-6.8(b) of 6 NYCRR Part 375 and listed in **Table 14**. Non-compliant soils will not be imported onto the Site without prior approval by NYSDEC. Nothing in the approved Remedial Action Work Plan or its approval by NYSDEC should be construed as an approval for this purpose.

Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this Site, will not be imported onto the Site without prior approval by NYSDEC. Nothing in this Remedial Action Work Plan should be construed as an approval for this purpose.

Solid waste will not be imported onto the Site.

Trucks entering the Site with imported soils will be securely covered with tight fitting covers.

5.4.10 Stormwater Pollution Prevention

Based on the size of the Site (less than one acre), a formal Storm Water Pollution Prevention Plan (SWPPP) is not necessary. Storm water pollution prevention measures detailed below will be implemented during remedial activities.

- Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by NYSDEC. All necessary repairs shall be made immediately.
- Accumulated sediments will be removed as required to keep the barrier and hay bale check functional.
- All undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials.
- Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.
- Erosion and sediment control measures identified in the RAWP shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters
- Silt fencing or hay bales will be installed around the entire perimeter of the remedial construction area.

5.4.11 Contingency Plan

If underground tanks or other previously unidentified contaminant sources are found during on-Site remedial excavation or development-related construction, sampling will be performed on product, sediment and surrounding soils, etc. Chemical analytical work will be for full scan parameters (TAL metals; TCL volatiles and semi-volatiles, TCL pesticides and PCBs). These analyses will not be limited to STARS parameters where tanks are identified without prior approval by NYSDEC. Analyses will not be otherwise limited without NYSDEC approval.

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

5.4.12 Community Air Monitoring Plan

A Site-specific Community Air Monitoring Plan (CAMP) has been prepared to provide measures for protection for the downwind community from potential airborne contaminants as a direct result of remedial activities. The CAMP is included as **Appendix D**.

The CAMP will be implemented and executed in accordance with the New York State Department of Health's (NYSDOH) Generic Community Air Monitoring Plan.

A map showing the location of fixed and mobile sampling stations is shown in **Figure 10**.

Exceedances observed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers and included in the Daily Report.

5.4.13 Odor, Dust and Nuisance Control Plan

The Final Engineering Report will include the following certification by the Remedial Engineer: "I certify that all invasive work during the remediation and all invasive development work were conducted in accordance with dust and odor suppression methodology defined in the Remedial Action Work Plan."

5.4.13.1 Odor Control Plan

This odor control plan is capable of controlling emissions of nuisance odors off-Site. Specific odor control methods to be used on a routine basis will include wetting soils to prevent off-Site migration, application of a foam suppressant on the source area, and/or covering the source area with a tarp. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of all other complaints about the project. Implementation of all odor controls, including the halt of work, will be the responsibility of the Volunteer's Remedial Engineer, who is responsible for certifying the Final Engineering Report.

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

Where odor nuisances have developed during remedial work and cannot be corrected, or where the release of nuisance odors cannot otherwise be avoided due to on-Site conditions or close proximity to

sensitive receptors, odor control will be achieved by sheltering excavation and handling areas under tented containment structures equipped with appropriate air venting/filtering systems.

5.4.13.2 Dust Control Plan

A dust suppression plan that addresses dust management during invasive on-Site work, will include, at a minimum, the items listed below:

- Water will be available on-site at suitable supply and pressure for use in dust control.
- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, non-vegetated soils vulnerable to dust production.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-Site roads will be limited in total area to minimize the area required for water spraying.

5.4.13.3 Other Nuisances

A plan for rodent control will be developed and utilized by the contractor prior to and during Site clearing and Site grubbing, and during all remedial work.

A plan will be developed and utilized by the contractor for all remedial work and will conform, at a minimum, to NYCDEP noise control standards.

6.0 ENGINEERING CONTROLS

6.1 Vapor Barrier

Migration of soil vapor from onsite or offsite sources into the building will be mitigated with a combination of building slab and vapor barrier. The vapor barrier will consist of a 20-mil thick VaporBlock Plus manufactured by Raven or equivalent vapor barrier under the new Site building floor slab and around all subgrade perimeter walls. The vapor barrier will be installed in accordance with manufacturer specifications.

A plan view showing the location of the proposed vapor barrier system is provided in **Figure 12**. Typical design sections for the vapor barrier on slab and sidewalls are also provided in **Figure 13**. Product specification sheets are provided in Appendix H. The Remedial Action Report will include as-built drawings and diagrams; manufacturer documentation; and photographs. The Remedial Action Report will include a PE-certified letter (on company letterhead) from the primary contractor responsible for installation oversight and field inspections and a copy of the manufacturer's certificate of warranty.

The Vapor Barrier System is a permanent engineering control and will be inspected and its performance certified at specified intervals as required by this RAWP and the Site Management Plan. A Materials Management Plan will be included in the Site Management Plan and will outline the procedures to be followed in the event that the composite cover system and underlying vapor barrier system is disturbed after the remedial action is complete. Maintenance of these systems will be described in the Site Management Plan in the Remedial Action Report.

The vapor barrier product specifications are included in **Appendix G**.

6.2 Sub-Slab Depressurization System

Migration of soil vapor into the building will be addressed with the construction of an active sub-slab depressurization system.

The SSDS will prevent soil vapor from accumulating in the building by creating a negative pressure zone beneath the entire floor slab. To create this negative pressure zone, the active SSDS will consist of three-inch diameter perforated schedule 40 PVC pipe installed within six-inches of three quarter to one-inch clean gravel with no sharp edges beneath the slab and the vapor barrier. The recommended layout will provide sufficient coverage in accordance with USEPA sub-slab depressurization design specifications. The SSDS will be outfitted with a collection point and riser. The riser will consist of a 3 inch diameter solid steel or cast iron pipe. The riser will be extended approximately 4 feet above roof of the building and will actively exhaust air from beneath the slab to the outdoors. The riser will be placed at a minimum distance of 10 feet from all air intakes. **Figure 12,** show the details of the SSDS. A second

riser and fan will be connected to the SSDS pipe under the building slab to minimize off-site migration of volatile organic vapors.

A manometer will be installed on each riser at an accessible area as a means of confirming that negative pressure is maintained over time. An audible and visual system deactivation alarm will also be incorporated into the SSDS. A RadonAway HS3000 fan will be attached to the risers to create negative pressure under the floor slab.

The SSDS is a permanent engineering control. The system will be inspected and its performance certified at specified intervals as required by this RAWP and the Site Management Plan. Maintenance of this SSDS will be described in the Site Management Plan in the Remedial Action Report.

6.3 Monitoring Wells

Two overburden groundwater monitoring wells will be installed into the West Farms Road sidewalk that adjoins the east side of the Site. The intent of well installation is to monitor attenuation of PCE and PCE degradation products in groundwater. Each well will be constructed of four-inch diameter PVC and will extend to 15 feet bgs with a ten-foot length of 0.02" slotted screen. Biannual groundwater sampling and laboratory analysis for VOCs at each well will be conducted on a biannual basis. Planned monitoring well locations are provided in **Figure 11.** Well construction details are provided in **Figure 11.**

7.0 INSTITUTIONAL CONTROLS

Soil/fill containing certain contaminants at levels exceeding UUSCOs at the Site, and active soil vapor mitigation is required through SSDS. In addition, PCE and PCE degradation products are been present in groundwater at concentrations that exceed applicable regulatory limits. Accordingly, Institutional Controls (ICs) will be incorporated in this remedial action to manage residual soil/fill and other media and render the Site protective of public health and the environment. These ICs define the program to operate, maintain, inspect and certify the performance of Engineering Controls and Institutional Controls on the Site. Institutional Controls would be implemented in accordance with a Site Management Plan included in the Final Engineering Report (FER). Institutional Controls would be:

- This RAWP includes a description of all ECs and ICs and summarizes the requirements of the SMP which will note that the Site owner and Site owner's successors and assigns must comply with the approved SMP;
- Recording of an NYSDEC-approved Declaration of Covenant and Restrictions (DCR) with the New York City Register or county clerk, as appropriate. The DCR will include a description of all ECs and ICs, will summarize the requirements of the SMP, and will note that the Site owner and Site owner's successors and assigns must comply with the DCR and the approved SMP. The recorded DCR will be submitted in the FER.
- Submittal of a SMP in the FER for approval by NYSDEC that provides procedures for appropriate operation, maintenance, and inspection, of ECs and ICs. The SMP will require that the Site owner and Site owner's successors and assigns will submit to NYSDEC a periodic written statement that certifies that: (1) controls employed at the Site are unchanged from the previous certification or that any changes to the controls were approved by OER; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with the SMP. NYSDEC retains the right to enter the Site in order to evaluate the continued maintenance of any controls. This certification shall be submitted at a frequency to be determine by NYSDEC in the SMP and will comply with RCNY §43-1407(l)(3).
- Vegetable gardens and farming on the Site are prohibited in contact with residual soil materials;
- All future activities on the Site that will disturb residual material must be conducted pursuant to the soil management provisions in an approved SMP;
- Use of groundwater underlying the Site is prohibited without treatment rendering it safe for its intended use;
- The Site will be used for residential use and will not be used for a higher level of use without prior approval by NYSDEC.

8.0 SITE MANAGEMENT PLAN

Site Management is the last phase of remediation and begins with the approval of the FER and issuance of the Notice of Completion (NOC) for the Remedial Action. The Site Management Plan (SMP) describes appropriate methods and procedures to ensure implementation of all ECs and ICs that are required by this RAWP. The Site Management Plan is submitted as part of the FER but will be written in a manner that allows its use as an independent document. Site Management continues until terminated in writing by NYSDEC. The Site owner is responsible to ensure that all Site Management responsibilities defined in the Site Management Plan are implemented.

The SMP will provide a detailed description of the procedures required to manage contaminated groundwater following completion of the remedial action in accordance with the BCA with NYSDEC. This includes a plan for: (1) implementation of EC's and ICs; (2) operation and maintenance of EC's; (3) inspection and certification of IC's and EC's.

Site management activities and EC/IC certification will be scheduled by NYSDEC on a periodic basis to be established in the RAR and the SMP and will be subject to review and modification by NYSDEC. The Site Management Plan will be based on a calendar year and certification reports will be due for submission to NYSDEC by July 31 of the year following the reporting period.

9.0 FINAL ENGINEERING REPORT

A Final Engineering Report (FER) will be submitted to NYSDEC following implementation of the Remedial Action defined in this RAWP. The FER provides the documentation that the remedial work required under this RAWP has been completed and has been performed in compliance with this plan. The FER will provide a comprehensive account of the locations and characteristics of all material removed from the Site. The Final Engineering Report will include as-built drawings for all constructed elements, calculation and manufacturer documentation for treatment systems, certifications, manifests, bills of lading as well as the complete Site Management Plan, as needed. The FER will provide a description of the changes in the Remedial Action from the elements provided in the RAWP and associated design documents. The FER will provide a tabular summary of all performance evaluation sampling results and all material characterization results and other sampling and chemical analysis performed as part of the Remedial Action. The FER will provide test results demonstrating that all mitigation and remedial systems are functioning properly. The FER will be prepared in conformance with DER-10.

- Where determined to be necessary by NYSDEC, a Financial Assurance Plan will be required to ensure the sufficiency of revenue to perform long-term operations, maintenance and monitoring tasks defined in the Site Management Plan and Environmental Easement. This determination will be made by NYSDEC in the context of the Final Engineering Report review.
- The Final Engineering Report will include written and photographic documentation of all remedial work performed under this remedy.
- The FER will include an itemized tabular description of actual costs incurred during all aspects of the Remedial Action.
- The FER will provide a thorough summary of all residual contamination left on the Site after the remedy is complete. Residual contamination includes all contamination that exceeds the Track 1 Unrestricted Use SCO in 6NYCRR Part 375-6. A table that shows exceedances from Track 1 Unrestricted SCOs for all soil/fill remaining at the Site after the Remedial Action and a map that shows the location and summarizes exceedances from Track 1 Unrestricted SCOs for all soil/fill remaining at the Site after the Remedial Action will be included in the FER.
- The FER will provide a thorough summary of all residual contamination that exceeds the SCOs defined for the Site in the RAWP and must provide an explanation for why the material was not removed as part of the Remedial Action. A table that shows residual contamination in excess of Site SCOs and a map that shows residual contamination in excess of Site SCOs will be included in the FER.
- The Final Engineering Report will include an accounting of the destination of all material removed from the Site, including excavated contaminated soil, historic fill, solid waste, hazardous waste, non-regulated material, and fluids. Documentation associated with disposal of all material must also include records and approvals for receipt of the material. It will provide an accounting of the origin and chemical quality of all material imported onto the Site.

Before approval of a FER and issuance of a Certificate of Completion, all project reports must be submitted in digital format (PDF).

9.1 Certifications

The following certification will appear in front of the Executive Summary of the Final Engineering Report. The certification will be signed by the Remedial Engineer [Karen Tyll] who is a Professional Engineer registered in New York State This certification will be appropriately signed and stamped. The certification will include the following statements:

I, Karen Tyll, am currently a registered professional engineer licensed by the State of New York. I had primary direct responsibility for implementation of the remedial program for the 1731 West Farms Road Site (NYSDEC BCA Index No. C203113-07-18, Site No. C203113).

I certify that the Site description presented in this FER is identical to the Site descriptions presented in the Environmental Easement, the Site Management Plan, and the Brownfield Cleanup Agreement for 1731 West Farms Road, Bronx, New York and related amendments.

I certify that the Remedial Action Work Plan dated [month day year] and Stipulations [if any] in a letter dated [month day year] and approved by the NYSDEC were implemented and that all requirements in those documents have been substantively complied with.

I certify that the remedial activities were observed by qualified environmental professionals under my supervision and that the remediation requirements set forth in the Remedial Action Work Plan and any other relevant provisions of ECL 27-1419 have been achieved.

I certify that all use restrictions, Institutional Controls, Engineering Controls, and all operation and maintenance requirements applicable to the Site are contained in an Environmental Easement created and recorded pursuant ECL 71-3605 and that all affected local governments, as defined in ECL 71-3603, have been notified that such easement has been recorded. A Site Management Plan has been submitted by the Volunteer for the continual and proper operation, maintenance, and monitoring of all Engineering Controls employed at the Site, including the proper maintenance of all remaining monitoring wells, and that such plan has been approved by the NYSDEC.

I certify that the export of all contaminated soil, fill, water or other material from the property was performed in accordance with the Remedial Action Work Plan, and were taken to facilities licensed to accept this material in full compliance with all Federal, State and local laws.

I certify that all import of soils from off-Site, including source approval and sampling, has been performed in a manner that is consistent with the methodology defined in the Remedial Action Work Plan.

I certify that all invasive work during the remediation and all invasive development work were conducted in accordance with dust and odor suppression methodology and soil screening methodology defined in the Remedial Action Work Plan.

I certify that all information and statements in this certification are true. I understand that a false statement made herein is punishable as Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

It is a violation of Article 130 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 130, New York State Education Law.

10.0 SCHEDULE

A schedule of remedial actions, including estimated dates for performance of work and deliverables, has been included as **Table 15**.

Table 1 Soil Sample Analytical Data – Volatile Organic Compounds for RIR

TABLE 1: VOCS IN SOIL (ESTABLISHED BY THE RI)
Results in Mg/Kg

Sample ID:	B1 0'-2'	B1 3'-5'	B2 0'-2'	B2 5'-7'	B3 0'-2'	B4 0'-2'	B4 5'-7'	B5 0'-2'	B5 7'-9'	B6 0'-2'	B6 7'-9'	B7 0'-2'	B7 7'-9'	UUSCO	RRSCO
Sample Date:	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	---	----
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
1,2-Dibromoethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
1,4-Dioxane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1	9.8
2-Hexanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
4-Methyl-2-pentanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Bromochloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Bromoform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Chloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Cyclohexane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Dichlorodifluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Methyl acetate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Methylcyclohexane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
trans-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02	0.9
Bromomethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33	100
Acetone	ND	ND	ND	ND	ND	0.0035	ND	ND	0.017	ND	ND	0.034	ND	0.05	100
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Methyl tert-butyl Ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.93	100
Methylene Chloride	0.0042	ND	0.0067	ND	ND	0.0058	0.0082	ND	ND	0.0099	0.0069	0.0042	0.008	0.05	100
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.19	100
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.27	26
2-Butanone	ND	ND	ND	ND	ND	0.0025	ND	ND	ND	ND	ND	ND	ND	0.12	100
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.76	2.4
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	0.018	ND	0.019	ND	ND	ND	0.25	100
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.37	49
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.68	100
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.06	4.78
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02	3.1
Trichloroethene	ND	ND	ND	ND	ND	ND	ND	0.023	0.0023	0.03	0.006	ND	ND	0.47	21
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.7	100
Tetrachloroethene	0.074	0.0068	0.059	0.017	ND	0.042	0.12	1.2	0.15	0.31	0.12	0.026	0.015	1.3	19
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	100
Ethyl Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	41
m/p-Xylenes	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.26	100
o-Xylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.26	100
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.4	49
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.8	13
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	100
TOTAL VOCs	0.0782	0.068	0.0657	0.017	0.0	0.0538	0.1282	1.241	0.1693	0.359	0.1329	0.0642	0.023		

ND – Not Detected

NA- No applicable standard

Bold- compound detected and exceeds Unrestricted Use Soil Cleanup Objectives (UUSCO) as defined in the New York State Department of Environmental Conservation, Division of Environmental Remediation, 6 NYCRR Part 375, Environmental Remediation Programs, dated December 14, 2006.

Bold and Shaded- Exceeds Restricted Residential Soil Cleanup Objectives (RRSCO) and Restricted Residential Use SCO as defined in the New York State Department of Environmental Conservation, Division of Environmental Remediation, 6 NYCRR Part 375, Environmental Remediation Programs, December 14, 2006.

Table 1A Soil Sample Analytical Data – Volatile Organic Compounds for Supplemental RIR

TABLE 1A: VOCS IN SOIL (DATA GATHERED BY THE SUPPLEMENTAL RI)
Results in Mg/Kg

Sample ID: / Sample Date:	B8 1' 1//21/20	B8 7' 1/21/20	B9 1' 1/21/20	B9 8' 1/21/20	B10 1' 1/21/20	B10 7' 1//21/20	B11 1' 1//21/20	B11 8' 1//21/20	B12 1' 1/21/20	B12 8' 1/21/20	B13 1' 1/21/20	B13 8' 1/21/20	UUSCO ---	RRSCO ----
1,2-Dibromo-3-chloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
1,2-Dibromoethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
1,2-Dichloropropane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
1,4-Dioxane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1	9.8
2-Hexanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
4-Methyl-2-pentanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Bromochloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Bromoform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Chloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
cis-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Cyclohexane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Dibromochloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Dichlorodifluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Methyl acetate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Methylcyclohexane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Styrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
trans-1,3-Dichloropropene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Vinyl Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02	0.9
Bromomethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
1,1-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33	100
Acetone	ND	0.094	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05	100
Carbon Disulfide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Methyl tert-butyl Ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.93	100
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05	100
trans-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.19	100
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.27	26
2-Butanone	ND	0.0061	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.12	100
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.76	2.4
cis-1,2-Dichloroethene	ND	ND	ND	ND	ND	ND	ND	ND	4.5	ND	0.35	ND	0.25	100
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.37	49
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.68	100
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.06	4.78
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02	3.1
Trichloroethene	0.0088	ND	0.024	ND	2.0	ND	ND	ND	8.6	0.0035	1.1	0.0026	0.47	21
Toluene	0.0017	ND	0.0061	ND	ND	ND	0.0022	ND	ND	ND	ND	ND	0.7	100
Tetrachloroethene	0.44	ND	1.8	7.0	110	0.021	0.32	62	77	1.4	44	0.13	1.3	19
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	100
Ethyl Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.0	41
m/p-Xylenes	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.26	100
o-Xylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.26	100
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.4	49
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.8	13
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	100
TOTAL VOCs	0.4505	0.1001	1.8301	7.0	112	0.021	0.3222	62	90.1	1.4035	45.45	0.1326		

ND – Not Detected

NA- No applicable standard

Bold- compound detected and exceeds Unrestricted Use Soil Cleanup Objectives (UUSCO) as defined in the New York State Department of Environmental Conservation, Division of Environmental Remediation, 6 NYCRR Part 375, Environmental Remediation Programs, dated December 14, 2006.

Bold and Shaded- Exceeds Restricted Residential Soil Cleanup Objectives (RRSCO) and Restricted Residential Use SCO as defined in the New York State Department of Environmental Conservation, Division of Environmental Remediation, 6 NYCRR Part 375, Environmental Remediation Programs, December 14, 2006.

Table 2 Soil Sample Analytical Data – Semi-Volatile Organic Compounds

TABLE 2: SVOCS IN SOIL
Results in Mg/Kg

Sample ID:	B1 0'-2'	B1 3'-5'	B2 0'-2'	B2 5'-7'	B3 0'-2'	B4 0'-2'	B4 5'-7'	B5 0'-2'	B5 7'-9'	B6 0'-2'	B6 7'-9'	B7 0'-2'	B7 7'-9'	UUSCO	RRUSCO
Sample Date:	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	---	---
1,2-Diphenylhydrazine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
2,4,5-Trichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
2,4-Dichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
2,4-Dimethylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
2,4-Dinitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
2,6-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
2-Chloronaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
2-Chlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
2-Methylnaphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
2-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
2-Nitroanaline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
2-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
3&4-Methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
3,3-Dichlorobenidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
3-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
4,6-Dinitro-2-methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
4-Bromophenyl-phenylether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
4-Chloro-3-methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
4-Chloroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
4-Chlorophenyl-phenylether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
4-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
4-Nitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	20	100
Acenaphthylene	ND	ND	0.072	ND	ND	ND	ND	ND	ND	0.14	ND	ND	ND	100	100
Aniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
Anthracene	ND	ND	0.091	ND	ND	ND	ND	0.21	ND	0.046	ND	ND	ND	100	100
Benzidine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
Benzo(a)anthracene	0.051	ND	0.63	ND	ND	0.16	0.061	1.5	ND	0.081	ND	ND	ND	1.0	1.0
Benzo(a)pyrene	0.06	ND	0.55	ND	ND	0.16	0.068	1.7	ND	0.2	ND	ND	ND	1.0	1.0
Benzo(b)fluoranthene	0.089	ND	0.77	ND	ND	0.24	0.1	2.4	ND	0.43	ND	0.076	ND	1.0	1.0
Benzo(g,h,i)perylene	0.049	ND	0.35	ND	ND	0.13	0.051	1.0	ND	0.55	ND	0.051	ND	100	100
Benzo(k)fluoranthene	ND	ND	0.2	ND	ND	0.059	ND	0.58	ND	0.12	ND	ND	ND	0.8	3.9
Benzoic acid	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
bis(2-Chloroethoxy)methane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
bis(2-Chloroethyl)ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
bis(2-Chloroisopropyl)ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
bis(2-Ethylhexyl)phthalate	ND	0.072	ND	ND	ND	ND	ND	ND	ND	0.23	ND	ND	ND	No UUSCO	No RRUSCO
Butylbenzylphthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
Carbazole	ND	ND	0.048	ND	ND	ND	ND	0.13	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
Chrysene	0.059	ND	0.62	ND	ND	0.17	0.074	1.6	ND	0.11	ND	ND	ND	1.0	3.9
Dibenzo(a,h)anthracene	ND	ND	0.094	ND	ND	ND	ND	0.27	ND	ND	ND	ND	ND	0.33	0.33
Dibenzofuran	ND	ND	0.011	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Diethylphthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
Dimethylphthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
Di-n-octylphthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
Di-n-butylphthalate	ND	0.015	0.021	0.034	0.011	0.13	ND	0.059	ND	ND	0.025	0.012	0.011	No UUSCO	No RRUSCO
Fluoranthene	ND	ND	0.94	ND	ND	0.28	0.12	2.5	ND	ND	ND	ND	ND	100	100
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	30	100
Hexachlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Hexachlorobutadiene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO

TABLE 2: SVOCS IN SOIL Results in Mg/Kg															
Sample ID:	**B1 0'-2'**	**B1 3'-5'**	**B2 0'-2'**	**B2 5'-7'**	**B3 0'-2'**	**B4 0'-2'**	**B4 5'-7'**	**B5 0'-2'**	**B5 7'-9'**	**B6 0'-2'**	**B6 7'-9'**	**B7 0'-2'**	**B7 7'-9'**	**UUSCO**	**RRUSCO**
Sample Date:	**10/15/19**	**10/15/19**	**10/15/19**	**10/15/19**	**10/15/19**	**10/15/19**	**10/15/19**	**10/15/19**	**10/15/19**	**10/15/19**	**10/15/19**	**10/15/19**	**10/15/19**	---	---
Hexachlorocyclopentadiene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
Hexachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
Indeno(1,2,3-cd)pyrene	0.046	ND	0.31	ND	ND	0.11	0.042	0.93	ND	0.33	ND	0.04	ND	0.5	0.5
Isophorone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
Naphthalene	ND	ND	0.012	ND	ND	0.011	ND	ND	ND	ND	ND	ND	ND	12	100
Nitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
N-Nitrosodiumethylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
N-Nitroso-di-n-propylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
N-Ntrosodiphenylamine	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No UUSCO	No RRUSCO
Pentachlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8	6.7
Phenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.33	100
Phenanthrene	ND	ND	0.37	ND	ND	0.15	0.046	1.0	ND	ND	ND	ND	ND	100	100
Pyrene	0.082	ND	0.98	ND	ND	0.28	0.11	2.6	ND	ND	ND	ND	ND	100	100
TOTAL SVOCs	0.436	0.087	6.069	0.034	0.011	1.88	0.672	16.479	0.0	2.237	0.025	0.179	0.011		

ND- Not detected above the method detection limit

NA- No applicable standard

Bold- compound detected and exceeds Unrestricted Use Soil Cleanup Objectives (UUSCO) as defined in the New York State Department of Environmental Conservation, Division of Environmental Remediation, 6 NYCRR Part 375, Environmental Remediation Programs, dated December 14, 2006.

Bold and Shaded- Exceeds Restricted Residential Soil Cleanup Objectives (RRSCO) and Restricted Residential Use SCO as defined in the New York State Department of Environmental Conservation, Division of Environmental Remediation, 6 NYCRR Part 375, Environmental Remediation Programs, December 14, 2006.

Table 3 Soil Sample Analytical Data – Pesticides

TABLE 3: PESTICIDES IN SOIL Results in Mg/Kg															
Sample ID:	B1 0'-2'	B1 3'-5'	B2 0'-2'	B2 5'-7'	B3 0'-2'	B4 0'-2'	B4 5'-7'	B5 0'-2'	B5 7'-9'	B6 0'-2'	B6 7'-9'	B7 0'-2'	B7 7'-9'	UUSCO	RRSCO
Sample Date:	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	---	---
alpha-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02	0.48
beta-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	36	36
delta-BHC	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.04	100
gamma-BHC (Lindane)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1	1.3
Heptachlor	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.042	21
Aldrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.005	0.097
Heptachlor epoxide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No SCO	No SCO
Endosulfan I	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.4	24
Dieldrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0017	ND	ND	ND	0.005	0.2
4,4-DDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0067	ND	ND	ND	0.0033	8.9
Endrin	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.014	11
Endosulfan II	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.4	24
4,4-DDD	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0093	ND	ND	ND	0.0033	13
Endosulfan Sulfate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.4	24
4,4-DDT	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.045	0.12	0.003	ND	0.0033	7.9
Methoxychlor	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No SCO	No SCO
Endrin ketone	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No SCO	No SCO
Endrin aldehyde	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No SCO	No SCO
alpha-Chlordane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.094	4.2
gamma-Chlordane	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No SCO	No SCO
Toxaphene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No SCO	No SCO

ND- Not detected above the method detection limit

Bold- compound detected and exceeds Unrestricted Use Soil Cleanup Objectives (UUSCO) as defined in the New York State Department of Environmental Conservation, Division of Environmental Remediation, 6 NYCRR Part 375, Environmental Remediation Programs, dated December 14, 2006.

Bold and Shaded- Exceeds Restricted Residential Soil Cleanup Objectives (RRSCO) and Restricted Residential Use SCO as defined in the New York State Department of Environmental Conservation, Division of Environmental Remediation, 6 NYCRR Part 375, Environmental Remediation Programs, dated December 14, 2006.

Table 4 Soil Sample Analytical Data –PCBs

TABLE 4: PCBS IN SOIL
Results in Mg/Kg

Sample ID:	B1 0'-2'	B1 3'-5'	B2 0'-2'	B2 5'-7'	B3 0'-2'	B4 0'-2'	B4 5'-7'	B5 0'-2'	B5 7'-9'	B6 0'-2'	B6 7'-9'	B7 0'-2'	B7 7'-9'	UUSCO	RRUSCO
Sample Date:	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	---	---
Aroclor-1016	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Aroclor-1221	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Aroclor-1232	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Aroclor-1242	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Aroclor-1248	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Aroclor-1254	ND	ND	0.91	ND	ND	ND	ND	ND	ND	0.028	ND	ND	ND	NA	NA
Aroclor-1262	ND	ND	0.29	ND	ND	ND	ND	0.062	ND	ND	ND	ND	ND	NA	NA
Aroclor-1268	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Aroclor-1260	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
TOTAL PCBs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.062	0.0	0.028	0.0	0.0	0.0	0.1	1.0

ND- Not detected above the method detection limit

Bold- compound detected and exceeds Unrestricted Use Soil Cleanup Objectives (UUSCO) as defined in the New York State Department of Environmental Conservation, Division of Environmental Remediation, 6 NYCRR Part 375, Environmental Remediation Programs, dated December 14, 2006.

Bold and Shaded- Exceeds Restricted Residential Soil Cleanup Objectives (RRSCO) and Restricted Residential Use SCO as defined in the New York State Department of Environmental Conservation, Division of Environmental Remediation, 6 NYCRR Part 375, Environmental Remediation Programs, dated December 14, 2006.

Table 5 Soil Sample Analytical Data – Metals

TABLE 5: METALS IN SOIL
Results in Mg/Kg

Sample ID:	B1 0'-2'	B1 3'-5'	B2 0'-2'	B2 5'-7'	B3 0'-2'	B4 0'-2'	B4 5'-7'	B5 0'-2'	B5 7'-9'	B6 0'-2'	B6 7'-9'	B7 0'-2'	B7 7'-9'	UUSCO	RRUSCO
Sample Date:	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	10/15/19	---	---
Aluminum	14000	13000	13000	15000	13000	11000	14000	9800	12000	6000	9100	29000	16000	No SCO	No SCO
Antimony	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No SCO	No SCO
Arsenic	3.6	3.5	ND	3.6	ND	4.8	5.2	5.5	3.3	9.6	3.8	5.0	3.8	13	16
Barium	95	95	180	70	66	170	120	310	130	170	76	340	120	350	400
Beryllium	0.59	0.4	ND	0.47	ND	0.42	0.58	0.38	0.41	0.26	4.8	0.7	ND	7.2	72
Cadmium	ND	ND	ND	ND	ND	ND	ND	2.0	ND	4.6	ND	ND	0.64	2.5	4.3
Calcium	1500	7000	2400	1700	1700	30000	2600	30000	2100	39000	24000	3700	2300	No SCO	No SCO
Chromium	21	21	24	18	23	23	20	33	20	14	15	58	24	30	180
Cobalt	10	10	12	9.2	17	8.7	10	12	8.4	7.0	7.2	22	11	No SCO	No SCO
Copper	14	20	130	36	42	26	24	100	19	48	59	91	ND	50	270
Iron	22000	21000	24000	24000	20000	18000	20000	25000	18000	22000	15000	56000	ND	No SCO	No SCO
Lead	79	26	560	37	ND	210	160	580	280	790	170	330	170	63	400
Magnesium	3200	3700	3400	3200	5900	5400	3600	9200	2900	3500	15000	8300	3400	No SCO	No SCO
Manganese	470	340	540	370	240	380	460	300	370	190	390	620	510	1600	2000
Mercury	0.26	ND	0.71	ND	ND	0.45	0.31	0.8	0.68	0.58	0.52	0.14	0.16	0.18	0.81
Nickel	16	15	25	13	32	19	17	26	14	15	13	38	19	30	310
Potassium	650	1300	1200	ND	3500	1600	1100	2900	1100	1300	1400	4000	1000	NA	NA
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.9	180
Silver	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	180
Sodium	ND	ND	ND	ND	ND	620	ND	ND	ND	ND	ND	ND	ND	No SCO	No SCO
Thallium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	No SCO	No SCO
Vanadium	28	25	31	28	32	24	28	33	26	25	19	76	33	No SCO	No SCO
Zinc	63	49	250	51	70	170	95	480	76	2000	98	230	54	109	10000
Cyanide	ND	ND	ND	ND	ND	2.0	ND	ND	ND	ND	ND	ND	ND	27	27

ND- Not detected above the method detection limit

Bold- compound detected and exceeds Unrestricted Use Soil Cleanup Objectives (UUSCO) as defined in the New York State Department of Environmental Conservation, Division of Environmental Remediation, 6 NYCRR Part 375, Environmental Remediation Programs, dated December 14, 2006.

Bold and Shaded- Exceeds Restricted Residential Soil Cleanup Objectives (RRSCO) and Restricted Residential Use SCO as defined in the New York State Department of Environmental Conservation, Division of Environmental Remediation, 6 NYCRR Part 375, Environmental Remediation Programs, dated December 14, 2006.

Table 6 Soil Sample Analytical Results – PFAS in Soil Sample B6 0’-2’

TABLE 6: FLUORINATED ALKYL SUBSTANCES IN SOIL SAMPLE B6 0'-2' Results in ug/kg	
Sample ID:	B6 0'-2'
Sample Date:	10/19/19
Perfluorobutanoic acid (PFBA)	ND
Perfluorohexanoic acid (PFHxA)	ND
Perfluoroheptanoic acid (PFHpA)	ND
Perfluoropentanoic acid (PFPeA)	ND
Perfluorooctanoic acid (PFOA)	ND
Perfluorononanoic acid (PFNA)	ND
Perfluordecanoic acid (PFDA)	ND
Perfluoroundecanoic acid (PFUnA)	ND
Perfluordodecanoic acid (PFDoA)	ND
N-MeFOSAA	ND
N-EtFOSSA	ND
Perfluoro-1-octanesulfonamide (FOSA)	ND
Perfluoro-1-heptanesulfonic acid (PFHpS)	ND
Perfluoro-1-decanesulfonic acid (PFDS)	ND
1H, 1H, 2H, 2H-Perfluorooctanesulfonic acid (6:2 FTS)	ND
1H, 1H, 2H, 2H-Perfluorodecanesulfonic acid (8:2 FTS)	ND
Perfluorotridecanoic acid (PFTriA)	ND
Perfluortetradecanoic acid (PFTeA)	ND
Perfluorbutanessulfonic acid (PFBS)	ND
Perfluorohexanesulfonic acid (PFHxS)	ND
Perfluorooctanesulfonic acid (PFOS)	0.83
Total Concentration	0.83

Notes:
ND – Not detected
(B) Indicates substance was detected in the method blank
(J) Indicates a result less than the reporting limit but greater than the minimum detection limit
No soil quality standards exist in the State of New York

Table 7 Groundwater Sample Analytical Data – Volatile Organic Compounds

TABLE 7: VOCS IN GROUNDWATER Results in ug/L				
Sample ID:	B2GW	B5GW	B6GW	LIMIT
Sample Date:	10/15/19	10/15/19	10/15/19	---
1,1,1-Trichloroethane	ND	ND	ND	5
1,1,2,2-Tetrachloroethane	ND	ND	ND	5
1,1,3-Trichloro-1,2,2-trichloroethane	ND	ND	ND	5
1,1,2-Trichloroethane	ND	ND	ND	1
1,1-Dichloroethane	ND	ND	ND	5
1,1-Dichloroethene	ND	ND	ND	5
1,2,3-Trichlorobenzene	ND	ND	ND	5
1,2,4-Trichlorobenzene	ND	ND	ND	5
1,2-Dibromo-3-Chloropropane	ND	ND	ND	0.04
1,2-Dibromoethane	ND	ND	ND	0.0006
1,2-Dichlorobenzene	ND	ND	ND	3
1,2-Dichloroethane	ND	ND	ND	0.6
1,2-Dichloropropane	ND	ND	ND	1
1,3-Dichlorobenzene	ND	ND	ND	3
1,4-Dichlorobenzene	ND	ND	ND	3
1,4-Dioxane	ND	ND	ND	1.0(recommended)
2-Butanone	ND	ND	ND	50
2-Hexanone	ND	ND	ND	50
4-Methyl-2-Pentanone	ND	ND	ND	NA
Acetone	ND	ND	ND	50
Benzene	ND	ND	ND	1
Bromochloromethane	ND	ND	ND	5
Bromodichloromethane	ND	ND	ND	50
Bromoform	ND	ND	ND	50
Bromomethane	ND	ND	ND	5
Carbon Disulfide	ND	ND	ND	NA
Carbon Tetrachloride	ND	ND	ND	5
Chlorobenzene	ND	ND	ND	5
Chloroethane	ND	ND	ND	5
Chloroform	ND	ND	ND	7
Chloromethane	ND	ND	ND	5
cis-1,2-Dichloroethene	ND	ND	4.3	5
cis-1,3-Dichloropropene	ND	ND	ND	0.4
Cyclohexane	ND	ND	ND	NA
Dibromochloromethane	ND	ND	ND	50
Dichlorodifluoromethane	ND	ND	ND	5
Ethylbenzene	ND	ND	ND	5
Isopropylbenzene	ND	ND	ND	5
m/p-Xylenes	ND	ND	ND	5
o-Xylene	ND	ND	ND	5
Methyl Acetate	ND	ND	ND	NA
Methylcyclohexane	ND	ND	ND	NA
Methylene Chloride	ND	ND	ND	5
Methyl tert-butyl Ether	ND	ND	ND	10
Styrene	ND	ND	ND	5
Tetrachloroethene	9.1	610	42	5
Toluene	ND	ND	ND	5
trans-1,2-Dichloroethene	ND	ND	ND	5
t-1,3-Dichloropropene	ND	ND	ND	0.4
Trichloroethene	ND	13	4.6	5
Trichlorofluoromethane	ND	ND	ND	5
Vinyl Chloride	ND	ND	ND	2
TOTAL VOCs	9.1	623	50.9	

ND – Not Detected

Bold- exceeds NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards /Guidance Values

Table 8 Groundwater Sample Analytical Data – Semi-Volatile Organic Compounds

TABLE 8: SVOCS IN GROUNDWATER Results in ug/L				
Sample ID:	B2GW	B5GW	B6GW	LIMIT
Sample Date:	10/15/19	10/15/19	10/15/19	
1,2-Diphenylhydrazine	ND	ND	ND	0.0
2,4-Dinitrotoluene	ND	ND	ND	5
2,6-Dinitrotoluene	ND	ND	ND	5
2-Chloronaphthalene	ND	ND	ND	10
2-Methylnaphthalene	ND	ND	ND	4.7
2-Nitroanaline	ND	ND	ND	5
3,3-Dichlorobenzidine	ND	ND	ND	5
3-Nitroaniline	ND	ND	ND	5
4,6-Dinitro-2-methylphenol	ND	ND	ND	N/A
4-Bromophenyl-phenylether	ND	ND	ND	N/A
4-Chloroaniline	ND	ND	ND	5
4-Chlorophenyl-phenylether	ND	ND	ND	N/A
4-Nitroaniline	ND	ND	ND	4
Acenaphthene	ND	ND	ND	20
Acenaphthylene	ND	ND	ND	20
Aniline	ND	ND	ND	5
Anthracene	ND	ND	ND	50
Benzidine	ND	ND	ND	5
Benzo(a)anthracene	ND	ND	ND	0.002
Benzo(a)pyrene	ND	ND	ND	0.002
Benzo(b)fluoranthene	ND	ND	ND	0.002
Benzo(g,h,i)perylene	ND	ND	ND	5
Benzo(k)fluoranthene	ND	ND	ND	0.002
bis(2-Chloroethoxy)methane	ND	ND	ND	5
bis(2-Chloroethyl)ether	ND	ND	ND	1.0
bis(2-Chloroisopropyl)ether	ND	ND	ND	N/A
bis(2-Ethylhexyl)phthalate	ND	ND	ND	50
Butylbenzylphthalate	ND	ND	ND	50
Carbazole	ND	ND	ND	N/A
Chrysene	ND	ND	ND	0.002
Dibenzo(a,h)anthracene	ND	ND	ND	50
Dibenzofuran	ND	ND	ND	5
Diethylphthalate	ND	ND	ND	50
Dimethylphthalate	ND	ND	ND	50
Di-n-octylphthalate	ND	ND	ND	50
Di-n-butylphthalate	ND	ND	ND	50
Fluoranthene	ND	ND	ND	50
Fluorene	ND	ND	ND	50
Hexachlorobenzene	ND	ND	ND	0.35
Hexachlorobutadiene	ND	ND	ND	0.5
Hexachlorocyclopentadiene	ND	ND	ND	5
Hexachloroethane	ND	ND	ND	5
Indeno(1,2,3-cd)pyrene	ND	ND	ND	0.002
Isophorone	ND	ND	ND	50
Naphthalene	ND	ND	ND	10
Nitrobenzene	ND	ND	ND	5
N-Nitrosodiumethylamine	ND	ND	ND	50
N-Nitroso-di-n-propylamine	ND	ND	ND	N/A
N-Nitrosodiphenylamine	ND	ND	ND	50
Phenanthrene	ND	ND	ND	50
Pyrene	ND	ND	ND	50
TOTAL SVOCs	0.0	0.0	0.0	

ND – Not Detected
Bold- exceeds NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards /Guidance Values

Table 9 Groundwater Sample Analytical Data Summary – Pesticides

Table 10 Groundwater Sample Analytical Data Summary – PCBs

TABLE 9: Pesticides Groundwater Results in ug/L				
Sample ID:	B2GW	B5GW	B6GW	
Sample Date:	10/15/19	10/15/19	10/15/19	LIMIT
alpha-BHC	ND	ND	ND	Not established
beta-BHC	ND	ND	ND	Not established
delta-BHC	ND	ND	ND	Not established
gamma-BHC (Lindane)	ND	ND	ND	Not established
Heptachlor	ND	ND	ND	0.04
Aldrin	ND	ND	ND	0.001
Heptachlor epoxide	ND	ND	ND	0.03
Endosulfan I	ND	ND	ND	0.009
Dieldrin	ND	ND	ND	0.001
4,4-DDE	ND	ND	ND	0.2
Endrin	ND	ND	ND	0.2
Endosulfan II	ND	ND	ND	0.009
4,4-DDD	ND	ND	ND	0.3
Endosulfan Sulfate	ND	ND	ND	Not established
4,4-DDT	ND	ND	ND	0.3
Methoxychlor	ND	ND	ND	35
Endrin ketone	ND	ND	ND	5
Endrin aldehyde	ND	ND	ND	5
alpha-Chlordane	ND	ND	ND	0.05
gamma-Chlordane	ND	ND	ND	0.05
Toxaphene	ND	ND	ND	0.06

ND – Not Detected
Bold- exceeds NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards /Guidance Values

TABLE 10: PCBs IN GROUNDWATER Results in ug/L				
Sample ID:	B2GW	B5GW	B6GW	LIMIT
Sample Date:	10/15/19	10/15/19	10/15/19	---
Aroclor-1016	ND	ND	ND	Not established
Aroclor-1221	ND	ND	ND	Not established
Aroclor-1232	ND	ND	ND	Not established
Aroclor-1242	ND	ND	ND	Not established
Aroclor-1248	ND	ND	ND	Not established
Aroclor-1254	ND	ND	ND	Not established
Aroclor-1260	ND	ND	ND	Not established
Total PCBs	0.0	0.0	0.0	0.09

ND – Not Detected
Bold- exceeds NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards /Guidance Values

Table 11 Groundwater Sample Analytical Data Summary – Metals

TABLE 11: METALS IN GROUNDWATER
Results in ug/L

	Unfiltered			Filtered			
Sample ID:	**B2GW**	**B5GW**	**B6GW**	**B2GW**	**B5GW**	**B6GW**	
Sample Date:	**10/15/19**	**10/15/19**	**10/15/19**	**10/15/19**	**10/15/19**	**10/15/19**	**LIMIT**
Aluminum	17000	14000	17000	ND	ND	ND	100
Antimony	ND	ND	ND	ND	ND	ND	3
Arsenic	5.4	3.4	4.9	ND	ND	ND	50
Barium	140	85	100	ND	ND	ND	1,000
Beryllium	ND	ND	ND	ND	ND	ND	11
Cadmium	ND	ND	ND	ND	ND	ND	5
Calcium	86000	92000	6000	85000	90000	59000	Not established
Chromium	ND	ND	ND	ND	ND	ND	50
Cobalt	17	ND	12	2.8	ND	ND	5
Copper	54	ND	ND	ND	ND	ND	200
Iron	26000	20000	24000	ND	ND	ND	300
Lead	13	ND	26	ND	ND	ND	50
Magnesium	14000	16000	13000	9900	12000	10000	35000
Manganese	1200	390	1100	680	71	560	300
Mercury	ND	ND	ND	ND	ND	ND	0.7
Nickel	ND	ND	ND	ND	ND	ND	100
Potassium	14000	1000	7500	11000	8900	6100	Not established
Selenium	ND	ND	ND	ND	ND	ND	10
Silver	ND	ND	ND	ND	ND	ND	50
Sodium	80000	83000	58000	83000	85000	61000	20000
Thallium	ND	ND	ND	ND	ND	ND	8
Vanadium	ND	ND	ND	ND	ND	ND	14
Zinc	55	ND	ND	ND	ND	ND	66
Cyanide	ND	ND	ND	ND	ND	ND	200

ND – Not Detected
Bold - exceeds NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards /Guidance Values

Table 12 Groundwater Sample Analytical Data Summary – PFAS in Sample No. B6GW

TABLE 12: FLUORINATED ALKYL SUBSTANCES IN GROUNDWATER SAMPLE B6GW Results in ng/L	
Sample ID:	**B6GW**
Sample Date:	**10/19/19**
Perfluorobutanoic acid (PFBA)	20.1
Perfluorohexanoic acid (PFHxA)	51.4
Perfluoroheptanoic acid (PFHpA)	75.4
Perfluoropentanoic acid (PFPeA)	44
Perfluorooctanoic acid (PFOA)	95.1
Perfluorononanoic acid (PFNA)	5.52
Perfluordecanoic acid (PFDA)	4.45
Perfluoroundecanoic acid (PFUnA)	ND
Perfluordodecanoic acid (PFDoA)	ND
N-MeFOSAA	6.68
N-EtFOSSA	ND
Perfluoro-1-octanesulfonamide (FOSA)	ND
Perfluoro-1-heptanesulfonic acid (PFHpS)	3.01
Perfluoro-1-decanesulfonic acid (PFDS)	ND
1H, 1H, 2H, 2H-Perfluorooctanesulfonic acid (6:2 FTS)	ND
1H, 1H, 2H, 2H-Perfluorodecanesulfonic acid (8:2 FTS)	ND
Perfluorotridecanoic acid (PFTriA)	ND
Perfluortetradecanoic acid (PFTeA)	ND
Perfluorbutanessulfonic acid (PFBS)	18.6
Perfluorohexanesulfonic acid (PFHxS)	40.3
Perfluorooctanesulfonic acid (PFOS)	126
Total Concentration	490.6

Notes:
ND – Not detected
(B) Indicates substance was detected in the method blank
(J) Indicates a result less than the reporting limit but greater than the minimum detection limit
No groundwater quality standard exists but USEPA has issued a 70 ng/l health advisory for drinking water

Table 13 Air Sample Analytical Data Summary – Volatile Organic Compounds

TABLE 13: SOIL VAPOR ANALYSIS RESULTS FOR VOCS
Results in ug/M^3

Sample ID:	SV1		SV2		SV3		SV4		SV5		SV6	
Sampling Date:	10/15/19		10/15/19		10/15/19		10/15/19		10/19/19		10/19/19	
Dichlorodifluoromethane	1.14	J	1.14	J	2.67		1.24	J	ND		ND	
Chloromethane	2.27		4.54		1.05		1.14		ND		ND	
Vinyl Chloride	0.66		1.1		0.15		0.2		ND		ND	
Bromomethane	ND		ND		ND		ND		ND		ND	
Chloroethane	0.34	J	0.68	J	ND		ND		ND		ND	
Tetrahydrofuran	ND		ND		ND		ND		ND		ND	
Trichlorofluoromethane	1.35	J	1.57	J	1.35	J	1.35	J	ND		ND	
1,1,2-Trichlorotrifluoroethane	ND		ND		ND		ND		ND		ND	
Dichlorotetrafluoroethane	ND		ND		ND		ND		ND		ND	
Bromoethene	ND		ND		ND		ND		ND		ND	
tert-Butyl alcohol	2.79		5.76		5.15		3.33		ND		ND	
Heptane	5.74		13.5		25		7.38		6.15	J	5.33	J
1,1-Dichloroethene	ND		ND		ND		ND		5.55	J	ND	
Acetone	285	B	475	B	285	B	333	B	25.6	B	14	B
Carbon Disulfide	14.6		22.1		7.79		6.85		ND		ND	
Methyl tert-Butyl Ether	ND		ND		ND		ND		ND		ND	
Methylene Chloride	7.99	B	2.54	B	4.17	B	3.82	B	ND		ND	
trans-1,2-Dichloroethene	2.14		ND		ND		ND		ND		9.91	J
1,1-Dichloroethane	ND		ND		ND		ND		ND		ND	
Cyclohexane	1.89		6.54		2.55		7.92		ND		ND	
2-Butanone	21.8		18.3		18		12.1		ND		12.7	J
Carbon Tetrachloride	0.38		0.31		ND		0.38		ND		ND	
cis-1,2-Dichloroethene	34.9		4.36		1.47	J	4.76		9120		912	
Chloroform	3.13		10.7		4.4		ND		232		29.8	
1,1,1-Trichloroethane	ND		0.44		ND		1.51	J	2.95		ND	
2,2,4-Trimethylpentane	2.38		3.41		1.77	J	2.15	J	48.6		ND	
Benzene	6.71		16.6		19.2		3.51		34.2		ND	
1,2-Dichloroethane	ND		ND		ND		ND		ND		ND	
Trichloroethene	45.7		19.4		13.4		14.5		14500		2260	
1,2-Dichloropropane	ND		ND		ND		ND		ND		ND	
Bromodichloromethane	ND		ND		ND		ND		ND		ND	
4-Methyl-2-Pentanone	1.84	J	2.58		1.77	J	0.94	J	ND		ND	
Toluene	27.9		45.6		34.7		22.6		16.6	J	13.6	J
t-1,3-Dichloropropene	ND		ND		ND		ND		ND		ND	
cis-1,3-Dichloropropene	ND		ND		ND		ND		ND		ND	
1,1,2-Trichloroethane	ND		ND		ND		ND		ND		ND	
Dibromochloromethane	ND		ND		ND		ND		ND		ND	
1,2-Dibromoethane	ND		ND		ND		ND		ND		ND	
Tetrachloroethene	5150		8140		3190		746		679000		33220	
Chlorobenzene	ND		ND		ND		ND		ND		ND	
Ethyl Benzene	7.82		11.7		8.69		5.21		ND		ND	
Xylenes	36.9		54.7		41.7		22.58		35.59	J	35.19	J
Styrene	0.89	J	1.87	J	1.83	J	0.64	J	ND		ND	
Bromoform	ND		ND		ND		ND		ND		ND	
1,1,2,2-Tetrachloroethane	ND		ND		ND		ND		ND		ND	
2-Chlorotoluene	ND		ND		ND		ND		ND		ND	
1,3,5-Trimethylbenzene	2.26	J	4.92		4.38		1.33	J	ND		ND	
1,2,4-Trimethylbenzene	6.88		16.7		16.2		4.23		ND		6.39	J
1,3-Dichlorobenzene	ND		ND		ND		ND		ND		ND	
1,4-Dichlorobenzene	ND		ND		ND		ND		ND		ND	
1,2-Dichlorobenzene	ND		ND		ND		ND		ND		ND	
1,2,4-Trichlorobenzene	ND		ND		ND		ND		ND		ND	
Hexachloro-1,3-Butadiene	ND		ND		ND		ND		ND		ND	
1,3-Butadiene	ND		ND		ND		ND		ND		ND	
Naphthalene	ND		2.73		1.83	J	ND		ND		ND	
4-Ethyltoluene	3.29		5.9		5.41		2.02	J	ND		ND	
Hexane	7.05		18.3		47.2		10.9		18.7		12	J
Allyl Chloride	ND		ND		ND		ND		ND		ND	
1,4-Dioxane	ND		ND		ND		ND		ND		ND	
Methyl Methacrylate	ND		ND		ND		ND		ND		ND	

ND – Not Detected
J – The concentration is an estimated value
B- Substance detected in the quality control method blank

Table 14 Soil Cleanup Objectives for the Site

TABLE 14: SOIL CLEANUP OBJECTIVES Values shown in mg/kg		
VOCs	**UUSCO**	**RRUSCO**
Perchloroethylene	1.3	NOT TO BE USED
Trichloroethene	0.47	NOT TO BE USED
cis-1,2-Dichloroethene	0.25	NOT TO BE USED
SVOCs	**UUSCO**	**RRUSCO**
Benzo(a)anthracene	1.0	1.0
Benzo(a)pyrene	1.0	1.0
Benzo(b)fluoranthene	1.0	1.0
Indeno(1,2,3-cd)pyrene	0.5	0.5
Metals	**UUSCO**	**RRUSCO**
Lead	NOT TO BE USED	400
Cadmium	NOT TO BE USED	4.3

Table 15 Project Schedule

TABLE 15 – ESTIMATED PROJECT SCHEDULE (Note: Subject to change)		
Schedule Milestone	**Weeks from Remedial Action Start**	**Duration (weeks)**
NYSDEC Approval of RAWP	0	4
Fact Sheet 2 announcing start of remedy	4	6
Mobilization	6	8
Remedial Excavation	8	10
Installation of Engineering Controls	10	40
Submit Remedial Action Report	40	55

Table 16 Remedial Permits

TABLE 16: REMEDIAL PERMITS 1731 West Farms Road, Bronx, NY				
PERMIT	**CITATION OF LAW, STATUTE OR CODE**	**AGENCY**	**CONTACT NAME**	**PHONE NUMBER**
Sheeting/Shoring	Chapter 33 NYC Construction Code	NYCDOB		(718) 802-3675
Waste Disposal Facility (nonhazardous)	6 NYCRR Part 360	TBD	TBD	TBD
Waste Disposal Facility (hazardous)	6 NYCRR Part 360 and federal RCRA	TBD	TBD	TBD

Table 17 Emergency Contact Numbers

TABLE 17: EMERGENCY TELEPHONE NUMBERS & DIRECTIONS

Emergency Medical Service	911	
Police: New York City Police Department (NYPD)	911	
Fire: New York City Fire Department (FDNY)	911	
New York City Office of Emergency Management	911	
National Response Center	(800)	424-8802
Poison Control Center	(800)	222-1222
Chemtrec	(800)	262-8200
Center for Disease Control	(800)	311-3435
USEPA(Region II)	(212)	637-5000
NYSDEC Emergency Spill Response	(800)	457-7362
Environmental Consultant	(631)	617-6200
Contractor Emergency Number	TBD	

DIRECTIONS AND HOSPITAL

Site Location: 1731 West Farms Road, Bronx, New York

Hospital Location: BronxCare Health System, 25-10 30th Ave., Bronx, NY

Hospital Phone: (718) 590-1800

- **Turn right from the Site and go south on West Farms Rd. 0.75 mile**
- **Turn right on East 167th Street, travel 0.9 mile**
- **Turn left on Franklin Avenue and hospital is on right.**

Figure 1 Property Location Map

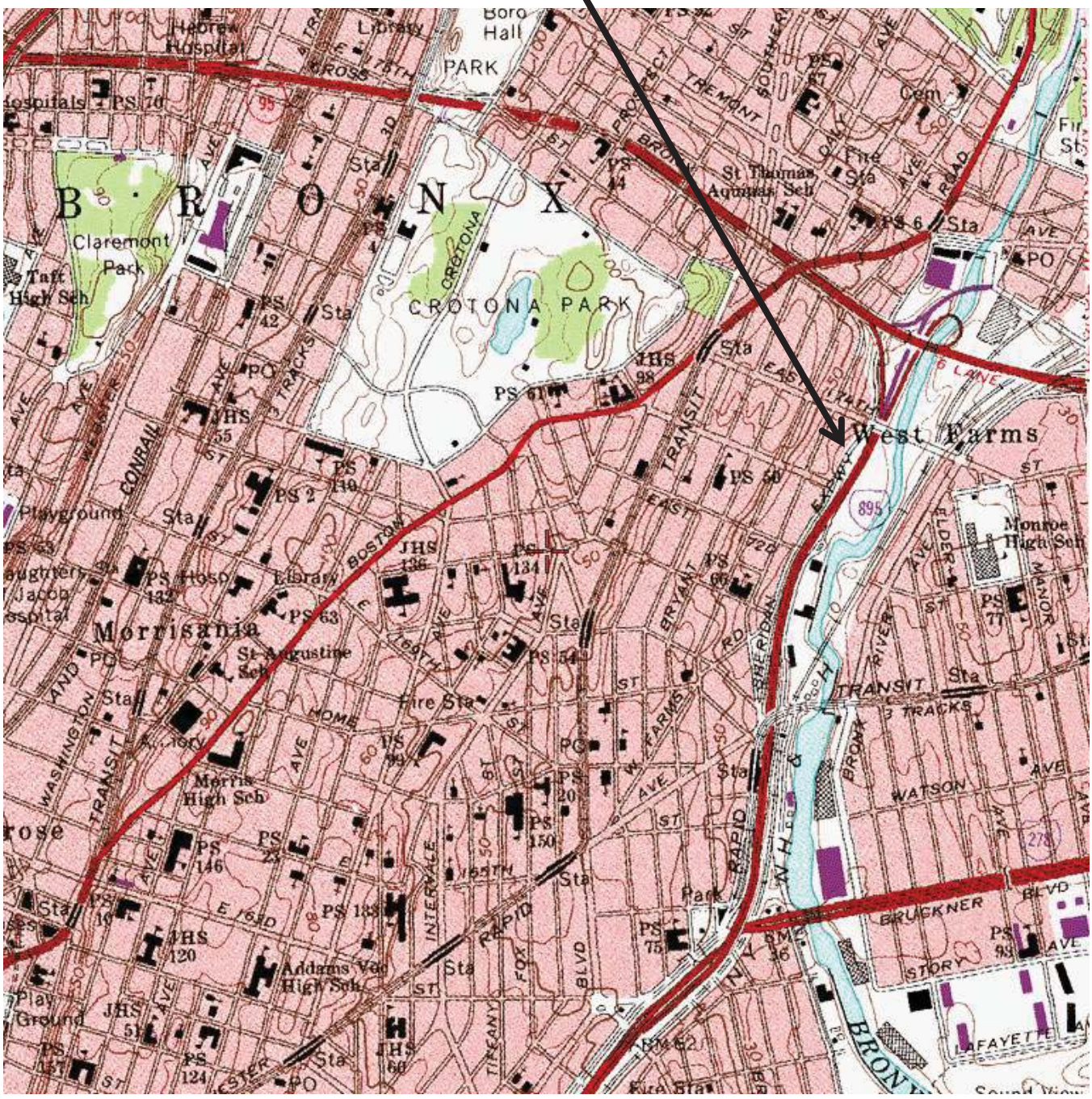


FIGURE 1: SITE LOCATION MAP Contour Interval: 10'	Site Address: **1731 West Farms Rd.** **Bronx, NY**
USGS 7.5" Quadrangle Map titled *Central Park, NY,* dated 1995	

Figure 2 Property Boundary Map

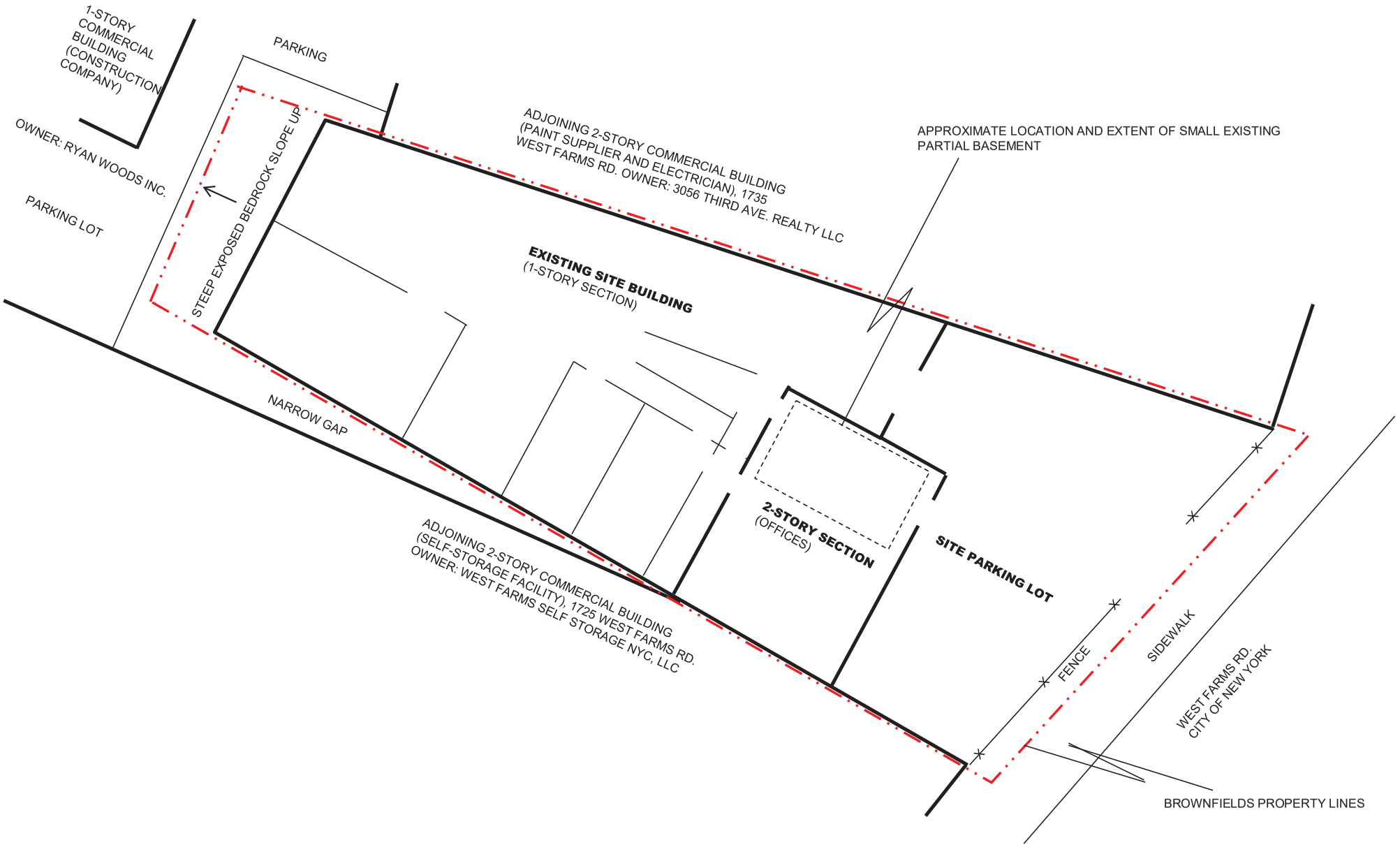


FIGURE 2: SITE BOUNDARY PLAN 1731 WEST FARMS ROAD
BRONX, NY

NOTE:
DRAWING SHOWS EXISTING SITE CONDITIONS & ADJACENT PROPERTY OWNERS

SCALE:
20 FT.

Drawn by: F. Galdun 1/31/20

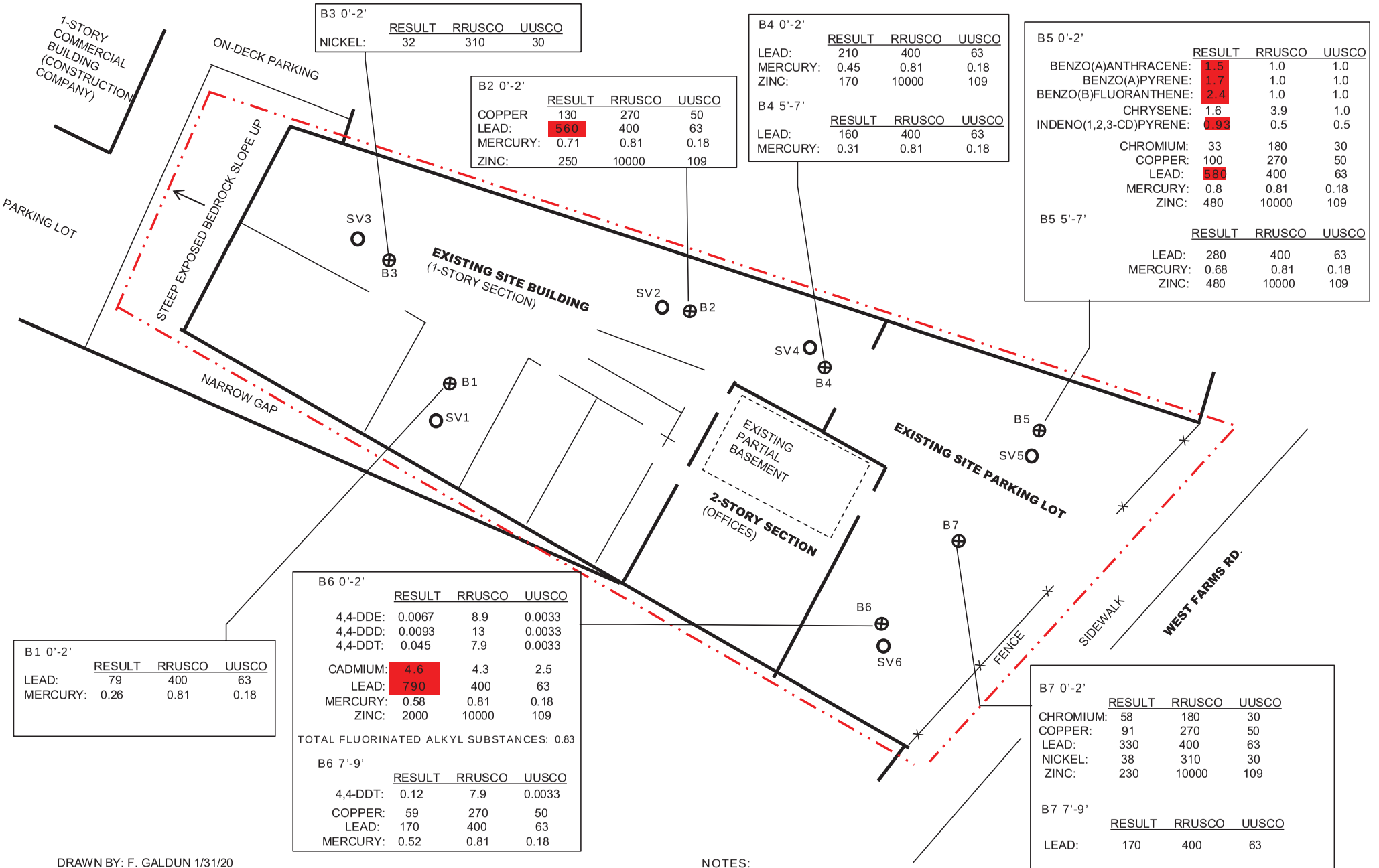
Figure 3 Surrounding Property Use Map

FIGURE 3: SURROUNDING PROPERTY USE: 1731 WEST FARMS RD. BRONX, NY

Map obtained from NYC SPEED database. Surrounding property Use based on SPEED, Googlemap search and observations during the RI

N

Figure 4 Soil Chemistry Plan



B3 0'-2'

	RESULT	RRUSCO	UUSCO
NICKEL:	32	310	30

B2 0'-2'

	RESULT	RRUSCO	UUSCO
COPPER	130	270	50
LEAD:	**560**	400	63
MERCURY:	0.71	0.81	0.18
ZINC:	250	10000	109

B4 0'-2'

	RESULT	RRUSCO	UUSCO
LEAD:	210	400	63
MERCURY:	0.45	0.81	0.18
ZINC:	170	10000	109

B4 5'-7'

	RESULT	RRUSCO	UUSCO
LEAD:	160	400	63
MERCURY:	0.31	0.81	0.18

B5 0'-2'

	RESULT	RRUSCO	UUSCO
BENZO(A)ANTHRACENE:	**1.5**	1.0	1.0
BENZO(A)PYRENE:	**1.7**	1.0	1.0
BENZO(B)FLUORANTHENE:	**2.4**	1.0	1.0
CHRYSENE:	1.6	3.9	1.0
INDENO(1,2,3-CD)PYRENE:	**0.93**	0.5	0.5
CHROMIUM:	33	180	30
COPPER:	100	270	50
LEAD:	**580**	400	63
MERCURY:	0.8	0.81	0.18
ZINC:	480	10000	109

B5 5'-7'

	RESULT	RRUSCO	UUSCO
LEAD:	280	400	63
MERCURY:	0.68	0.81	0.18
ZINC:	480	10000	109

B1 0'-2'

	RESULT	RRUSCO	UUSCO
LEAD:	79	400	63
MERCURY:	0.26	0.81	0.18

B6 0'-2'

	RESULT	RRUSCO	UUSCO
4,4-DDE:	0.0067	8.9	0.0033
4,4-DDD:	0.0093	13	0.0033
4,4-DDT:	0.045	7.9	0.0033
CADMIUM:	**4.6**	4.3	2.5
LEAD:	**790**	400	63
MERCURY:	0.58	0.81	0.18
ZINC:	2000	10000	109

TOTAL FLUORINATED ALKYL SUBSTANCES: 0.83

B6 7'-9'

	RESULT	RRUSCO	UUSCO
4,4-DDT:	0.12	7.9	0.0033
COPPER:	59	270	50
LEAD:	170	400	63
MERCURY:	0.52	0.81	0.18

B7 0'-2'

	RESULT	RRUSCO	UUSCO
CHROMIUM:	58	180	30
COPPER:	91	270	50
LEAD:	330	400	63
NICKEL:	38	310	30
ZINC:	230	10000	109

B7 7'-9'

	RESULT	RRUSCO	UUSCO
LEAD:	170	400	63

DRAWN BY: F. GALDUN 1/31/20

FIGURE 4: SOIL CHEMISTRY PLAN 1731 WEST FARMS ROAD BRONX, NY

SCALE: 20 FT.

O DENOTES SOIL VAPOR SAMPLE LOCATIONS

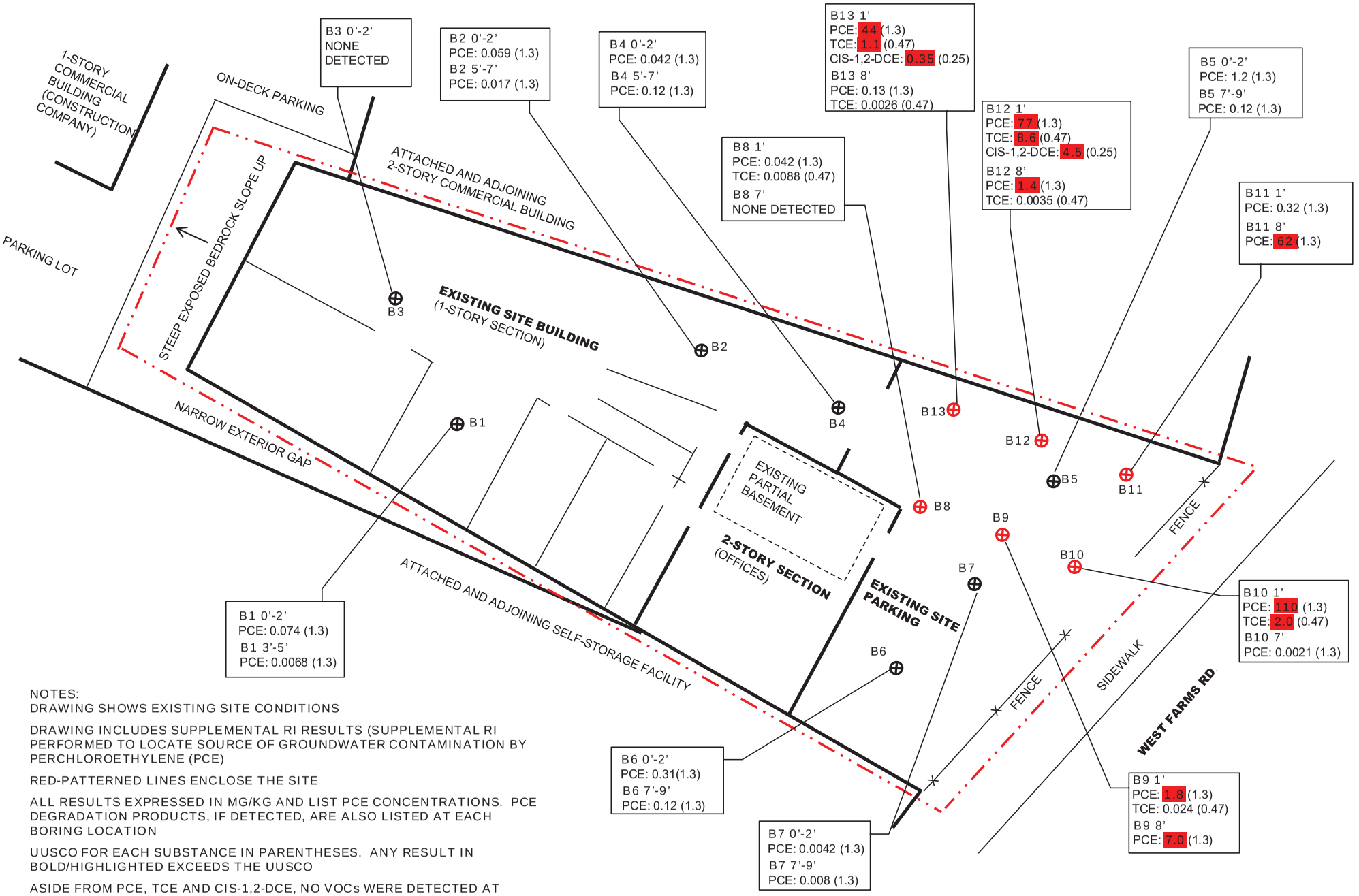
⊕ DENOTES SOIL BORING LOCATIONS

NOTES:
DRAWING SHOWS EXISTING SITE CONDITIONS

ONLY THOSE SUBSTANCES DETECTED ABOVE UUSCOs ARE LISTED AND RESULTS IN BOLD/HIGHLIGHTS EXCEED RRUSCOs

ALL RESULTS EXPRESSED IN MG/KG EXCEPT FLUORINATED ALKYL SUBSTANCES, WHICH IS EXPRESSED IN UG/KG

Figure 5 PCE and PCE Degradation Products in Soil Plan



NOTES:
DRAWING SHOWS EXISTING SITE CONDITIONS

DRAWING INCLUDES SUPPLEMENTAL RI RESULTS (SUPPLEMENTAL RI PERFORMED TO LOCATE SOURCE OF GROUNDWATER CONTAMINATION BY PERCHLOROETHYLENE (PCE)

RED-PATTERNED LINES ENCLOSE THE SITE

ALL RESULTS EXPRESSED IN MG/KG AND LIST PCE CONCENTRATIONS. PCE DEGRADATION PRODUCTS, IF DETECTED, ARE ALSO LISTED AT EACH BORING LOCATION

UUSCO FOR EACH SUBSTANCE IN PARENTHESES. ANY RESULT IN BOLD/HIGHLIGHTED EXCEEDS THE UUSCO

ASIDE FROM PCE, TCE AND CIS-1,2-DCE, NO VOCs WERE DETECTED AT LEVELS EXCEEDING UUSCOs

FIGURE 5: PCE & PCE DEGRADATION PRODUCTS IN SOIL PLAN
1731 WEST FARMS ROAD
BRONX, NY

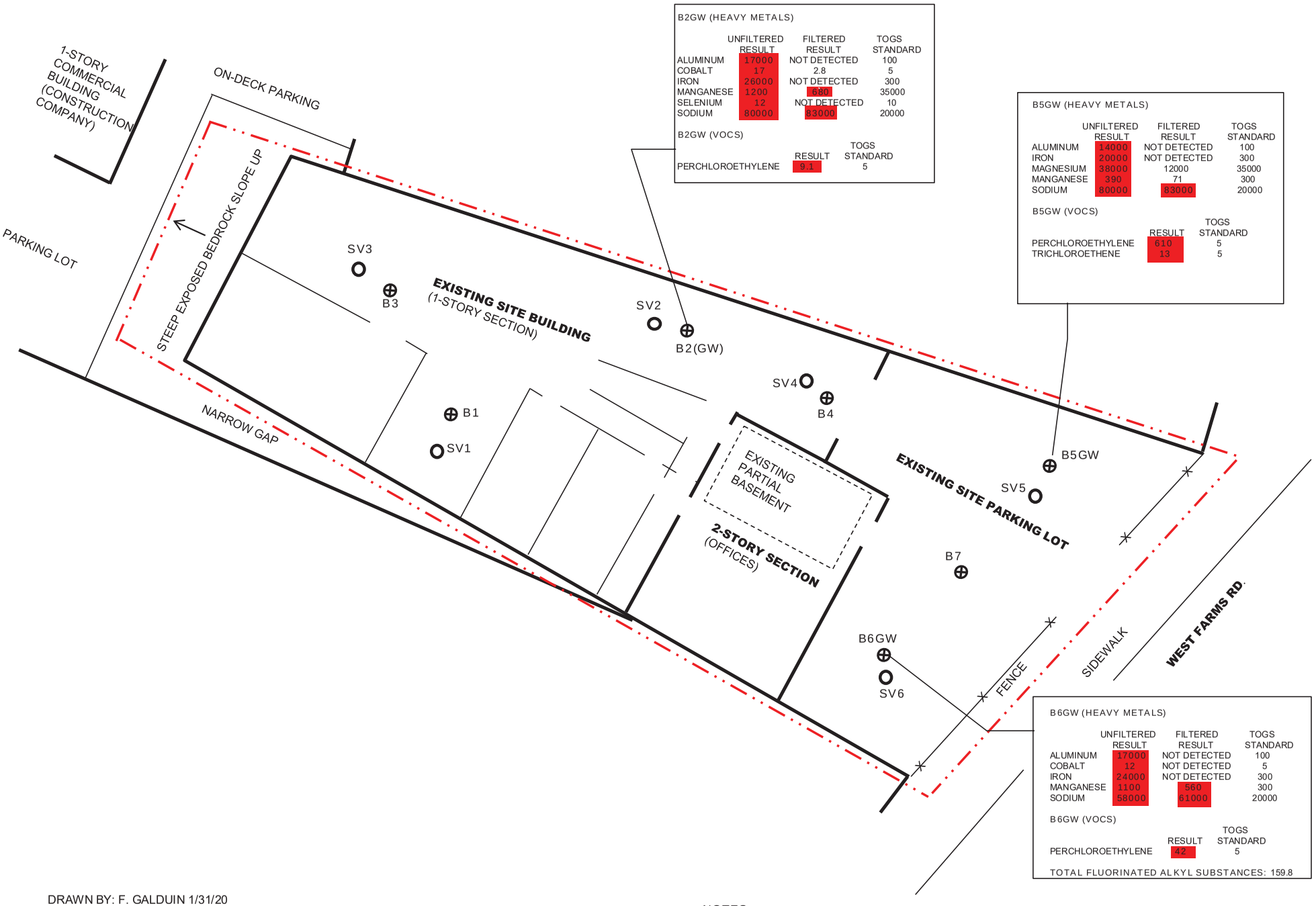
SCALE:
20 FT.

⊕ IDENTIFIES SOIL BORINGS INSTALLED BY THIS CURRENT SUPPLEMENTAL RI

⊕ DENOTES SOIL BORINGS INSTALLED IN OCTOBER 2019 DURING THE RI

DRAWN BY: F. GALDUN 1/31/20

Figure 6 Groundwater Chemistry Plan



DRAWN BY: F. GALDUIN 1/31/20

FIGURE 2: GROUNDWATER CHEMISTRY PLAN 1731 WEST FARMS ROAD BRONX, NY

SCALE: 20 FT.

O DENOTES SOIL VAPOR SAMPLE LOCATIONS

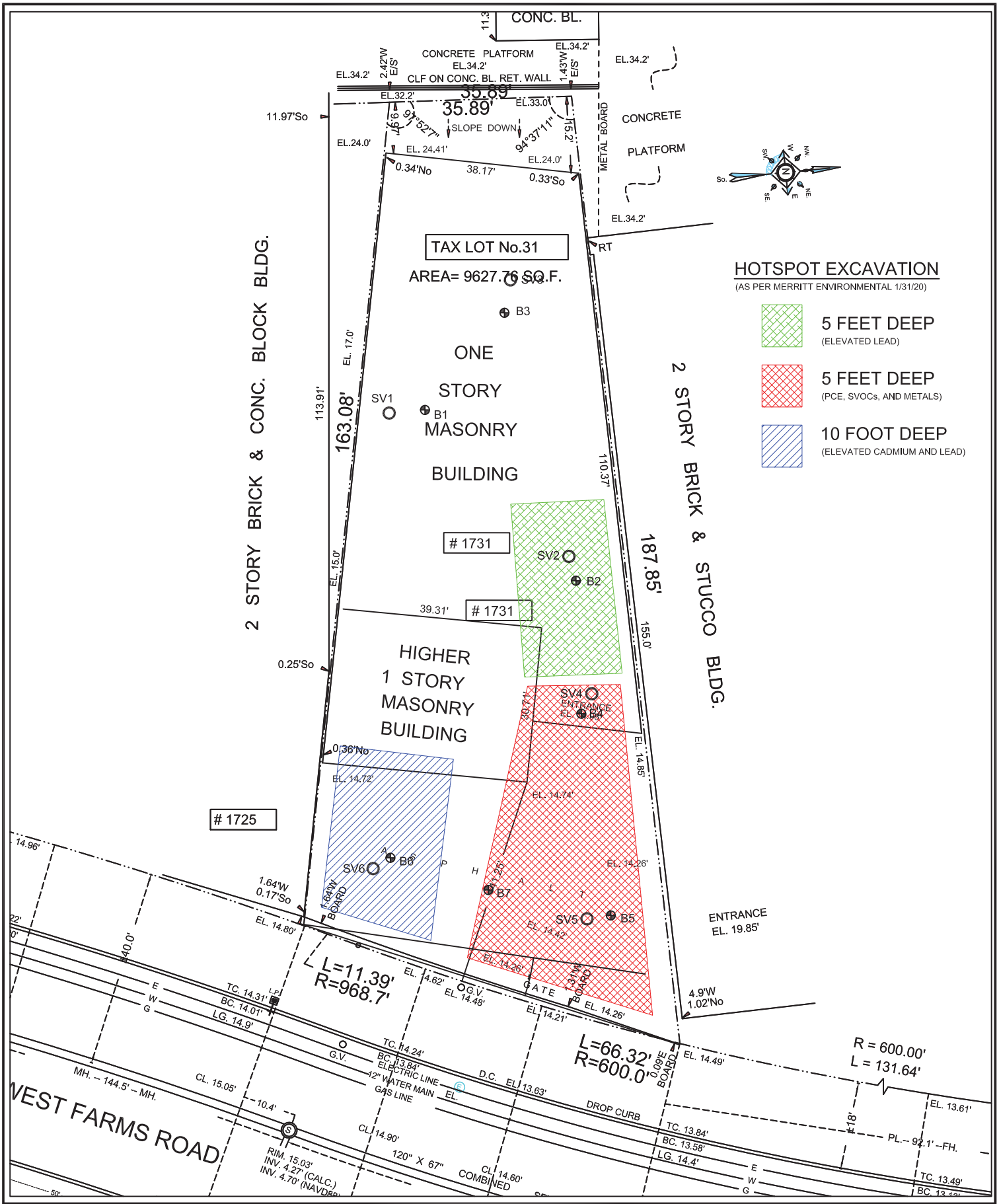
⊕ DENOTES SOIL BORING LOCATIONS ("GW" NOTATION IDENTIFIES GROUNDWATER SAMPLING LOCATIONS)

NOTES:
DRAWING SHOWS EXISTING SITE CONDITIONS

RESULTS IN BOLD/HIGHLIGHTS EXCEED STATE OF NEW YORK GROUNDWATER QUALITY STANDARDS
ONLY THOSE SUBSTANCES AT CONCENTRATIONS EXCEEDING THESE STANDARDS ARE LISTED

ALL RESULTS EXPRESSED IN UG/L EXCEPT FLUORINATED ALKYL SUBSTANCES,
WHICH IS EXPRESSED IN NG/L

Figure 7 Proposed Excavation Area – Alternative 2

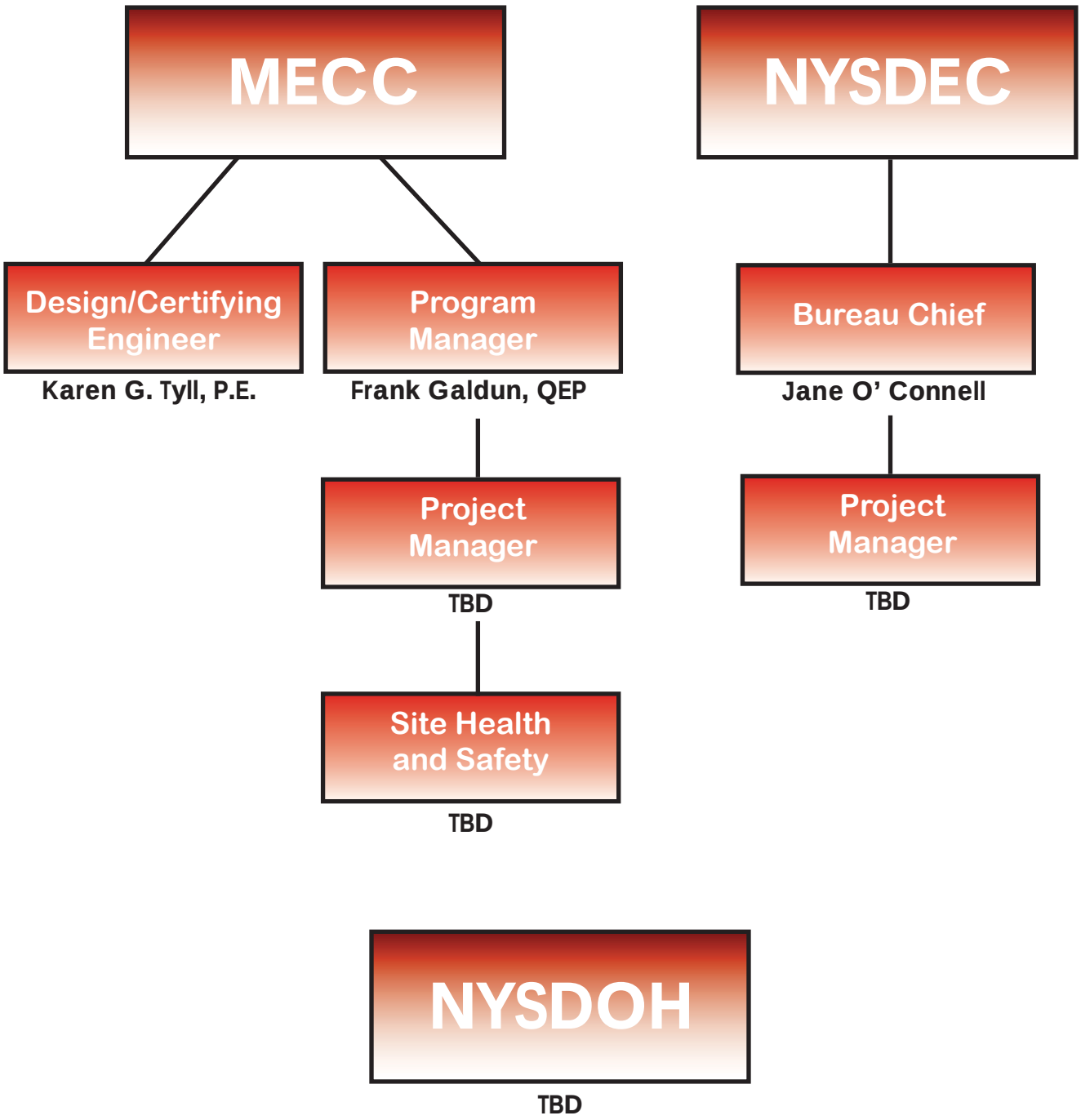


PREPARED BY:	TITLE:		
TYLL ENGINEERING & CONSULTING PC 169 Commack Road, Suite H173, Commack, NY 11725 PHONE: (631) 629-5373 info@tyllengineering.com	**PROPOSED EXCAVATION AREA ALTERNATIVE 2** 1731 WEST FARMS ROAD BRONX, NY		

DWN:	SCALE:	DATE:	PROJECT NO.:
-	1=300'	1/31/20	PRP1901
CHKD:	APPD:	REV.:	NOTES:
KT	KT	-	-

FIGURE NO.: 7

Figure 8 Organizational Chart

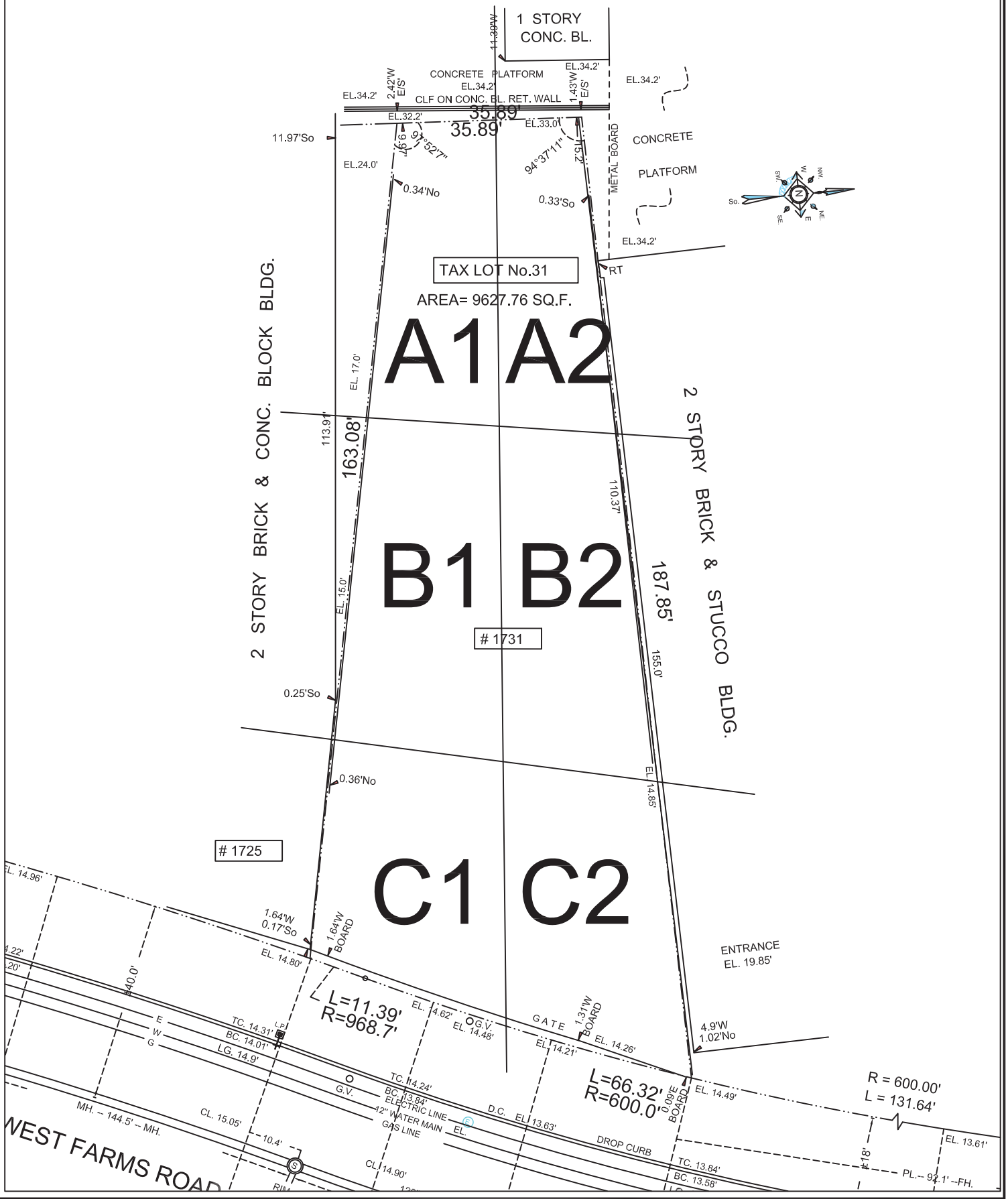


77 ARKAY DRIVE, SUITE D
HAUPPAUGE, NY 11788
PH: (631) 617-6200 FAX: (631)617-6201

SITE ADDRESS:	
PROJECT NO:	
DRAWING DATE:	
DRAWN BY:	APPROVED BY:

MERRITT ENVIRONMENTAL CONSULTING CORP

Figure 9 Alpha Numeric Grid



PREPARED BY: **TYLL ENGINEERING & CONSULTING PC** 169 Commack Road, Suite H173, Commack, NY 11725 PHONE: (631) 629-5373 info@tyllengineering.com	TITLE: **GRID MAP** 1731 WEST FARMS ROAD BRONX, NY	DWN: -	SCALE: NTS	DATE: 1/31/20	PROJECT NO.: PRP1901
		CHKD: KT	APPD: KT	REV.: -	NOTES: -
		FIGURE NO.: 13			

Figure 10 Community Air Monitoring Stations

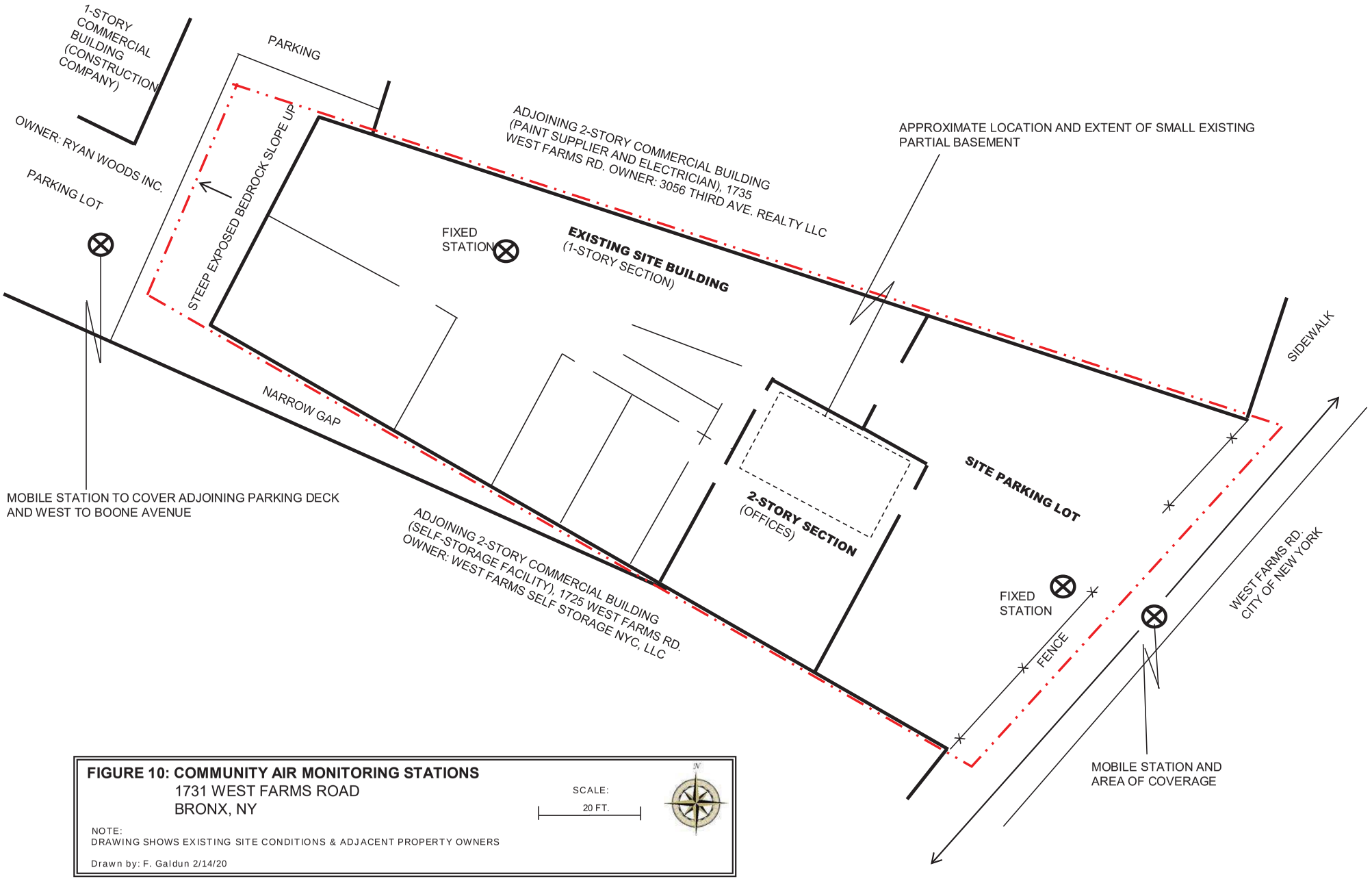


FIGURE 10: COMMUNITY AIR MONITORING STATIONS
1731 WEST FARMS ROAD
BRONX, NY

SCALE: 20 FT.

NOTE:
DRAWING SHOWS EXISTING SITE CONDITIONS & ADJACENT PROPERTY OWNERS

Drawn by: F. Galdun 2/14/20

Figure 11 Permanent Groundwater Monitoring Well Locations (to be installed)

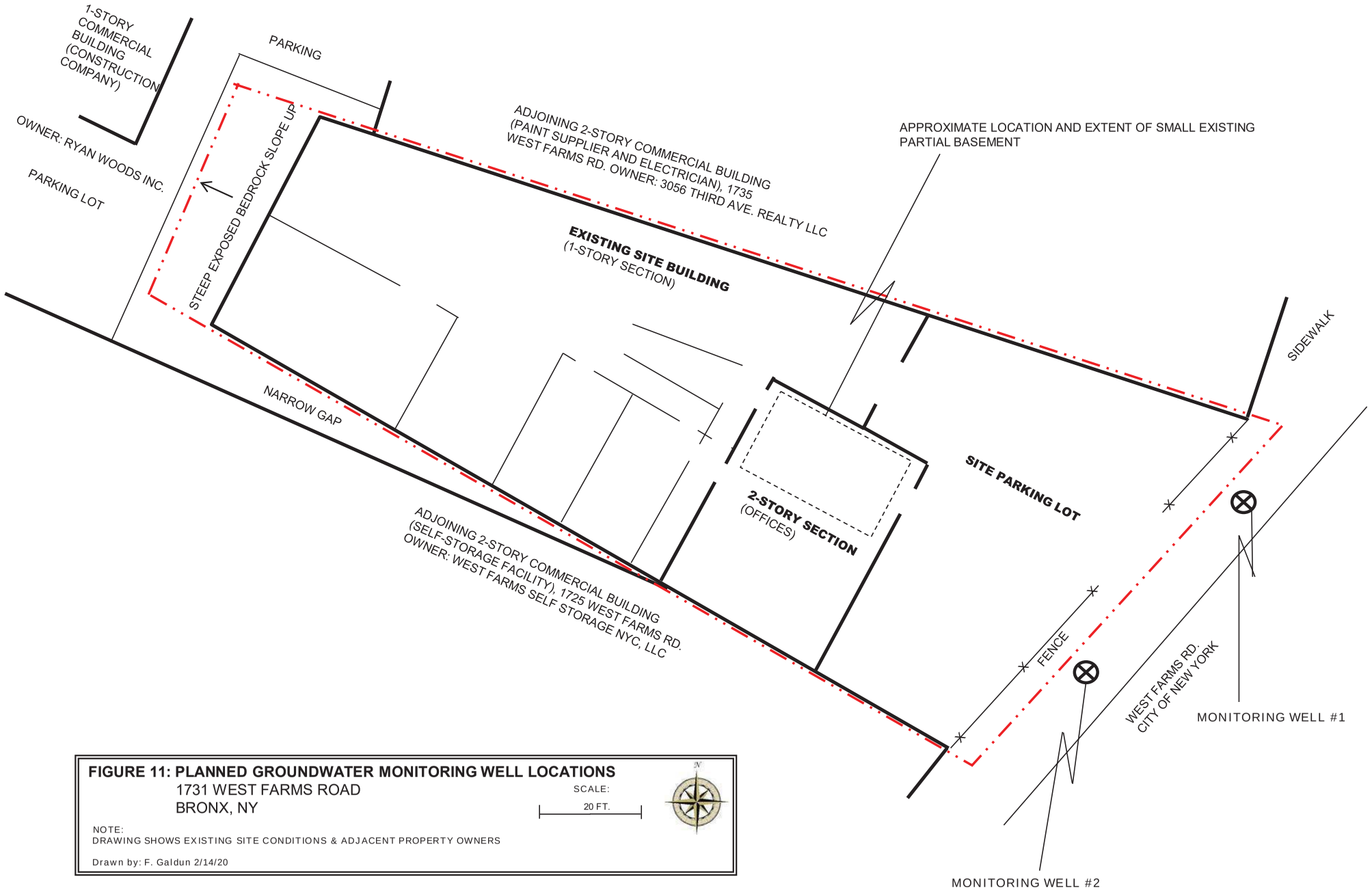


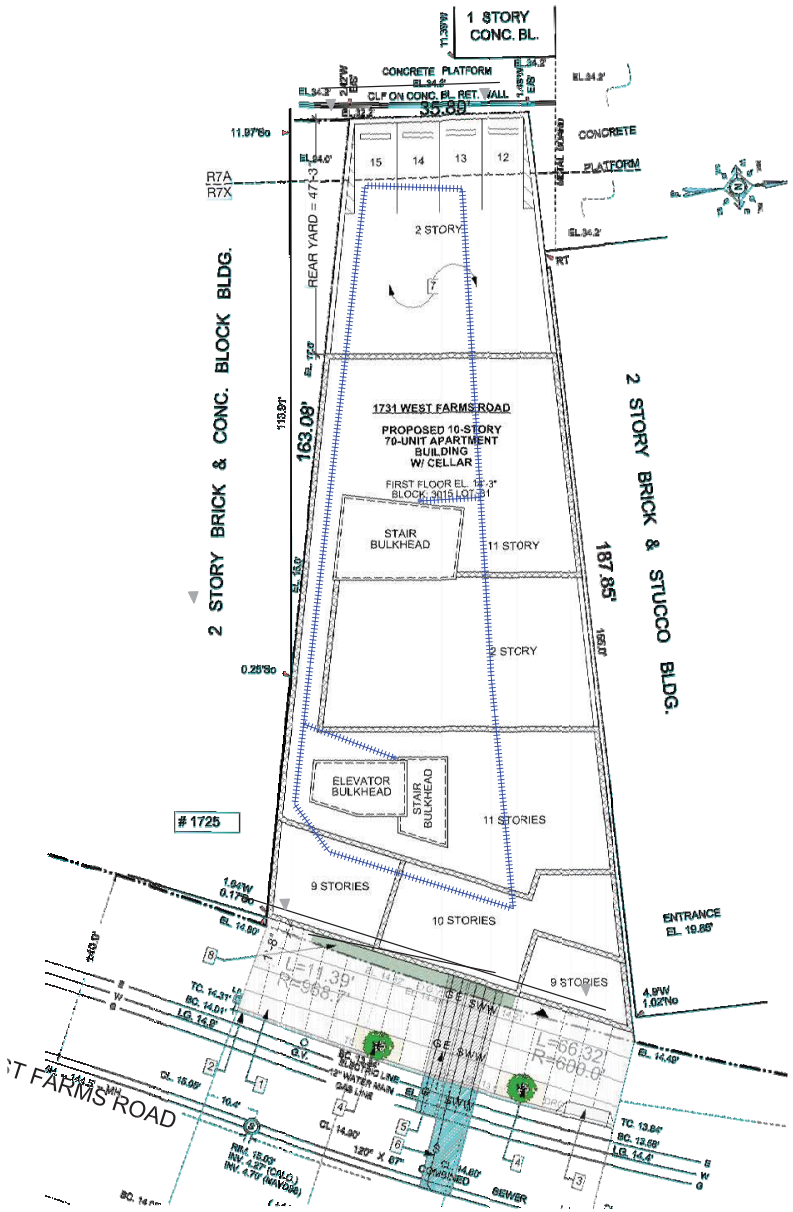
FIGURE 11: PLANNED GROUNDWATER MONITORING WELL LOCATIONS
1731 WEST FARMS ROAD
BRONX, NY

SCALE:
20 FT.

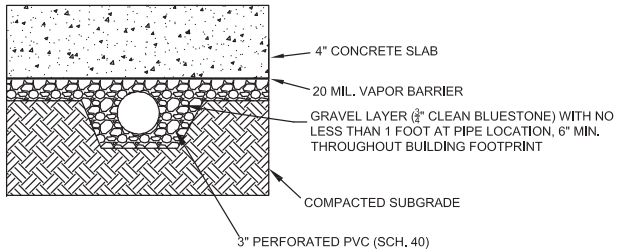
NOTE:
DRAWING SHOWS EXISTING SITE CONDITIONS & ADJACENT PROPERTY OWNERS

Drawn by: F. Galdun 2/14/20

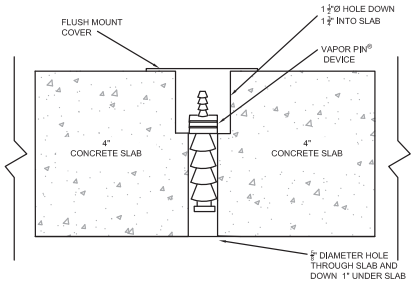
Figure 12 SSDS Layout Plan



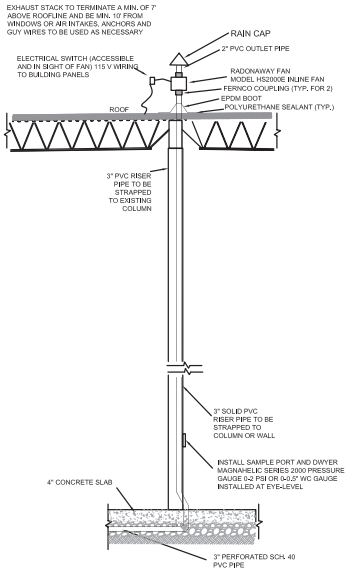
SSDS LAYOUT PLAN
SCALE: NTS



TYPICAL PIPE TRENCH DETAIL
SCALE: NTS



TYPICAL VACUUM MONITORING POINT
SCALE: NTS



TYPICAL SSDS PROFILE
SCALE: NTS

NOTES:
1. SEAL ALL PERFORATIONS, JOINTS AND SEAMS FOLLOWING MANUFACTURER'S RECOMMENDATIONS WITH SUPPLIED TAPE.
2. OER MUST PRE-APPROVE ALL FILL MATERIAL BEFORE DELIVERY TO SITE.
3. TEC/MERRITT MUST INSPECT, PHOTOGRAPH, AND DOCUMENT SSDS INSTALLATION (PIPING AND VAPOR BARRIER) BEFORE BACKFILLING.

LEGEND
VACUUM MONITORING POINT
SSDS HORIZONTAL PIPING

REV	DATE	CK	DESCRIPTION
REVISIONS			

SSDS LAYOUT PLAN

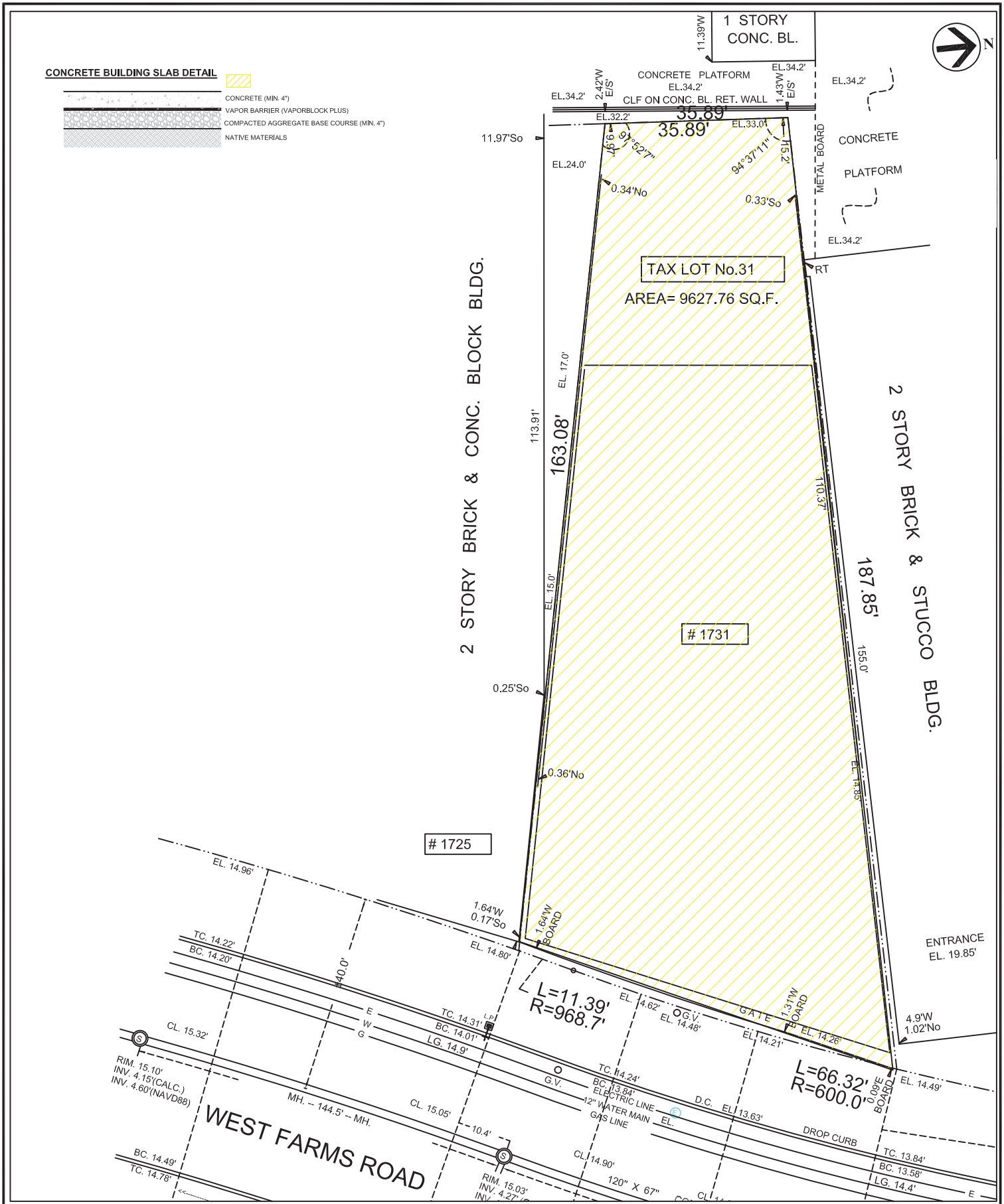
1731 WEST FARMS ROAD
BRONX, NY

TYLL ENGINEERING & CONSULTING PC
169 Commack Road, Suite H173, Commack, NY 11725
PHONE: (631) 629-5373 Info@tyllengineering.com

SHEET TITLE:	SSDS LAYOUT PLAN		
DESIGNED BY:	KT	SCALE:	NTS
REVIEWED BY:	KT	DATE:	FEBRUARY 10, 2020
PLAN SHEET BY:	KT	PROJECT NO:	PRP1901

12

Figure 13 Composite Cover Plan



PREPARED BY:	TITLE:	DWN:	SCALE:	DATE:	PROJECT NO.:
TYLL ENGINEERING & CONSULTING PC 169 Commack Road, Suite H173, Commack, NY 11725 PHONE: (631) 629-5373 Info@tyllengineering.com	**COMPOSITE COVER PLAN** 1731 WEST FARMS ROAD BRONX, NY	-	1=25'	2/7/20	PRP1901
		CHKD: KT	APPD: KT	REV.: -	NOTES: -
		FIGURE NO.: 13			

Figure 14 Truck Route Map

TRUCK ROUTING

MERRITT ENVIRONMENTAL
CONSULTING CORP
77 ARKAY DRIVE, SUITE D
HAUPPAUGE, NY 11788 (631) 617-6200

SITE ADDRESS: 1731 West Farms Road

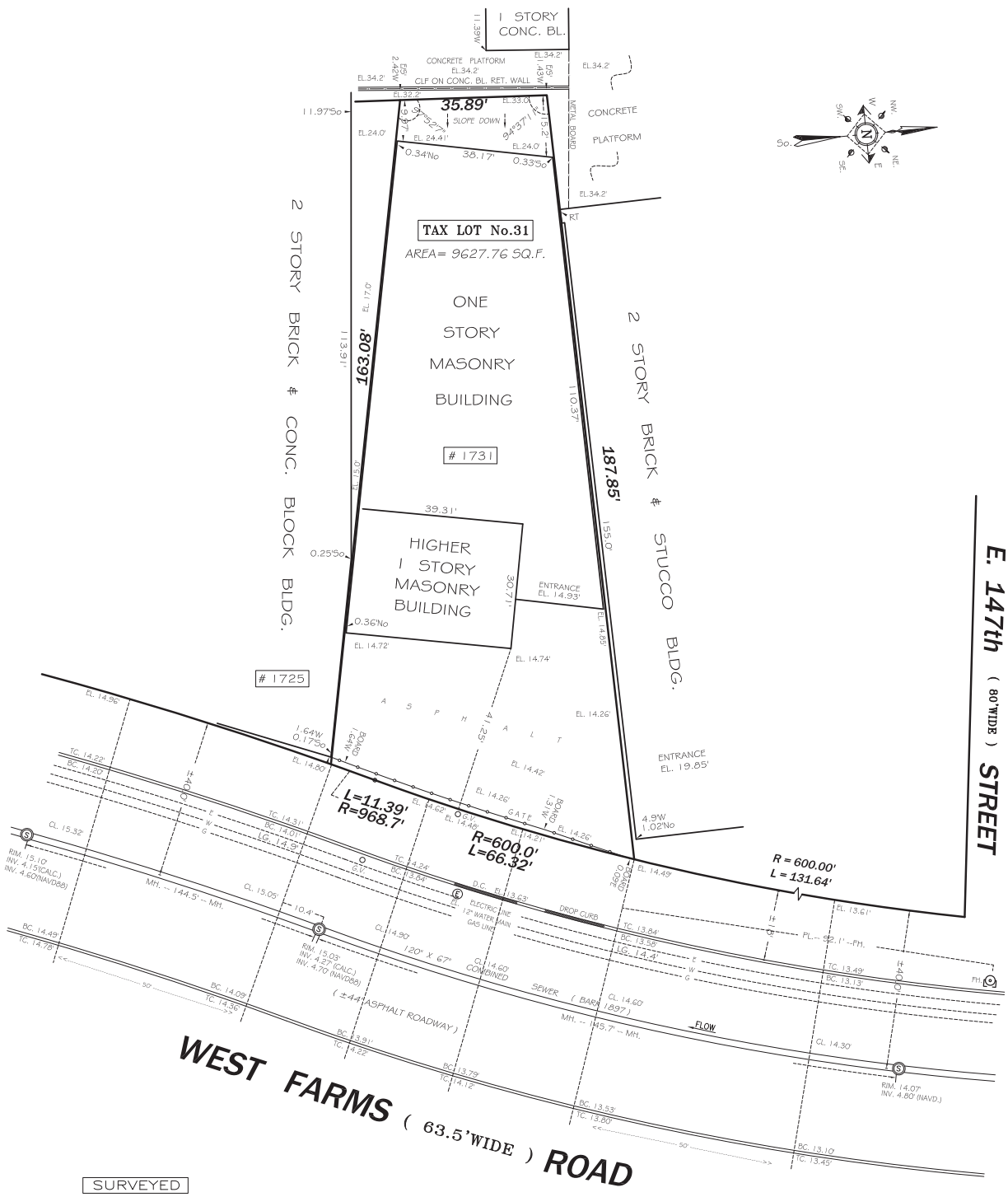
Appendix A Site Survey/Metes and Bounds

(NOT FOR TITLE PURPOSES) — LEGEND —

No. NORTH | So. SOUTH | E. EAST | F.E. FIRE ESCAPE | W.W. WINDOW WELL | C.D. CELLAR DOOR | ENT.UND. ENT. UNDER | ENT. ENTRANCE | L.A. LOW AREA | A. AREAWAY | Cl. CLEAR | RT. RIGHT

LIGHT POST | UTILITY POLE | CATCH BASIN | WATER VALVE | GAS VALVE | PARKING METER | TRAFFIC SIGN | HYDRANT HYD. | E.E. ELECTRIC BOX | TREE PIT | SEWER MANHOLE | ELECTRIC MANHOLE | TELEPHONE MANHOLE | D.W.S WATER

JOB # 15231-BX



SURVEYED

NOVEMBER 21, 2018

UPDATE:FEBRUARY 08, 2019

BLOCK:	3015
LOT (s):	31
SECTION:	11
COUNTY:	BRONX
DWG BY:	Srdjan B.
CHK'D BY:	

VINCENT M. TEUTONICO
N.Y.S LIC. No.050307
IG APPLE LAND SURV. D.
65 MEADOW LANE GROUND LEVEL
NEW ROCHELLE, NY 10805
OFF.(914)365-1847 ; FAX (914)365-1849
E-mail: BIGAPPLELS@YAHOO.COM

ARCHITECTURAL SURVEY

CAUTION: BEFORE PERFORMING ANY DIGGING OR DRILLING ON THIS SITE, IT IS REQUIRED THAT SUBSURFACE SERVICES, INCLUDING THE UNDERGROUND MAINS BE MARKED AND IDENTIFIED BY THE UTILITY INVOLVED IN COMPLIANCE WITH INDUSTRIAL CODE 53 OF NEW YORK STATE.

1) ALL ELEVATIONS REFER TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) WHICH IS 1.508 FEET ABOVE THE BRONX TOPOGRAPHICAL DATUM

2) UNDERGROUND UTILITY INFORMATION SHOWN WAS OBTAINED FROM VARIOUS COMPANIES AND CITY AGENCIES AND IS NOT GUARANTEED FOR ACCURACY OR COMPLETENESS.

3) THIS IS TO CERTIFY THAT THERE ARE NO APPARENT STREAMS NOR NATURAL WATER COURSES IN THE PROPERTY AS SHOWN ON THIS SURVEY

SCALE: 1"=25'

Appendix B Health and Safety Plan

CONSTRUCTION HEALTH & SAFETY PLAN

1731 West Farms Road, Bronx, New York

Prepared for:
1731 West Farms Road LLC
35-37 36th Street, 6th Floor
Long Island City, New York 11106
Email Address: alfred@propcoholdings.com

Prepared by:
Merritt Environmental Consulting Corp.
77 Arkay Dr., Suite D
Hauppauge, NY 11788

February 2020

Contents

APPENDIX A

Material Safety Data Sheets for Contaminants of Concern

1.0 GLOSSARY OF TERMS

AHA: Activity Hazard Analysis

BZ: Breathing Zone

C: Ceiling Limit

CNS Central Nervous System

CTPV: Coal tar pitch volatiles

CRZ: Contamination Reduction Zone

CSP: Construction Superintendent

CZ: Clean Zone

dBA: Decibels Adjusted

ERCP: Emergency Response and Contingency Plan

EZ: Exclusion Zone

FDNY: New York City Fire Department

GI: Gastrointestinal

HSO: Health & Safety Officer

IP: Ionization Potential

Mg/m^3: Micrograms per cubic meter

MPH: Miles per hour

NIOSH: National Institute for Occupational Safety and Health

OSHA: Occupational Health and Safety Administration

PAHs: Poly aromatic hydrocarbons

PEL: Permissible Exposure Limit

PM: Project Manager

PPE: Personal Protective Equipment

PPM:	Parts per Million
PSM:	Project Safety Manager
SHASP:	Site-Specific Health and Safety Plan:
SITE:	40-05 Crescent Street, Queens, NY
STEL:	Short-term exposure limit (15 minutes)
SVOCs	Semi-Volatile Organic Compounds
SZ:	Support Zone
TLV:	Threshold Limit Value
TWA:	Time-weighted average (8 hours)
USEPA:	United States Environmental Protection Agency

2.0 INTRODUCTION

The Site is located at 1731 West Farms Road in the West Farms section in Bronx, New York and is identified as Block 3015 and Lot 31 on the New York City Tax Map. Figure 1 shows the Site location. The Site is 9,723-square feet and is bounded by a two-story commercial building to the north, a large commercial self-storage building to the south, West Farms Road to the east, and a single-story building containing a construction contractor to the west. A map of the Site boundary is shown in Figure 2. Currently, the Site is vacant but is used for vehicle parking and construction materials storage. Current Site improvements consist of a partial one-story and partial two-story commercial building and an exterior parking lot.

This Site-Specific Construction Health and Safety Plan (CHASP) has been developed by Merritt Environmental Consulting Corp. ("MECC") for specific activities associated with the construction of a new residential building at the Site.

This CHASP documents the policies and procedures which will protect workers from potential chemical hazards associated with the soils and/or fill at this Site. Other plans and documentation will establish the policies and procedures that will protect workers from potential physical hazards associated with traditional demolition and construction activities at the Site.

This plan assigns responsibilities, establishes standard operating procedures, and provides for contingencies that may arise during the disturbance of soil/fill at the Site. This CHASP was prepared by MECC. The general contractor and its subcontractors will be required to utilize this plan when working at the site.

Although this plan focuses on the specific work activities planned for this site, it must remain flexible because of the nature of this work. Conditions may change and unforeseen situations may arise that require modifications from the original plan. Therefore, M only makes representations or warranties as to the adequacy of this CHASP for currently anticipated activities and conditions. This flexibility allows modification by authorized personnel, e.g. Project Manager, Project Safety Manager.

Refusal or failure to comply with this CHASP or violation of any safety procedures by field personnel and/or subcontractors may result in immediate removal from the Site following consultation with the Project Safety Manager (PSM) and the Project Manager (PM).

It is expected that this CHASP will be implemented at a multi-employer work site. Information and references within this plan shall in no way imply or alleviate any other Site contractor from their responsibility to comply with any and all applicable State or Federal statutes or regulations regarding the completion of this project. It is the responsibility of each employer to communicate and coordinate work planning so as to prevent their work activities from becoming a potential hazard to other workers at the project site. Failure to communicate will not alter an employer's responsibilities or obligations for any resulting injuries to their employees.

2.1 SITE HISTORY

According to information obtained by the review of the Phase I ESA, the Site contained residential buildings prior to 1931, which is the reported date of construction of the current improvements. The Phase I ESA indicates that a marble shop/stone mason reportedly occupied the Site between 1931 and the 1970s. According to the Phase I ESA, subsequent Site occupants included a machine shop apparently during the 1970s and 1980s, and that various dry cleaning and laundry equipment sales and refurbishing operations were present from the 1980s until recent times (the specific date in which this operation ceased is unknown). Other past occupants of the Site (according to the Phase I ESA) include "Tikva Electric," in the 1990s. The Site is currently unoccupied (period of vacancy unknown), but certain information contained in the Phase I ESA shows that the dry cleaning equipment sales and refurbishing operations were present until at least 2005. The current Site owner (1731 West Farms Road LLC) uses the Site for vehicle parking and construction materials storage.

The AOCs identified for the Site include:

1. Historical on-site machine shop
2. Dry cleaning machine supplier and possibly dry cleaning refurbishing by the most recent occupant from 1983 to an unknown date.

MECC performed an RI at the Site in October 2019. A Supplemental RI was conducted by MECC in January 2020. The purpose of the two studies was to delineate soil, groundwater, and soil vapor impact within the Site boundary and to determine what, if any, impact may have migrated off-Site.

Findings of the RI and the Supplemental RI include the following:

- Soil sample analytical results for the RI identified SVOCs, metals and pesticides concentrations exceeding their respective UUSCOs in both shallow and deep soil. Exceedances of RRUSCOs for these substances were detected at three locations in shallow soil only. Such impact at the levels detected at the Site is commonly associated with the presence of historic fill material. While UUSCOs for these substances were exceeded in deeper soil samples, none of the various concentrations exceed RRUSCOs.

- Laboratory analysis of the 12 grab soil samples collected during the Supplemental RI has confirmed that the Site is the source of PCE contamination in groundwater. Elevated PCE and PCE degradation product concentrations are present in both shallow and deep soil under a portion of the exterior parking lot at the east end of the Site.

- PCE was detected at concentrations exceeding the NYSDEC Ambient Water Quality Standards (AWGS) in each of three collected groundwater samples. PCE concentrations detected in the samples range from 9.1 ug/l to 610 ug/l. The sample reported by the laboratory as containing the highest PCE concentration was collected from the PCE source area in soil, and at the area where the highest PCE concentration in soil vapor (east parking lot).

- Metals (manganese and sodium) were detected at concentrations exceeding their respective NYSDEC AWQS in the three collected groundwater samples. Because elevated concentrations of these metals were not detected in soils at the Site, the presence of these metals in groundwater is likely due to the chemical composition of bedrock beneath the Site and/or soils within the aquifer.

- High PCE vapor concentrations were detected in five of the six soil vapor sample collected at the Site. PCE vapor concentrations range from 746 micrograms per cubic meter (ug/m^3) of air to 679,000 ug/m^3, with the highest concentration reported in the sample collected at the PCE source area in soil. PCE degradation products were also detected at elevated concentrations in three of the six soil vapor samples and include trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE) and 1,1-dichloroethene (1,1-DCE).

2.2 SCOPE OF WORK

Although the construction of the new multi-unit residential building involves many different activities, only those activities associated with the disturbance and handling of urban fill are addressed in this CHASP.

The principal tasks covered in this CHASP include the following:

- Mobilization/demobilization,
- Sheeting and shoring,
- Excavation of urban fill and/or soil,
- Loading of urban fill into trucks for disposal,
- Installation of footings and foundation,
- Heavy equipment decontamination,

This CHASP has been prepared and approved for the above scope of work. In order to remain approved, any changes to the scope of work will require amendment of the plan.

KEY PERSONNEL

The Project Manager (PM), Construction Superintendent (CS), Health & Safety Officer (HSO), and Project Safety Manager (PSM) all share responsibilities for formulating and enforcing health and safety requirements, and assuring that the CHASP is implemented as intended. This section outlines the responsibilities for each of these positions. Responsibilities for Site employees and subcontractor personnel are also outlined in this section. The General Contractor and/or other authorized personnel may also be involved and identified in future CHASP documents, as appropriate.

3.0 PROJECT MANAGER (PM)

The PM has the overall responsibility for the project and to assure that the requirements of the contract are attained in a manner consistent with the CHASP requirements. The PM will coordinate with the CS and the HSO to assure that the work is completed in a manner consistent with the HASP. The PM will supervise the allocation of resources and staffing to implement specific aspects of the HASP and may delegate authority to expedite and facilitate any application of the program. This role will be filled by the General Contractor or Excavation Subcontractor.

CONSTRUCTION SUPERINTENDENT (CS)

The CS is responsible for field implementation of the CHASP and Site Emergency Response and Contingency Plan and will act as the HSO in his/her absence. This role will be filled by the general contractor or primary subcontractor. A representative of the general contractor will serve as the CS for this project.

Specific responsibilities for the CS include:

- Ensures that the CHASP is implemented;
- Ensures that field work is scheduled with adequate equipment to complete the job safely;
- Enforces site health and safety rules;
- Ensures that proper personal protective equipment is utilized;
- Ensures that the PSM is informed of project changes which require modifications to the CHASP;
- Ensures that the procedure modifications are implemented;
- Investigates incidents;
- Conducts the daily Site safety briefing;
- Reports to PSM to provide summaries of field operations and progress; and
- Acts as Emergency Coordinator.

HEALTH AND SAFETY OFFICER (HSO)

The HSO is authorized to administer the HASP. The HSO's primary operational responsibilities include personal and environmental monitoring, selection and monitoring of personal protective equipment, assignment of protection levels, coordination/review of work permits and observation of work activities. The HSO is authorized to stop work when an imminent health or safety risk exists. The HSO will review the essential safety requirements with all on-site personnel and will facilitate the daily safety meetings. A representative of the general contractor will serve as the HSO for this project.

Specific responsibilities for HSO performance include:

- Monitoring workers for signs of stress, such as cold stress, heat stress, and fatigue. Reevaluating site conditions on an on-going basis.
- Coordinating protective measures including engineering controls, work practices and personal protective equipment.
- Assisting the CS in the preparation, presentation and documentation of daily safety meetings.
- Conducting and preparing reports of daily safety inspections of work processes, site conditions, and equipment conditions. Discussing any necessary corrective actions with the CS and reviewing new procedures.
- Initiating revisions of the CHASP as necessary for new tasks or modifications of existing operations and submitting to the Project Safety Manager for approval (see Appendix B).
- Performing air monitoring as required by the CHASP.
- Assisting the PM and CS in incident investigations.
- Preparing permits for special operations, e.g., hot work, confined spaces, line breaking, etc.
- Maintaining site safety records.
- Conducting inspections of all fire extinguishers, first-aid kits and eye washes on a regular basis.
- Informing subcontractors of the elements of the CHASP.

PROJECT SAFETY MANAGER (PSM)

The Project Safety Manager (PSM) is responsible for developing/reviewing the CHASP and ensuring that it is complete and accurate. The PSM provides technical and administrative support and will be available for consultation when required. If necessary, the PSM will direct modifications (Appendix B) to specific aspects of the HASP to adjust for on-site changes that affect safety. The HSO will coordinate with the PSM on necessary modifications to the HASP. The PSM may make periodic visits to the project site to review implementation of this HASP. This role is role will be filled by the General Contractor’s representative.

EMPLOYEE SAFETY RESPONSIBILITIES

Each employee is responsible for personal safety as well as the safety of others in the work area and is expected to participate fully in the site safety and health program. Employees will use all equipment provided in a safe and responsible manner as directed by the CS. Employees shall report any hazardous conditions which might affect the health and safety of site personnel to the CS and/or HSO. To protect the health and safety of all personnel, site employees that knowingly disregard safety policies/procedures will be subject to removal.

Specific requirements include:

- Reading the CHASP and any amendments prior to the start of on-site work.
- Providing documentation of any applicable medical surveillance and training to the CS/HSO prior to the start of work.
- Attending the pre-entry briefing prior to beginning on-site work as well as other scheduled safety meetings.
- Asking any questions or reporting concerns regarding the content of the CHASP to the
- CS/HSO prior to the start of work.
- Reporting all potentially dangerous situations, incidents, injuries, and illnesses, regardless
- of their severity, to the CS/HSO.
- Complying with the requirements of this CHASP and the requests of the CS/HSO.

ACTIVITY HAZARD ANALYSIS

This section outlines the potential chemical and physical hazards which workers may be exposed to during work on this project. The assessment of chemical hazards in this section is based on the results provided in the RI by MECC for the Site. This is a representative list of contaminants that have been identified through extensive soil and groundwater testing at the Site.

CHEMICAL HAZARDS

Based on review of the RI report, workers at this Site have the potential to be exposed to the following substances in the upper five feet of fill at the Site (these substances were detected at concentrations exceeding UUSCOs):

Metals

Chromium: ranging in concentration from 17 milligrams per kilogram (mg/kg) to 35 mg/kg (UUSCO: 30 mg/kg)

Copper: ranging from 14 mg/kg to 140 mg/kg (UUSCO: 50 mg/kg)

Lead: ranging from 8.3 mg/kg to 400 mg/kg (UUSCO: 63 mg/kg)

Mercury: ranging from undetect to 1.3 mg/kg (UUSCO: 0.18 mg/kg)

Zinc: ranging from 38 mg/kg to 1100 mg/kg (UUSCO: 109 mg/kg)

These substances were generally identified in the fill at low levels, but above the Part 375 Unrestricted Use Soil Objectives (UUSCOs), and will be considered potential contaminants of concern.

Soil Vapor

In addition, PCE (a volatile organic compound) was detected in subsurface soil vapor at concentrations ranging from 746 micrograms per cubic meter of air (ug/m^3) to 679,000 ug/m^3. Generally, the State of New York raises PCE in vapor form as an area of concern under a building at concentrations exceeding 1,000 ug/m^3. However, construction excavation work in an outdoor setting likely will not cause elevated PCE vapors to exist. Air quality monitoring will be conducted to verify that no elevated concentration of volatile organic compounds in vapor form exist during construction excavation.

Potential exposure to the contaminants of concern may occur during intrusive soil activities or where direct contact with the contaminated soil takes place. The substances are primarily inhalation hazards and exposure can be minimized with simple dust control measures. A summary of hazard information is listed in Table 4-1.

CHEMICAL DATA

COMPOUND	ACGIH TLV	OSHA PEL	ROUTE OF EXPOSURE	SYMPTOMS OF EXPOSURE	TARGET ORGANS	PHYSICAL DATA
Chromium	0.5 mg/m³	1.0 mg/m³	Inhalation Ingestion Skin contact	Eye and skin irritant. Digestive tract irritant	Liver	Solid silver-grey metal
Copper	1.0 mg/m³	1.0 mg/m³	Inhalation Ingestion Skin contact	Irritant to skin	Lungs, mucous membrane	Bluish lustrous metal, Noncombustible Solid
Lead	0.05 mg/m³	0.1 mg/m³	Inhalation Ingestion Skin contact	Weakness, lassitude, insomnia; facial pallor; eye irritation, anorexia, low-weight, malnutrition; constipation; abdominal pain; colic; hypertension, anemia; gingival lead line; tremors; paralysis of wrist, ankles; encephalopathy; neuropathy	GI Tract, CNS, kidneys, blood, gingival tissue	Noncombustible Solid
Mercury	0.25 mg/m3	0.1 mg/m³	Inhalation Ingestion Skin contact	Inflammation of eyes and skin; coughing; choking; shortness of breath; death	Blood, kidneys, liver, brain, peripheral nervous system, CNS	Non-combustible Liquid
Zinc	2.0 mg/m³ (As ZnO)	5.0 mg/m³ (as ZnO)	Inhalation Ingestion Skin contact	Irritant to skin	Skin	Noncombustible Solid (as ZnO)

Abbreviations
ACGIH = American Conference of Governmental Industrial Hygienists mg/m³= milligrams per cubic meter
C = Ceiling Unit OSHA = Occupational Safety and Health Administration
CNS = Central Nervous System PNS = Peripheral Nervous System
CVS = Cardiovascular System ppm = parts per million
GI = Gastrointestinal PEL – Permissible Exposure Level
TLV = Threshold Level Value

The following general symptoms may indicate exposure to a hazardous material. Personnel will be removed from the work site and provided immediate medical attention should any of the following symptoms occur:

- Dizziness or stupor
- Nausea, headaches, or cramps
- Irritation of the eyes, nose, or throat
- Euphoria
- Chest pains and coughing
- Rashes or burns

PHYSICAL HAZARDS

To minimize physical hazards, standard safety protocols will be followed at all times. Failure to follow safety protocols may result in removal of the employee from the site. All personnel shall be familiar with the physical hazards presented by each of the tasks they perform. Task specific hazard analyses are provided in Section 4.5. These hazard analyses shall be reviewed prior to beginning each task and periodically throughout the task. It must be noted that these activity hazard analyses are general in nature. It is the responsibility of the CS to revise and adapt them as necessary to reflect site-specific conditions.

The CS and HSO will observe the general work practices of each crew member and enforce safe procedures. Work areas will be inspected by the crew leaders, CS and HSO. All hazards will be corrected in a timely manner. A variety of physical hazards may be encountered during work activities at this site. Activity Hazard Analyses will be developed for each principal activity and will identify all major hazards to which employees may be exposed. Hard hats, safety glasses, and steel-toe safety boots are required in all work areas of the site. Site-specific hazards and all necessary precautions will be discussed at the daily safety meetings. The General Contractor's Safety Manual will be maintained at the project site as a reference document.

ENVIRONMENTAL HAZARDS

Environmental factors such as weather, wild animals, insects, and irritant plants may pose a hazard when performing outdoor tasks. The HSO and CS will take necessary actions to alleviate these hazards should they arise.

Heat Stress

The combination of warm ambient temperature and protective clothing increases the potential for heat stress. Heat stress disorders include:

- Heat rash
- Heat cramps
- Heat exhaustion
- Heat stroke

This information will be reviewed during safety meetings. Workers are encouraged to increase consumption of water and electrolyte-containing beverages. Heat stress can be prevented by assuring an adequate work/rest schedule.

The CS and HSO will determine the specific work-rest schedule based on project specific conditions. In addition, workers are encouraged to take rests and report symptoms whenever they feel any adverse effects that may be heat-related. The frequency of breaks may need to be increased based on worker recommendation to the HSO and CS. The CS and HSO will determine the specific work-rest schedule based on project specific conditions. In addition, workers are encouraged to take rests and report symptoms whenever they feel any adverse effects that may be heat-related. The frequency of breaks may need to be increased based on worker recommendation to the HSO and CS.

Heat stress can be prevented by assuring an adequate work/rest schedule and adequate fluid consumption. A guide for work-rest schedules for various protection levels (defined in Section 5.0) is given below. The number of hours before a work-rest period is based on experience with similar work. The time periods should be considered maximum. It must also be remembered that individual physical variability and differences in physical work activities may require revisions to site plans. This table should be used as a guide. Professional judgment (evaluation of individual work load, ambient weather conditions, worker acclimatization and PPE levels) of the CS and HSO is necessary to assure a fully protective plan to prevent heat stress disorders.

Alternately the work/rest schedule can be calculated based on heat stress monitoring results. Monitoring consists of taking the radial pulse of a worker for 30 seconds immediately after exiting the work area. The frequency of monitoring is described below.

If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by 1/3 and keep the rest period the same. If the heart rate still exceeds 110 beats per minute at the next rest period, increase the following rest period by 1/3. The initial rest period should be at least 5 minutes.

Body temperature, measured orally or through the ear canal, may also be monitored to assess heat stress. Workers should not be permitted to continue work when their body temperature exceeds 100.4 F (38C). Monitoring should be conducted at the beginning of each break period as noted above.

Monitoring for heat stress will begin when the ambient temperature reaches or exceeds 72.5 degrees Fahrenheit when wearing chemical protective clothing (Level C, B, A), or 80 degrees Fahrenheit for site activities performed with no chemical protective clothing (Level D). Monitoring should include pulse rate, weight loss, oral/ or ear canal temperature, signs and symptoms of heat stress and fluid intake.

An additional measure that can be employed to minimize heat stress is through the utilization of Heat Stress Relief Stations. A Heat Stress Relief Station (HSRS) is a location inside the exclusion zone where workers can partially remove their personal protective equipment, rest and take in fluids. Since the HSRS is established inside the exclusion zone, it is imperative that its use be closely monitored and controlled to ensure that workers do not ingest contamination during use.

The following is a detailed description of the Heat Stress Relief Station:

- Location- The HSRS should be located in an area of the exclusion zone where it will be predominantly upwind of site activities. This can typically be adjacent to the contamination reduction zone.

- Delineation- The HSRS must be separated from the exclusion zone by temporary fencing and must be labeled as "Heat Stress Relief Station".

- Elements- The HSRS contains several elements:

    - A tarp or tent for shade;
    - A bench or chairs for workers to sit on;

    - A wash station;
    - A table for fluids, cups and clean personal protective equipment (PPE); and

    - A trash can for contaminated PPE.

- Set-Up- Proper set up of the HSRS is imperative its successful use.

    - In the Support Zone, prepare the water cooler with ice and water or electrolyte-containing liquids.

    - The person bringing the items to the HSRS must don the appropriate PPE required for the Exclusion Zone.

    - Bring the following items to the HSRS:

        - Cooler;

        - Clean disposable cups;

        - Disinfectant wipes;

        - A clean trash bag;

        - Surgical gloves; and

        - Duct tape.

    - Ensure the wash station has clean water and paper towels for drying hands/face.

- Procedure for Use- In order for the HSRS to be effective, it must be properly used. It is imperative that workers decontaminate properly before drinking fluids so that ingestion of site contaminants does not take place. The following are the steps to properly use the HSRS:
    - Upon entering the HSRS:
        - If wearing a Tyvek, remove duct tape on wrists and unzip and tie around waist;
        - Remove your outer gloves and surgical gloves; set outer gloves aside and throw surgical gloves into trash;
        - Wash hands and/or face at Wash Station;
        - Use disinfectant wipe on hands;
        - Get drink and/or rest on bench/chair.
    - Before re-entering the Exclusion Zone:
        - Dispose of cups in trash;
        - Put on a clean pair of surgical gloves;
        - If wearing a Tyvek, pull up and rezip;
        - Re-apply duct tape to wrists;
        - Put on outer gloves.

- Monitoring- The CS and HSO are both responsible for monitoring the use of the Heat Stress Relief Station. The HSO should review the procedures for use of the HSRS with the workers before its use begins to ensure that everyone understands the parameters for proper use.

4.3.2 Exposure to Cold

With outdoor work in the winter months, the potential exists for hypothermia and frostbite. Several forms of cold stress as well as preventative measures are described in this section of the HASP.

4.3.2.1 Cold Stress Conditions and Symptoms

Typical cold stress conditions are included in the tables below, including symptoms and first aid precautions. If cold stress conditions develop, professional medical attention will be sought.

In cold weather, the potential for frostbite exists, especially in body extremities. Personnel will be instructed to pay particular attention to hands, feet, and any exposed skin when dressing. Personnel will be advised to obtain more clothing if they begin to experience loss of sensation due to cold exposure.

4.3.2.2 Monitoring and Preventative Actions

Typical cold stress monitoring procedures are included in the tables below, including temperatures to initiate monitoring, protective clothing uses and administrative practices to prevent or reduce the potential for cold stress related injury/illness. For weather conditions below
-43 °C or -45 °F with no wind and/or similar conditions all work will cease.

Cold Protection Values		
2	<40°F	Cold weather protective clothing available; check core body
3	<30°F	Record ambient temperature and wind speed every 4 hours; compare to
4	<19°F	Provide and use heated warming shelters for work breaks and when
5	<10°F	Constant observation of workers, i.e. “buddy system”; rest in heated
6	<0°F/	Obtain medical certification for workers subject to hypothermia risk.

** Based on “2009 ACGIH Threshold Limit Values... for Physical Agents.”*
Note: refer to wind-chill and work-warmup charts in Table 4.3.2E

Cold Protection Guide	
1	If wind chill is a factor at a work location, the cooling effect of the wind shall be reduced by shielding the work area or providing employees an outer windbreak layer garment.
3	Employees performing light work whose clothing may become wet shall wear an outer layer of
4	Employees performing moderate to heavy work whose clothing may become wet shall wear an
5	Outer garments must provide for ventilation to prevent wetting of inner clothing by sweat, or if not possible, a heated shelter for warming/drying clothing, or a change of clothing, shall be

Protective clothing greatly reduces the possibility of hypothermia in workers. However, personnel will be instructed to wear warm clothing and to stop work to obtain more clothing if they become too cold. Employees will also be advised to change into dry clothes if their clothing becomes wet from perspiration or from exposure to precipitation.

Employees will be instructed to use heated shelters on site, at regular intervals, depending upon the severity of ambient temperatures. Symptoms of cold stress, including heavy shivering, excessive fatigue, drowsiness, irritability, or euphoria necessitate immediate return to the shelter.

Biological Hazards

The contractor will be required to monitor and control insects, rodents, and other pests identified on site. Standing water will not be allowed on-site, in an effort to control insects. Pest control

procedures used by the contractor will include bait, trap, spray, or other means to abate pest problems that develop on site during disruption activities.

4.3.4 Noise

Hearing protection is required for workers operating or working near heavy equipment, where the noise level is greater than 85 dbA (Time Weighted Average) as well as personnel working around heavy equipment. The HSO will determine the need and appropriate testing procedures, (i.e., sound level meter and/or dosimeter) for noise measurement. The provisions for noise protection for workers are presented in other safety-related documents for the Site.

VEHICLE AND HEAVY EQUIPMENT SAFETY

Vehicle Safety

Motor vehicle incidents are the number one cause of occupational fatalities, accounting for one in three deaths. The safety provisions for vehicle use at the Site are presented in other safety-related documents for the Site.

Heavy Equipment Safety

The use of backhoes, front-end loaders, etc. for excavation and other material handling equipment will present various physical hazards. The safety provisions for heavy equipment use at the Site are presented on other safety-related documents for the Site.

TASK-SPECIFIC ACTIVITY HAZARD ANALYSES (AHA)

This section of the HASP provides a breakdown of the hazards and control measures for each principal task. These Activity Hazard Analyses (AHAs) are general in nature and must be made project specific by the Construction Superintendent prior to each task. The AHAs will be field checked by the supervisor on an ongoing basis and revised as necessary. All revisions will be communicated to the work crew.

WORK AND SUPPORT AREAS

To prevent migration of contamination from personnel and equipment, work areas will be clearly specified as designated below prior to beginning operations. Each work area will be clearly identified using signs or physical barriers.

EXCLUSION ZONE (EZ)

The EZ is the area suspected of contamination and presents the greatest potential for worker exposure. Personnel entering the area must wear the mandated level of protection for that area. In certain instances, different levels of protection will be required depending on the tasks and monitoring performed within that zone. The EZ for this project will include the excavation areas, any stockpiling/staging areas, and areas where disturbance of urban fill is likely occurring.

CONTAMINATION - REDUCTION ZONE (CRZ)

The CRZ or transition zone will be established between the EZ and support zone (SZ). In this area, personnel will begin the sequential decontamination process required to exit the EZ. To prevent off-site migration of contamination and for personnel accountability, all personnel will enter and exit the EZ through the CRZ. The CRZ for this project will be the access/egress routes to/from the EZ and the personnel and equipment decontamination stations.

SUPPORT ZONE (SZ)

The SZ serves as a clean, control area. Operational support facilities are located within the SZ. Normal work clothing and support equipment are appropriate in this zone. Contaminated equipment or clothing will not be allowed in the SZ. There will be a clearly marked controlled access point from the SZ into the CRZ and EZ that is monitored closely by the HSO and the CS to ensure proper safety protocols are followed. The SZ will be any office areas/trailers and the parking and visitor access ways to the project site.

SITE CONTROL LOG

A log of all personnel visiting, entering or working on the site shall be maintained in the main office location. The log will record the date, name, company or agency, and time entering or exiting the site.

No visitor will be allowed in the EZ without showing proof of training and compliance with applicable medical monitoring requirements. Visitors will supply their own protective equipment, including hard hat, boots and respiratory equipment, if required. Visitors will attend a site orientation given by the HSO and sign the HASP.

GENERAL

The following items are requirements to protect the health and safety of workers and will be discussed in the safety briefing prior to initiating work on the site.

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand to mouth transfer and ingestion of contamination is prohibited in the EZ and CRZs.
- Hands and face must be washed upon leaving the EZ and before eating, drinking, chewing gum or tobacco and smoking or other activities which may result in ingestion of contamination.
- During site operations, each worker will consider himself as a safety backup to his partner. All personnel will be aware of dangerous situations that may develop.
- Visual contact will be maintained between workers on site when performing hazardous duties.
- No personnel will be admitted to the site without the proper safety equipment, training, and medical surveillance certification.
- All personnel must comply with established safety procedures. Any site personnel, who do not comply with safety policy, as established by the HSO or the CS, will be dismissed from the site.
- Proper decontamination procedures must be followed before leaving the site.
- All site workers are authorized to stop work if they observe unsafe actions of workers or other unsafe conditions on site which may cause an imminent danger.
- All workers and visitors must sign in and out of the site.

PROTECTIVE EQUIPMENT

This section specifies the levels of personal protective equipment (PPE) which are or may be required for each principal activity performed at this site. All site personnel must be trained in the use of all PPE utilized.

ANTICIPATED PROTECTION LEVELS

The following protection levels have been established for the site work activities based on site information concerning the levels of contaminants and the scope of work. Results of site air monitoring and visual inspection of the work activities may indicate the need for changes in final PPE level(s).

Task	Initial PPE Level	Upgrade/ Downgrade PPE Level	Skin Protection	Respiratory Protection	Other PPE
General Support Zone Activities	Level D	—	Generally none	None	Hard-hat, Steel-toe work boots, safety glasses, safety vests. Leather work gloves as needed. Hearing protection when >85 dBA.
Mobilization/ Demobilization	Level D	—	Generally none	None	Hard-hat, Steel-toe work boots, safety glasses, safety vests. Leather work gloves as needed. Hearing protection when >85
Excavation, Loading of Trucks with Contaminated Soil/Fill, Equipment Decont-amination	Level D		Generally none,	Initial: None (See Section 7)	Hard-hat, Steel-toe work boots, safety glasses, leather work gloves for material handling, hearing protection >85 dBA

PROTECTION LEVEL DESCRIPTIONS

This section lists the minimum requirements for the anticipated protection level at the Site. Modification to these requirements may have been noted in the table shown above.

6.2.1 Level D Detail

Level D consists of the following:

- Safety glasses with side shields
- Hard hat
- Steel-toed work boots
- Work clothing as prescribed by weather
- Leather work gloves when material handling

DECONTAMINATION PROCEDURES

This section describes the procedures necessary to ensure that both personnel and equipment are free from contamination when they leave the work site.

PERSONNEL DECONTAMINATION

Decontamination procedures will ensure that material which workers may have contacted in the EZ does not result in personal exposure and is not spread to clean areas of the site. This sequence describes the general decontamination procedures for Level D. The specific stages will vary depending on the site, the task, the protection level, etc. Dry decontamination may be used if there is insufficient space to support a full decontamination station as delineated with the steps below and approved by the HSO. The CS and the HSO will ensure that the decontamination procedures are adequate.

Level D Decontamination

1. Go to end of EZ
2. Cross into CRZ
3. Wash face and hands

Suspected Contamination

Any employee suspected of sustaining skin contact with chemical materials will first use the emergency shower. Following a thorough drenching, the worker will proceed to the decontamination area. Here the worker will remove clothing and don clean clothing. Medical attention will be provided as determined by the degree of injury.

Personal Hygiene

Personnel will wash hands, arms, neck and face, following decontamination and before any eating, smoking, or drinking.

EQUIPMENT DECONTAMINATION

Heavy equipment and other vehicles operated within the EZ will be decontaminated before being removed from the site. Workers operating the equipment/vehicles will move the equipment to a gross decontamination location near the exit of the EZ. Following gross decontamination the equipment/vehicle will be moved to the decontamination pad. Equipment decontamination will be performed on the pad until the equipment is visually clean. Following decontamination

activities equipment will be inspected by the HSO or CS prior to leaving the site. Once the equipment is inspected it will be removed from the site.

Heavy Equipment / Vehicle Decontamination

1. Equipment operator will move the heavy equipment / vehicle to a position near the EZ / CRZ interchange
2. Worker will use manual equipment (shovel, track spade) to remove gross contamination from tracks, bucket, dump box, and vehicle undercarriage (as required)
3. Following removal of gross decontamination equipment will be moved onto the decontamination pad and pressure washed / steam cleaned until equipment / vehicle is visually clean.
4. Equipment / vehicle decontaminated for removal from the site will be moved to a clean area for the HSO / CS inspection.
5. Once the equipment / vehicle is inspected and approved it will be removed from the site. Vehicles that fail inspection will be returned to the decontamination pad for further cleaning and re-inspected.

7.3 DISPOSAL OF WASTES

Wastes will be disposed according to applicable Local, State and Federal regulations.

7.4 DUST /EROSION CONTROL

The contractor will control dust and implement erosion control measures to be protective of nearby pedestrians and occupants of neighboring properties. Specifically, dust control will consist of maintaining moist exposed soil when excavation work is proceeding.

AIR MONITORING

Air monitoring will be conducted in order to characterize personnel exposures and fugitive emissions from site contaminants. Principal contaminants of concern are listed in Section 4.0 of this HASP. The target compounds selected for air monitoring purposes for this site include particulates. Results of air monitoring will be used to ensure the proper selection of protective clothing and equipment, including respiratory protection, to protect on-site personnel and off-site receptors from exposure to unacceptable levels of site contaminants. Descriptions of air monitoring strategies, procedures and equipment are provided below. Modification of this plan, including additional monitoring, may be considered as judged necessary by the PSM, in conjunction with the HSO.

WORK AREA AIR MONITORING

Work area air monitoring will include direct reading methods and personal exposure monitoring. Air monitoring will be conducted during soil/waste excavation, transportation, relocation and/or staging, and any other intrusive activities.

Direct Reading Air Monitoring

During active sifting operations, direct reading air monitoring will be performed to determine the potential for worker exposure to airborne hazards. A summary of air monitoring information is provided in section 8.1.5. Real-time air samples will be taken at least four times each 8-hour worker shift in the workers breathing zone (BZ).

Instrumentation

The following is a description of the air monitoring equipment to be used:

- MIE PDR-1000 Personal DataRAM, Dust trak or equivalent unit for real-time measuring particulates.
- Mini-Rae photoionization detector for use in determining if elevated levels of volatile organic vapors exist during excavation work

Use and Maintenance of Survey Equipment

All personnel using field survey equipment must have training in its operation, limitations, and maintenance. Maintenance and internal or electronic calibration will be performed in accordance with manufacturer recommendations by individuals familiar with the devices before their use on site. Repairs, maintenance, and internal or electronic calibration of these devices will be recorded in an equipment maintenance logbook. The equipment maintenance logbook for each instrument will be kept in that instrument's case. For rented monitoring equipment, repairs and maintenance will be conducted by the rental company. Daily calibration records will be documented on a log sheet.

Air monitoring equipment will be calibrated before work begins. Only basic maintenance (such as changing batteries) will be performed by on-site personnel. Any additional maintenance or repairs will be performed by a trained service technician.

8.1.4 Air Monitoring Recordkeeping

The HSO will ensure that all air-monitoring data is recorded on a data sheet found in Appendix D. The PSM may periodically review this data.

8.1.5 Action Levels

During soil/waste excavation, transportation, relocation and/or staging or any intrusive activities, direct reading air monitoring will be performed in the EZ to determine exposure to workers. A summary of air monitoring information is provided in the table below.

Monitoring Device	Monitoring	Monitoring Frequency	Action Level	Action
Dust/PID	areas/laborers, technicians, equipment operators	every 8-hour shift during soil disturbance activities	≥5.0 mg/m^3 * for dust 5 ppm for volatiles	Stop work; notify PSM Implement dust suppression measures and resume work after dust/volatile organic vapor levels are below action levels

** Sustained levels in the breathing zone for 5 minutes*

EMERGENCY RESPONSE AND CONTINGENCY PLAN (ERCP)

PRE-EMERGENCY PLANNING

Prior to engaging in construction/remediation activities at the site, the CS will plan for possible emergency situations and have adequate supplies and manpower to respond. In addition, site personnel will be briefed on proper emergency response procedures during the site orientation.

The following situations would warrant implementation of the emergency plan:

Fire/Explosion	The potential for human injury exists. • Toxic fumes or vapors are released. • The fire could spread on site or off site and possibly ignite other flammable materials or cause heat-induced explosions. • The use of water and/or chemical fire suppressants could result in contaminated run-off. An imminent danger of explosion exists.
Spill or Release of Hazardous Materials	The spill could result in the release of flammable liquids or vapors, • thus causing a fire or gas explosion hazard. • The spill could cause the release of toxic liquids or fumes in sufficient quantities or in a manner that is hazardous to or could
Natural Disaster	A rain storm exceeds the flash flood level. The facility is in a projected tornado path or a tornado has damaged • facility property. Severe wind gusts are forecasted or have occurred and have caused • damage to the facility.
Medical Emergency	Overexposure to hazardous materials. Trauma injuries (broken bones, severe lacerations/ bleeding, Eye/skin contact with hazardous materials. • Medical Conditions e.g., loss of consciousness, heat stress (heat

The following measures will be taken to assure the availability of adequate equipment and manpower resources:

- Sufficient equipment and materials will be kept on site and dedicated for emergencies only. The inventory will be replenished after each use.
- It will be the responsibility of the CS/HSO to brief on site personnel on anticipated hazards at the site. The CS/HSO shall also be responsible for anticipating and requesting equipment that will be needed for response activities.

Communications will be established prior to commencement of any activities at the remediation site. Communication will be established so that all responders on site have availability to all pertinent information to allow them to conduct their activities in a safe and healthful manner. A telephone will be available to summon assistance in an emergency.

Primary communication with local responders in the event of an emergency will be accomplished using commercial telephone lines.

EMERGENCY RECOGNITION AND PREVENTION

Because unrecognized hazards may result in emergency incidents, it will be the responsibility of the CS and Health & Safety Officer (HSO), through daily site inspections and employee feedback to recognize and identify hazards that are found at the site.

Once a hazard has been recognized, the CS and/or the HSO will take immediate action to prevent the hazard from becoming an emergency. This may be accomplished by the following:

- Daily safety meeting
- Task-specific training prior to commencement of activity
- Personal Protective Equipment (PPE) selection/use
- Written and approved permits for hot work, confined space
- Trenching/shoring procedure
- Air monitoring
- Following all standard operating procedures

EMERGENCY TELEPHONE NUMBERS

Emergency telephone numbers can be found on the following page. The emergency numbers will be posted in all site trailers.

EMERGENCY TELEPHONE NUMBERS & DIRECTIONS		
Emergency Medical Service	911	
Police: New York City Police Department (NYPD)	911	
Fire: New York City Fire Department (FDNY)	911	
New York City Office of Emergency Management	911	
National Response Center	(800)	424-8802
Poison Control Center	(800)	222-1222
Chemtrec	(800)	262-8200
Center for Disease Control	(800)	311-3435
USEPA(Region II)	(212)	637-5000
NYSDEC Emergency Spill Response	(800)	457-7362
Contractor Emergency Number	TBD	

DIRECTIONS AND HOSPITAL

Site Location: 1731 West Farms Road, Bronx, New York

Hospital Location: BronxCare Health System, 25-10 30th Ave., Bronx, NY

Hospital Phone: (718) 590-1800

- **Turn right from the Site and go south on West Farms Rd. 0.75 mile**
- **Turn right on East 167th Street, travel 0.9 mile**
- **Turn left on Franklin Avenue and hospital is on right.**

PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATIONS

This section of the ERCP describes the various roles, responsibilities, and communication procedures that will be followed by personnel involved in emergency responses.

The primary emergency coordinator for this site is the CS. In the event an emergency occurs and the emergency coordinator is not on site, the HSO will serve as the emergency coordinator until the CS arrives. The emergency coordinator will determine the nature of the emergency and take appropriate action as defined by this ERCP.

The emergency coordinator will implement the ERCP immediately as required. The decision to implement the plan will depend upon whether the actual incident threatens human health or the environment.

Immediately after being notified of an emergency incident, the emergency coordinator or his designee will evaluate the situation to determine the appropriate action.

Responsibilities and Duties

This section describes the responsibilities and duties assigned to the emergency coordinator.

It is recognized that the structure of the "Incident Command System" will change as additional response organizations are added. Personnel will follow procedures as directed by the fire department, LEPC, state and federal agencies as required.

On-Site Emergency Coordinator Duties

The on-site emergency coordinator is responsible for implementing and directing the emergency procedures. All emergency personnel and their communications will be coordinated through the emergency coordinator. Specific duties are as follows:

- Identify the source and character of the incident, type and quantity of any release. Assess possible hazards to human health or the environment that may result directly from the problem or its control.
- Discontinue operations in the vicinity of the incident if necessary to ensure that fires, explosions, or spills do not recur or spread to other parts of the site. While operations are dormant, monitor for leaks, pressure build-up, gas generation, or ruptures in valves, pipes, or other equipment, where safe and appropriate.
- Notify the Client Representative and local Emergency Response Teams if their help is necessary to control theincident.
- Direct on-site personnel to control the incident until, if necessary, outside help arrives. Specifically: Ensure that the building or area where the incident occurred and the surrounding area are evacuated and shut off possible ignition sources, if safe and

appropriate. The Emergency Response Coordinator is responsible for directing site personnel such that they avoid the area of the incident and leave emergency control procedures unobstructed.

- If fire or explosion is involved, notify local Fire Department.
- Have protected personnel, in appropriate PPE, on standby for rescue.

If the incident may threaten human health or the environment outside of the site, the emergency coordinator should immediately determine whether evacuation of area outside of the site may be necessary and, if so, notify the Police Department and the Office of Emergency Management.

When required, notify the National Response Center. The following information should be provided to the National Response Center:

- Name and telephone number
- Name and address of facility
- Time and type of incident
- Name and quantity of materials involved, if known
- Extent of injuries
- Possible hazards to human health or the environment outside of the facility.

The emergency telephone number for the National Response Center is 800-424-8802.

If hazardous waste has been released or produced through control of the incident, ensure that:

- Waste is collected and contained.
- Containers of waste are removed or isolated from the immediate site of the emergency.
- Treatment or storage of the recovered waste, contaminated soil or surface water, or any other material that results from the incident or its control is provided.
- .Ensure that no waste that is incompatible with released material is treated or stored in the facility until cleanup procedures are completed.
- Insure that all emergency equipment used is decontaminated, recharged, and fit for its intended use before operations are resumed.
- Notify the USEPA Regional Administrator that cleanup procedures have been complete and that all emergency equipment is fit for its intended use before resuming operations in the affected area of the facility. The USEPA Regional Administrator's telephone number is included in the Emergency Contacts.
- Record date, time, details of the incident, and submit a written report to the USEPA Regional Administrator. The report is due to the USEPA within 15 days of the incident.

9.5 SAFE DISTANCES AND PLACES OF REFUGE

The emergency coordinator for all activities will be the CS. No single recommendation can be made for evacuation or safe distances because of the wide variety of emergencies which could occur. Safe distances can only be determined at the time of an emergency based on a combination of site and incident-specific criteria. However, the following measures are established to serve as general guidelines.

In the event of minor hazardous materials releases (small spills of low toxicity), workers in the affected area will report initially to the contamination reduction zone. Small spills or leaks (generally less than 55 gallons) will require initial evacuation of at least 50 feet in all directions to allow for cleanup and to prevent exposure. After initial assessment of the extent of the release and potential hazards, the emergency coordinator or his designee will determine the specific boundaries for evacuation. Appropriate steps such as caution tape, rope, traffic cones, barricades, or personal monitors will be used to secure the boundaries.

If a major incident may threaten the health or safety of the surrounding community, the public will be informed and, if necessary, evacuated from the area. The emergency coordinator, or his designee will inform the proper agencies in the event that this is necessary. Telephone numbers are listed in Table 9-1.

Places of refuge will be established prior to the commencement of activities. These areas must be identified for the following incidents:

- Chemical release
- Fire/explosion
- Power loss
- Medical emergency
- Hazardous weather

In general, evacuation will be made to the site entrance, unless the emergency coordinator determines otherwise. It is the responsibility of the emergency coordinator to determine when it is necessary to evacuate personnel to off-site locations.

In the event of an emergency evacuation, all the employees will gather at the entrance to the site until a head count establishes that all are present and accounted for. No one is to leave the site without notifying the emergency coordinator.

9.6 EVACUATION ROUTES AND PROCEDURES

All emergencies require prompt and deliberate action. In the event of an emergency, it will be necessary to follow an established set of procedures. Such established procedures will be followed as closely as possible. However, in specific emergency situations, the emergency coordinator may deviate from the procedures to provide a more effective plan for bringing the situation under control. The emergency coordinator is responsible for determining which situations require site evacuation.

Evacuation Signals and Routes

Two-way radio communication or equivalent will be used to notify employees of the necessity to evacuate an area or building involved in a release/spill of a hazardous material. As necessary, each crew supervisor will have a two-way radio. Total site evacuation will be initiated only by the emergency coordinator, however, in his absence, decision to preserve the health and safety of employees will take precedence.

Evacuation Procedures

In the event evacuation is necessary the following actions will be taken:

- The emergency signal will be activated.
- No further entry of visitors, contractors, or trucks will be permitted. Vehicle traffic within the site will cease in order to allow safe exit of personnel and movement of emergency equipment.
- Shut off all machinery if safe to do so.
- ALL on-site personnel, visitors, and contractors in the support zone will assemble at the entrance to the site for a head count and await further instruction from the emergency coordinator.
- ALL persons in the exclusion zone and contamination reduction zone will be accounted for by their immediate crew leaders. Leaders will determine the safest exits for employees and will also choose an alternate exit if the first choice is inaccessible.
- During exit, the crew leader should try to keep the group together. Immediately upon exit, the crew leader will account for all employees in his crew.
- Upon completion of the head count, the crew leader will provide the information to the emergency coordinator.
- Contract personnel and visitors will also be accounted for.
- The names of emergency response team members involved will be reported to the emergency coordinator.
- A final tally of persons will be made by the emergency coordinator or designee. No attempt to find persons not accounted for will involve endangering lives of site personnel by re-entry into emergency areas.
- In all questions of accountability, immediate crew leaders will be held responsible for those persons reporting to them. Visitors will be the responsibility of those employees they are seeing. Contractors and truck drivers are the responsibility of the Construction Superintendent.
- Personnel will be assigned by the emergency coordinator to be available at the main gate to direct and brief emergency responders.

- Re-entry into the site will be made only after clearance is given by the emergency coordinator. At his direction, a signal or other notification will be given for re-entry into the facility.

EMERGENCY SPILL RESPONSE PROCEDURES AND EQUIPMENT

In the event of an emergency involving a hazardous material spill or release, the following general procedures will be used for rapid and safe response and control of the situation.

Emergency contacts found in Table 9-1 provide a quick reference guide to follow in the event of a major spill.

9.7.1 Notification Procedures

If an employee discovers a chemical spill or process upset resulting in a vapor or material release, he or she will immediately notify the on-site emergency coordinator.

On-site Emergency Coordinator will obtain information pertaining to the following:

- . The material spilled or released.
- . Location of the release or spillage of hazardous material.
- . An estimate of quantity released and the rate at which it is being released.
- . The direction in which the spill, vapor or smoke release is heading.
- . Any injuries involved.
- . Fire and/or explosion or possibility of these events.
- . The area and materials involved and the intensity of the fire or explosion.

This information will help the on-site emergency coordinator to assess the magnitude and potential seriousness of the spill or release.

9.7.2 Procedure for Containing/Collecting Spills

The initial response to any spill or discharge will be to protect human health and safety, and then the environment. Identification, containment, treatment, and disposal assessment will be the secondary response.

If for some reason a chemical spill is not contained within a dike or sump area, an area of isolation will be established around the spill. The size of the area will generally depend on the size of the spill and the materials involved. If the spill is large (greater than 55 gallons) and involves a tank or a pipeline rupture, an initial isolation of at least 100 ft. in all directions will be used. Small spills (less than or equal to 55 gallons) or leaks from a tank or pipe will require evacuation of at least 50 ft. in all directions to allow cleanup and repair and to prevent exposure. When any spill occurs, only those persons involved in overseeing or performing emergency operations will be allowed within the designated hazard area. If possible the area will be roped or otherwise blocked off.

If the spill results in the formation of a toxic vapor cloud (by reaction with surrounding materials or by outbreak of fire) and its release (due to high vapor pressures under ambient conditions), further evacuation will be necessary. In general an area at least 500 feet wide and 1,000 feet long will be evacuated downwind if volatile materials are spilled. (Consult the DOT Emergency Response Guide for isolation distances for listed hazardous materials.)

If an incident may threaten the health or safety of the surrounding community, the public will be informed and possibly evacuated from the area. The on-site emergency coordinator will inform the proper agencies in the event this is necessary. (Refer to Table 9-1)

As called for in regulations developed under the Comprehensive Environmental Response Compensation Liability Act of 1980 (Superfund), a spill of a pound or more of any hazardous material for which a reportable quantity has not been established and which is listed under the Solid Waste Disposal Act, Clean Air Act, Clean Water Act, or TSCA shall be reported.

Clean up personnel will take the following measures:

- Make sure all unnecessary persons are removed from the hazard area.
- Put on protective clothing and equipment.
- If a flammable material is involved, remove all ignition sources, and use spark and explosion proof equipment for recovery of material.
- Remove all surrounding materials that could be especially reactive with materials in the waste. Determine the major components in the waste at the time of the spill.
- If wastes reach a storm sewer, try to dam the outfall by using sand, earth, sandbags, etc. If this is done, pump this material out into a temporary holding tank or drums as soon as possible.
- Place all small quantities of recovered liquid wastes (55 gallons or less) and contaminated soil into drums for incineration or removal to an approved disposal site.
- Spray the spill area with foam, if available, if volatile emissions may occur.

- Apply appropriate spill control media (e.g. clay, sand, lime, etc.) to absorb discharged liquids.

For large spills, establish diking around leading edge of spill using booms, sand, clay or other appropriate material. If possible, use diaphragm pump to transfer discharged liquid to drums or holding tank.

Emergency Response Equipment

The following equipment will be staged in the support zone and throughout the site, as needed, to provide for safety and first aid during emergency responses.

- ABC-type fire extinguisher
- First-aid kit, industrial size
- Portable eyewash

Emergency Spill Response Clean-Up Materials and Equipment

A sufficient supply of appropriate emergency response clean-up and personal protective equipment will be available as needed.

The materials listed below may be kept on site for spill control, depending on the types of hazardous materials present on site. The majority of this material will be located in the support zone, in a supply trailer or storage area. Small amounts, as necessary, will be placed on pallets and located in the active work areas.

. Sand or clay to solidify/absorb liquid spills.

*** Note: All contaminated soils, absorbent materials, solvents and other materials resulting from the clean-up of spilled or discharged substances shall be properly stored, labeled, and disposed of off-site.**

EMERGENCY CONTINGENCY PLAN

This section of the ERCP details the contingency measures the Site Contractor will take to prepare for and respond to fires, explosions, spills and releases of hazardous materials, hazardous weather, and medical emergencies.

MEDICAL EMERGENCY CONTINGENCY MEASURES

The procedures listed below will be used to respond to medical emergencies. A minimum of one First-Aid/CPR trained personnel should be available on site.

Response

The nearest workers will immediately assist a person who shows signs of medical distress or who is involved in an accident. The work crew supervisor will be summoned.

The work crew supervisor will immediately make radio contact with the on-site emergency coordinator to alert him of a medical emergency situation. The supervisor will advise the following information:

. Location of the victim at the work site

. Nature of the emergency

. Whether the victim is conscious

. Specific conditions contributing to the emergency, if known

The Emergency Coordinator will notify the Health & Safety Officer. The following actions will then be taken depending on the severity of the incident:

- *Life-Threatening Incident* – If an apparent life-threatening condition exists, the crew supervisor will inform the emergency coordinator by radio, and the local Emergency Response Services (EMS) will be immediately called. An on-site person will be appointed who will meet the EMS and have him/her quickly taken to the victim. Any injury within the EZ will be evacuated by personnel to a clean area for treatment by EMS personnel. No one will be able to enter the EZ without showing proof of training, medical surveillance and site orientation.

- *Non Life-Threatening Incident* – If it is determined that no threat to life is present, the Health & Safety Officer will direct the injured person through decontamination procedures (see below) appropriate to the nature of the illness or accident. Appropriate first aid or medical attention will then be administered.

*** Note: The area surrounding an accident site must not be disturbed until the scene has been cleared by the Health & Safety Officer.**

Any personnel requiring emergency medical attention will be evacuated from exclusion and contamination reduction zones if doing so would not endanger the life of the injured person or otherwise aggravate the injury. Personnel will not enter the area to attempt a rescue if their own lives would be threatened. The decision whether or not to decontaminate a victim prior to evacuation is based on the type and severity of the illness or injury and the nature of the contaminant. For some emergency victims, immediate decontamination may be an essential part of life-saving first aid. For others, decontamination may aggravate the injury or delay life-saving first aid. Decontamination will be performed if it does not interfere with essential treatment.

If decontamination can be performed, observe the following procedures:

- Wash external clothing and cut it away.

If decontamination cannot be performed, observe the following procedures:

- Wrap the victim in blankets or plastic to reduce contamination of other personnel.
- Alert emergency and off-site medical personnel to potential contamination, instruct them about specific decontamination procedures.
- Send site personnel familiar with the incident and chemical safety information, e.g. MSDS, with the affected person.

All injuries, no matter how small, will be reported to the HSO or the CS. An accident/injury/illness report will be completely and properly filled out and submitted to the Corporate Health and Safety Manager.

Notification

The following personnel/agencies will be notified in the event of a medical emergency:

- Local Fire Department or EMS
- On-site Emergency Coordinator
- Workers in the affected areas
- Client Representative

FIRE CONTINGENCY MEASURES

Because flammable/combustible materials are present at this site, fire is an ever-present hazard. Safety personnel are not trained professional firefighters. Therefore, if there is any doubt that a fire can be quickly contained and extinguished, personnel will notify the emergency coordinator by radio and vacate the structure or area. The emergency coordinator will immediately notify the local Fire Department.

The following procedures will be used to prevent the possibility of fires and resulting injuries:

- Sources of ignition will be kept away from where flammable materials are handled or stored.
- The air will be monitored for explosivity before and during hot work and periodically where flammable materials are present. Hot work permits will be required for all such work.
- "No smoking" signs will be conspicuously posted in areas where flammable materials are present.
- Fire extinguishers will be placed in all areas where a fire hazard may exist.
- Before workers begin operations in an area the foreman will give instruction on egress procedures and assembly points. Egress routes will be posted in work areas and exit points clearly marked.

Response

The following procedures will be used in the event of a fire:

- Anyone who sees a fire will notify their supervisor who will then contact the Emergency Coordinator by radio. The emergency coordinator will activate the emergency air horns and contact the local Fire Department.
- When the emergency siren sounds, workers will disconnect electrical equipment in use (if possible) and proceed to the nearest fire exit.
- Work crews will be comprised of pairs of workers (buddy system) who join each other immediately after hearing the fire alarm and remain together throughout the emergency. Workers will assemble at a predetermined rally point for a head count.
- When a small fire has been extinguished by a worker, the emergency coordinator will be notified.

HAZARDOUS WEATHER CONTINGENCY MEASURES

Operations outside will not be started or continued when the following hazardous weather conditions are present:

- Lightning
- Heavy Rains/Snow
- High Winds

Response

- Excavation/soil stock piles will be covered with plastic liner.
- All equipment will be shut down and secured to prevent damage.
- Personnel will be moved to safe refuge. The emergency coordinator will determine when it is necessary to evacuate personnel to off-site locations and will coordinate efforts with fire, police and other agencies.

Notification

The emergency coordinator will be responsible for assessing hazardous weather conditions and notifying personnel of specific contingency measures. Notifications will include:

- Site workers and subcontractors
- Client Representative
- Local Emergency Management Agency

SPILL/RELEASE CONTINGENCY MEASURES

In the event of release or spill of a hazardous material the following measures will be taken:

Any person observing a spill or release will act to remove and/or protect injured/contaminated persons from any life-threatening situation. First aid and/or decontamination procedures will be implemented as appropriate.

First aid will be administered to injured/contaminated personnel. All personnel will act to prevent any unsuspecting persons from coming in contact with spilled materials by alerting other nearby persons. Attempt to stop the spill at the source, if possible. Without taking unnecessary risks, personnel will attempt to stop the spill at the source. This may involve activities such as uprighting a drum, closing a valve or temporarily sealing a hole with a plug.

The emergency coordinator will be notified of the spill/release, including information on material spilled, quantity, personnel injuries and immediate life threatening hazards. Air monitoring will be implemented by the emergency coordinator and HSO to determine the potential impact on the surrounding community. Notification procedures will be followed to inform on-site personnel and off-site agencies. The emergency coordinator will make a rapid assessment of the spill/release and direct confinement, containment and control measures. Depending upon the nature of the spill, measures may include:

- Construction of a temporary containment berm utilizing on-site clay absorbent earth
- Digging a sump, installing a polyethylene liner and
- Diverting the spill material into the sump placing drums under the leak to collect the spilling material before it flows over the ground
- Transferring the material from its original container to another container

The emergency coordinator will notify the Client Representative of the spill and steps taken to institute clean-up. Emergency response personnel will clean-up all spills following the spill clean- up plan developed by the emergency coordinator. Supplies necessary to clean up a spill may include, but are not limited to:

- Shovel, rake
- Clay absorbent
- Polyethylene liner
- Personal safety equipment
- Steel drums
- Pumps and miscellaneous hand tools

The emergency coordinator will inspect the spill site to determine that the spill has been cleaned up to the satisfaction of the Client Representative. If necessary, soil, water or air samples may be taken and analyzed to demonstrate the effectiveness of the spill clean-up effort. The emergency coordinator will determine the cause of the spill and determine remedial steps to ensure that recurrence is prevented. The emergency coordinator will review the cause with the Client Representative and obtain his concurrence with the remedial action plan.

TRAINING REQUIREMENTS

All personnel entering the exclusion zone will be trained in the provisions of this site safety plan and be required to sign an acknowledgment form.

SITE-SPECIFIC TRAINING ORIENTATION

Outlines of the orientation for site workers, subcontractor personnel and visitors are presented below:

CONTRACTOR WORKERS	VISITORS

10.2 DAILY SAFETY MEETINGS

A safety meeting will be conducted by the CS and the HSO 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.

APPENDIX A

Material Safety Data Sheets for Contaminants of Concern

Health	3
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Cadmium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Cadmium

Catalog Codes: SLC3484, SLC5272, SLC2482

CAS#: 7440-43-9

RTECS: EU9800000

TSCA: TSCA 8(b) inventory: Cadmium

CI#: Not applicable.

Synonym:

Chemical Name: Cadmium

Chemical Formula: Cd

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
Cadmium	7440-43-9	100

Toxicological Data on Ingredients: Cadmium: ORAL (LD50): Acute: 2330 mg/kg [Rat.]. 890 mg/kg [Mouse]. DUST (LC50): Acute: 50 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant). Severe over-exposure can result in death.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, lungs, liver. 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: No known effect on eye contact, rinse with water for a few minutes.

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: May be combustible at high temperature.

Auto-Ignition Temperature: 570°C (1058°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances:
Non-flammable in presence of open flames and sparks, of heat, of oxidizing materials, of reducing materials, of combustible materials, of moisture.

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:
Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits toxic fumes.

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:
Use a shovel to put the material into a convenient waste disposal container. 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 dust. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Highly toxic or infectious materials should be stored in a separate locked safety storage cabinet or room.

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: Safety glasses. 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:
TWA: 0.01 (ppm) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

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

Odor: Not available.

Taste: Not available.

Molecular Weight: 112.4 g/mole

Color: Silvery.

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

Boiling Point: 765°C (1409°F)

Melting Point: 320.9°C (609.6°F)

Critical Temperature: Not available.

Specific Gravity: 8.64 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

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

Special Remarks on Reactivity: Reacts violently with potassium.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 890 mg/kg [Mouse]. Acute toxicity of the dust (LC50): 229.9 mg/m3 4 hour(s) [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP. The substance is toxic to kidneys, lungs, liver.

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: An allergen. 0047 Animal: embryotoxic, passes through the placental barrier.

Special Remarks on other Toxic Effects on Humans: May cause allergic reactions, exzema and/or dehydration of the skin.

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 as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification:

Identification:

Special Provisions for Transport:

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

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

Other Classifications:

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

DSCL (EEC):
R26- Very toxic by inhalation. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

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

Health: 3

Flammability: 1

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. Safety glasses.

Section 16: Other Information

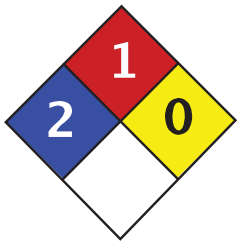
References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -Liste des produits purs tératogènes, mutagènes, cancérogènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec. -Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec. -SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

Created: 10/09/2005 04:29 PM

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

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



Health	2
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Chromium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Chromium

Catalog Codes: SLC4711, SLC3709

CAS#: 7440-47-3

RTECS: GB4200000

TSCA: TSCA 8(b) inventory: Chromium

CI#: Not applicable.

Synonym: Chromium metal; Chrome; Chromium Metal Chips 2" and finer

Chemical Name: Chromium

Chemical Formula: Cr

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
Chromium	7440-47-3	100

Toxicological Data on Ingredients: Chromium LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

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

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to kidneys, lungs, liver, 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. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

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

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

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

Serious Inhalation: Not available.

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 580°C (1076°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

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

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

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:
Moderate fire hazard when it is in the form of a dust (powder) and burns rapidly when heated in flame.
Chromium is attacked vigorously by fused potassium chlorate producing vivid incandescence.
Pyrophoric chromium unites with nitric oxide with incandescence.
Incandescent reaction with nitrogen oxide or sulfur dioxide.

Special Remarks on Explosion Hazards:
Powdered Chromium metal +fused ammonium nitrate may react violently or explosively.
Powdered Chromium will explode spontaneously in air.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

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

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

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:
TWA: 0.5 (mg/m3) from ACGIH (TLV) [United States]
TWA: 1 (mg/m3) from OSHA (PEL) [United States]
TWA: 0.5 (mg/m3) from NIOSH [United States]
TWA: 0.5 (mg/m3) [United Kingdom (UK)]
TWA: 0.5 (mg/m3) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

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

Odor: Odorless.

Taste: Not available.

Molecular Weight: 52 g/mole

Color: Silver-white to Grey.

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

Boiling Point: 2642°C (4787.6°F)

Melting Point: 1900°C (3452°F) +/- !0 deg. C

Critical Temperature: Not available.

Specific Gravity: 7.14 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Insoluble in cold water, hot water.
Soluble in acids (except Nitric), and strong alkalies.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, incompatible materials

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

Corrosivity: Not available.

Special Remarks on Reactivity:
Incompatible with molten Lithium at 180 deg. C, hydrogen peroxide, hydrochloric acid, sulfuric acid, most caustic alkalies and alkali carbonates, potassium chlorate, sulfur dioxide, nitrogen oxide, bromine pentafluoride.
It may react violently or ignite with bromine pentafluoride.
Chromium is rapidly attacked by fused sodium hydroxide + potassium nitrate.
Potentially hazardous incompatibility with strong oxidizers.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available.
LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for

human.) by IARC.
May cause damage to the following organs: kidneys, lungs, liver, upper respiratory tract.

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May cause cancer based on animal data. There is no evidence that exposure to trivalent chromium causes cancer in man.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
May cause skin irritation.
Eyes: May cause mechanical eye irritation.
Inhalation: May cause irritation of the respiratory tract and mucous membranes of the respiratory tract.
Ingestion: May cause gastrointestinal tract irritation with nausea, vomiting, diarrhea.
Chronic Potential Health Effects:
Inhalation: The effects of chronic exposure include irritation , sneezing, reddness of the throat, bronchospasm, asthma, cough, polyps, chronic inflammation, emphysema, chronic bronchitis, pharyngitis, bronchopneumonia, pneumoconoisis. Effects on the nose from chronic chromium exposure include irritation, ulceration, and perforation of the nasal septum. Inflammation and ulceration of the larynx may also occur.
Ingestion or Inhalation: Chronic exposure may cause liver and kidney damage.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

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

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

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

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:

Connecticut hazardous material survey.: Chromium
Illinois toxic substances disclosure to employee act: Chromium
Illinois chemical safety act: Chromium
New York release reporting list: Chromium
Rhode Island RTK hazardous substances: Chromium
Pennsylvania RTK: Chromium
Minnesota: Chromium
Michigan critical material: Chromium
Massachusetts RTK: Chromium
Massachusetts spill list: Chromium
New Jersey: Chromium
New Jersey spill list: Chromium
Louisiana spill reporting: Chromium
California Director's List of Hazardous Substances: Chromium
TSCA 8(b) inventory: Chromium
SARA 313 toxic chemical notification and release reporting: Chromium
CERCLA: Hazardous substances.: Chromium: 5000 lbs. (2268 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): Not controlled under WHMIS (Canada).

DSCL (EEC):
R40- Limited evidence of carcinogenic effect
S36/37/39- Wear suitable protective clothing, gloves and eye/face protection.
S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

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

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

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

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:16 PM

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

MSDS 027
Revised 11/2010

MATERIAL SAFETY DATA SHEET

MWS Wire Industries
31200 Cedar Valley Drive
Westlake Village, CA 91362
(818) 991-8553

Trade Name: Bare Copper, OFHC Copper Wire, ETP Copper Wire

Chemical Family: Copper

Chemical Formula: N/A

HAZARDOUS INGREDIENTS

Ingredient	CAS No.	TLV	PEL	STEL
Copper	7440-50-8	1 (D) / 0.2 (F)	1 (D) / 0.1 (F)	2

Note: TLV - American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (mg/m^3)
PEL - OSHA Permissible Exposure Level (mg/m^3), 8 hour time weighted average
STEL - ACGIH Short Term Exposure Limit (mg/m^3), 15 minutes maximum
* Ceiling Level (Not to be exceeded) D = Dust F = Fume NS = Not Specified

PHYSICAL DATA

Boiling Point °C: N/A
Vapor Pressure: N/A
Vapor Density: N/A
% Volatile: N/A
Evaporation Rate: N/A
Solubility in H_20: Insoluble
Specific Gravity: 8.89
Melting Temperature: 1083ºC
Appearance & Odor: Lustrous orange-red metal. No odor.

FIRE & EXPLOSION HAZARD DATA

Flash Point: N/A
Fire or Explosion Hazard: None

Note: Copper is nonflammable, although sparks from other operations may ignite flammable or combustible materials. Use extinguishing media suitable for surrounding materials. Fire fighters should use self-contained breathing apparatus as deemed necessary.

HEALTH HAZARD DATA

Fine powders, granules and fumes from welding or abrasive operations may pose a health hazard. When burned, soldered or brazed copper wire and solder or brazing material may give off fumes that cause eye and/or respiratory irritation. Use adequate local exhaust to prevent irritation and maintain fume levels below OSHA ceiling limits.

Short Term Exposure: Dust and fumes irritate the eyes, nose and throat. Symptoms may include cough, metallic taste in mouth, fever, fatigue and nausea.

Long Term Exposure: Watering of the eyes, headaches, difficulty in breathing, coughing, severe chest pains and in acute cases, lung disease, lung fibrosis, pneumoconiosis or neurological damage.

Emergency First Aid Procedure:

- In case of fume inhalation, remove from exposure and consult a physician.
- In case of eye contact, flush with large amounts of water for at least fifteen minutes. Seek medical attention.
- In case of ingestion, seek immediate medical attention.

Carcinogenic assessment: Copper has not been identified as a known or suspected carcinogen by NTP, IARC or OSHA.

REACTIVITY DATA

Stability: Stable. Hazardous polymerization will not occur.

SPILL, LEAK, DISPOSAL PROCEDURES

Scrap copper wire has reclamation value. Where this is not practical, it may be disposed in accordance with state and federal regulations. In solid form, copper poses no special clean up problems. If material is in powder or dust form, clean up should be conducted to minimize generation of airborne powder and dust and to avoid contamination of water. Depending on the quantity, spills or releases to the environment may require a report to the National Response Center at (800) 424-8802.

SARA TITLE II SECTION 313

Copper is subject to the reporting requirements of Section 313 of Title III of the Superfund Amendment and Reauthorization Act of 1986 and 40 CFR Part 372 of the Federal Register. Additional information can be obtained from the Emergency Planning and Community Right-To-Know Information Hot Line, US EPA, at (800) 535-0202.

EC RoHS DIRECTIVE COMPLIANCE

Bare copper wire complies with Directive 2002/95/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment.

ECHA REACH COMPLIANCE

Copper magnet wire meets the definition of an article under REACH and does not contain SVHC listed as of the revision date of this MSDS. Also see *http://www.mwswire.com/pdf_files/reach.pdf* for more information on MWS Wire products and REACH.

SPECIAL PROTECTION

Wear safety glasses when risk of eye injury is present, particularly during machining, grinding, welding, powder handling, etc. Gloves and other protective equipment may be required during handling operations as appropriate to the circumstances of exposure.

SPECIAL PRECAUTIONS

When welding, melting, casting, grinding, sanding, polishing or otherwise abrading the surface of copper wire in a manner which generates finely divided particles, an exposure to copper in excess of the occupational standard can occur. Use with adequate ventilation to meet listed exposure limits. Processes generating airborne particles must be air sampled to determine exposure levels. Where exposure data indicate, medical surveillance should be conducted.

PACKAGING & LABELING REQUIREMENTS

D.O.T. Shipping Name: Not regulated Hazard Class: NA

MWS Wire Industries (MWS) has attempted to provide current and accurate information in this data sheet, however MWS makes no representations regarding the accuracy or completeness of the information. Information is supplied upon the condition that the persons receiving it will make their own determinations as to its suitability prior to use. MWS assumes no liability for any loss, damage or injury of any kind which may arise out of the use or reliance on the information by any person. No warranties, either express or implied, of merchantability, fitness for a particular purpose or of any other nature are made with respect to the foregoing information or the product to which the information refers. Contact person: Ken Goss at (818) 991-8553.

SAFETY DATA SHEET
p,p'-DDD

Revision: 06/29/2018

according to Regulation (EC) No. 1907/2006 as amended by (EC) No. 1272/2008

Section 1. Identification of the Substance/Mixture and of the Company/Undertaking

1.1 Product Code: 24234

Product Name: p,p'-DDD

Synonyms: 1,1'-(2,2-dichloroethylidene)bis[4-chloro-benzene]; 4,4'-DDD; 4,4'-Dichlorodiphenyldichloroethane; p,p-Dichlorodiphenyldichloroethane; NSC 8941;

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

Relevant identified uses: For research use only, not for human or veterinary use.

1.3 Details of the Supplier of the Safety Data Sheet:

Company Name: Cayman Chemical Company
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108

Web site address: www.caymanchem.com

Information: Cayman Chemical Company +1 (734)971-3335

1.4 Emergency telephone number:

Emergency Contact: CHEMTREC Within USA and Canada: +1 (800)424-9300
CHEMTREC Outside USA and Canada: +1 (703)527-3887

Section 2. Hazards Identification

2.1 Classification of the Substance or Mixture:

Acute Toxicity: Oral, Category 3

Acute Toxicity: Skin, Category 4

Aquatic Toxicity (Acute), Category 1

Aquatic Toxicity (Chronic), Category 1

2.2 Label Elements:

GHS Signal Word: **Danger**

GHS Hazard Phrases:

H301: Toxic if swallowed.

H312: Harmful in contact with skin.

H400: Very toxic to aquatic life.

H410: Very toxic to aquatic life with long lasting effects.

GHS Precaution Phrases:

P264: Wash {hands} thoroughly after handling.

P273: Avoid release to the environment.

P280: Wear {protective gloves/protective clothing/eye protection/face protection}.

GHS Response Phrases:

P301+310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.

P302+352: IF ON SKIN: Wash with plenty of soap and water.

P312: Call a POISON CENTER or doctor/physician if you feel unwell.

P321: Specific treatment {see ... on this label}.

P330: Rinse mouth.

P362+364: Take off contaminated clothing and wash it before reuse.

P391: Collect spillage.

GHS Storage and Disposal Phrases:

Please refer to Section 7 for Storage and Section 13 for Disposal information.

2.3 Adverse Human Health Effects and Symptoms: Harmful in contact with skin.
Material may be irritating to the mucous membranes and upper respiratory tract.
May be harmful by inhalation.
May cause eye, skin, or respiratory system irritation.
Toxic if swallowed.
Very toxic to aquatic life with long lasting effects.
To the best of our knowledge, the toxicological properties have not been thoroughly investigated.

Section 3. Composition/Information on Ingredients

CAS # / RTECS #	Hazardous Components (Chemical Name)/ REACH Registration No.	Concentration	EC No./ EC Index No.	GHS Classification
72-54-8 KI0700000	DDD {6-hydroxy-2-naphthyl disulfide; p,p'-TDE (p,p'-DDD); 4,4-DDD; p-Tetrachloro diphenyl ethane}	100.0 %	200-783-0 NA	Acute Tox.(O) 3: H301 Acute Tox.(D) 4: H312 Aquatic (A) 1: H400 Aquatic (C) 1: H410

Section 4. First Aid Measures

4.1 Description of First Aid Measures:

In Case of Inhalation: Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Get immediate medical attention.

In Case of Skin Contact: Immediately wash skin with soap and plenty of water for at least 15 minutes. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse.

In Case of Eye Contact: Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Have eyes examined and tested by medical personnel.

In Case of Ingestion: Wash out mouth with water provided person is conscious. Never give anything by mouth to an unconscious person. Get medical attention. Do NOT induce vomiting unless directed to do so by medical personnel.

Section 5. Fire Fighting Measures

5.1 Suitable Extinguishing Media: Use alcohol-resistant foam, carbon dioxide, water, or dry chemical spray.
Use water spray to cool fire-exposed containers.

Unsuitable Extinguishing Media: A solid water stream may be inefficient.

5.2 Flammable Properties and Hazards: No data available.

No data available.

Flash Pt: No data.

Explosive Limits: LEL: No data. UEL: No data.

Autoignition Pt: No data.

5.3 Fire Fighting Instructions: As in any fire, wear self-contained breathing apparatus pressure-demand (NIOSH approved or equivalent), and full protective gear to prevent contact with skin and eyes.

Section 6. Accidental Release Measures

6.1 Protective Precautions, Protective Equipment and Emergency Procedures: Avoid raising and breathing dust, and provide adequate ventilation. As conditions warrant, wear a NIOSH approved self-contained breathing apparatus, or respirator, and appropriate personal protection (rubber boots, safety goggles, and heavy rubber gloves).

6.2 Environmental Precautions: Take steps to avoid release into the environment, if safe to do so.

6.3 Methods and Material For Containment and Cleaning Up: Contain spill and collect, as appropriate. Transfer to a chemical waste container for disposal in accordance with local regulations.

Section 7. Handling and Storage

7.1 Precautions To Be Taken in Handling: Avoid breathing dust/fume/gas/mist/vapours/spray. Avoid prolonged or repeated exposure.

7.2 Precautions To Be Taken in Storing: Keep container tightly closed. Store in accordance with information listed on the product insert.

Section 8. Exposure Controls/Personal Protection

8.1 Exposure Parameters:

8.2 Exposure Controls:

8.2.1 Engineering Controls (Ventilation etc.): Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.

8.2.2 Personal protection equipment:

Eye Protection: Safety glasses

Protective Gloves: Compatible chemical-resistant gloves

Other Protective Clothing: Lab coat

Respiratory Equipment (Specify Type): NIOSH approved respirator, as conditions warrant.

Work/Hygienic/Maintenance Practices: Do not take internally. Facilities storing or utilizing this material should be equipped with an eyewash and a safety shower. Wash thoroughly after handling.

No data available.

Section 9. Physical and Chemical Properties

9.1 Information on Basic Physical and Chemical Properties

Physical States:	[ ] Gas [ ] Liquid [X] Solid
Appearance and Odor:	A solid
pH:	No data.
Melting Point:	No data.
Boiling Point:	No data.
Flash Pt:	No data.
Evaporation Rate:	No data.
Flammability (solid, gas):	No data available.
Explosive Limits:	LEL: No data. UEL: No data.
Vapor Pressure (vs. Air or mm Hg):	No data.
Vapor Density (vs. Air = 1):	No data.

	Specific Gravity (Water = 1):	No data.
	Solubility in Water:	No data.
	Solubility Notes:	Soluble (slightly) in: chloroform;
	Octanol/Water Partition Coefficient:	No data.
	Autoignition Pt:	No data.
	Decomposition Temperature:	No data.
	Viscosity:	No data.
9.2	**Other Information**	
	Percent Volatile:	No data.
	Molecular Formula & Weight:	C14H10Cl4 320.0

Section 10. Stability and Reactivity

10.1	**Reactivity:**	No data available.
10.2	**Stability:**	Unstable [ ] Stable [X]
10.3	**Stability Note(s):**	Stable if stored in accordance with information listed on the product insert.
	Polymerization:	Will occur [ ] Will not occur [X]
10.4	**Conditions To Avoid:**	No data available.
10.5	**Incompatibility - Materials To Avoid:**	strong oxidizing agents
10.6	**Hazardous Decomposition or Byproducts:**	carbon dioxide carbon monoxide hydrogen chloride gas

Section 11. Toxicological Information

11.1	**Information on Toxicological Effects:**	The toxicological effects of this product have not been thoroughly studied. p,p'-DDD - Toxicity Data: Oral LD50 (rat): 113 mg/kg; Oral LDLO (mouse): 600 mg/kg; Oral LDLO (human): 4300 mg/kg;
	Chronic Toxicological Effects:	p,p'-DDD - Investigated as a agricultural chemical, mutagen, and tumorigen. Only select Registry of Toxic Effects of Chemical Substances (RTECS) data is presented here. See actual entry in RTECS for complete information. p,p'-DDD RTECS Number: KI0700000

CAS #	Hazardous Components (Chemical Name)	NTP	IARC	ACGIH	OSHA
72-54-8	DDD {6-hydroxy-2-naphthyl disulfide; p,p'-TDE (p,p'-DDD); 4,4-DDD; p-Tetrachloro diphenyl ethane}	n.a.	n.a.	n.a.	n.a.

Section 12. Ecological Information

12.1	**Toxicity:**	Avoid release into the environment. Runoff from fire control or dilution water may cause pollution.
12.2	**Persistence and Degradability:**	No data available.
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:**	No data available.

Section 13. Disposal Considerations

13.1 Waste Disposal Method: Dispose in accordance with local, state, and federal regulations.

Section 14. Transport Information

14.1 LAND TRANSPORT (US DOT):

DOT Proper Shipping Name: Toxic solid, organic, n.o.s. (2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane)
DOT Hazard Class: 6.1 POISON
UN/NA Number: UN2811 **Packing Group:** III

14.1 LAND TRANSPORT (European ADR/RID):

ADR/RID Shipping Name: Toxic solid, organic, n.o.s. (2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane)
UN Number: 2811 **Packing Group:** III
Hazard Class: 6.1 - POISON

14.3 AIR TRANSPORT (ICAO/IATA):

ICAO/IATA Shipping Name: Toxic solid, organic, n.o.s. (2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane)
UN Number: 2811 **Packing Group:** III
Hazard Class: 6.1 - POISON **IATA Classification:** 6.1

Additional Transport Information: Transport in accordance with local, state, and federal regulations.
When sold in quantities of less than or equal to 1 mL, or 1 g, with an Excepted Quantity Code of E1, E2, E4, or E5, this item meets the De Minimis Quantities exemption, per IATA 2.6.10. Therefore packaging does not have to be labeled as Dangerous Goods/Excepted Quantity.

Section 15. Regulatory Information

EPA SARA (Superfund Amendments and Reauthorization Act of 1986) Lists

CAS #	Hazardous Components (Chemical Name)	S. 302 (EHS)	S. 304 RQ	S. 313 (TRI)
72-54-8	DDD {6-hydroxy-2-naphthyl disulfide; p,p'-TDE (p,p'-DDD); 4,4-DDD; p-Tetrachloro diphenyl ethane}	No	Yes 1 LB	No

CAS #	Hazardous Components (Chemical Name)	Other US EPA or State Lists
72-54-8	DDD {6-hydroxy-2-naphthyl disulfide; p,p'-TDE (p,p'-DDD); 4,4-DDD; p-Tetrachloro diphenyl ethane}	CAA HAP,ODC: No; CWA NPDES: Yes; TSCA: No; CA PROP.65: Yes: Canc.

Regulatory Information Statement: This SDS was prepared in accordance with 29 CFR 1910.1200 and Regulation (EC) No.1272/2008.

Section 16. Other Information

Revision Date:	06/29/2018
Additional Information About This Product:	No data available.
Company Policy or Disclaimer:	DISCLAIMER: This information is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes.

SAFETY DATA SHEET
p,p'-DDE

Revision: 06/25/2018

according to Regulation (EC) No. 1907/2006 as amended by (EC) No. 1272/2008

Section 1. Identification of the Substance/Mixture and of the Company/Undertaking

1.1 Product Code: 24241

Product Name: p,p'-DDE

Synonyms: 1,1'-(2,2-dichloroethenylidene)bis[4-chloro-benzene]; 4,4'-DDE; p,p'-Dichlorodiphenyldichloroethylene; NSC 1153;

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

Relevant identified uses: For research use only, not for human or veterinary use.

1.3 Details of the Supplier of the Safety Data Sheet:

Company Name: Cayman Chemical Company
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108

Web site address: www.caymanchem.com

Information: Cayman Chemical Company +1 (734)971-3335

1.4 Emergency telephone number:

Emergency Contact: CHEMTREC Within USA and Canada: +1 (800)424-9300
CHEMTREC Outside USA and Canada: +1 (703)527-3887

Section 2. Hazards Identification

2.1 Classification of the Substance or Mixture:

Acute Toxicity: Inhalation, Category 4

Acute Toxicity: Oral, Category 4

Skin Corrosion/Irritation, Category 2

Aquatic Toxicity (Chronic), Category 1

2.2 Label Elements:

GHS Signal Word: **Warning**

GHS Hazard Phrases:

H302: Harmful if swallowed.

H315: Causes skin irritation.

H332: Harmful if inhaled.

H410: Very toxic to aquatic life with long lasting effects.

GHS Precaution Phrases:

P261: Avoid breathing {dust/fume/gas/mist/vapors/spray}.

P264: Wash {hands} thoroughly after handling.

P273: Avoid release to the environment.

P280: Wear {protective gloves/protective clothing/eye protection/face protection}.

GHS Response Phrases:

P301+312: IF SWALLOWED: P312: Call a POISON CENTER or doctor/physician if you feel unwell.

P302+352: IF ON SKIN: Wash with plenty of soap and water.

P304+340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.

P330: Rinse mouth.

P332+313: If skin irritation occurs, get medical advice/attention.

P362+364: Take off contaminated clothing and wash it before reuse.

P391: Collect spillage.

GHS Storage and Disposal Phrases:

Please refer to Section 7 for Storage and Section 13 for Disposal information.

2.3 Adverse Human Health Effects and Symptoms: Causes skin irritation.
Harmful if inhaled or swallowed..
Material may be irritating to the mucous membranes and upper respiratory tract.
May be harmful by skin absorption.
May cause eye or respiratory system irritation.
Very toxic to aquatic life with long lasting effects.
To the best of our knowledge, the toxicological properties have not been thoroughly investigated.

Section 3. Composition/Information on Ingredients

CAS # / RTECS #	Hazardous Components (Chemical Name)/ REACH Registration No.	Concentration	EC No./ EC Index No.	GHS Classification
72-55-9 KV9450000	DDE {p,p'-DDE; 2,2-Bis(4-chlorophenyl)-1,1-dichloroethylene; 4,4-DDE}	100.0 %	200-784-6 NA	Acute Tox.(O) 4: H302 Skin Corr. 2: H315 Aquatic (C) 1: H410 Acute Tox.(I) 4: H332

Section 4. First Aid Measures

4.1 Description of First Aid Measures:

In Case of Inhalation: Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Get immediate medical attention.

In Case of Skin Contact: Immediately wash skin with soap and plenty of water for at least 15 minutes. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse.

In Case of Eye Contact: Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Have eyes examined and tested by medical personnel.

In Case of Ingestion: Wash out mouth with water provided person is conscious. Never give anything by mouth to an unconscious person. Get medical attention. Do NOT induce vomiting unless directed to do so by medical personnel.

Section 5. Fire Fighting Measures

5.1 Suitable Extinguishing Media: Use alcohol-resistant foam, carbon dioxide, water, or dry chemical spray.
Use water spray to cool fire-exposed containers.

Unsuitable Extinguishing Media: A solid water stream may be inefficient.

5.2 Flammable Properties and Hazards: No data available.

No data available.

Flash Pt: No data.

Explosive Limits: LEL: No data. UEL: No data.

Autoignition Pt: No data.

5.3 Fire Fighting Instructions: As in any fire, wear self-contained breathing apparatus pressure-demand (NIOSH approved or equivalent), and full protective gear to prevent contact with skin and eyes.

Section 6. Accidental Release Measures

6.1 Protective Precautions, Protective Equipment and Emergency Procedures: Avoid raising and breathing dust, and provide adequate ventilation. As conditions warrant, wear a NIOSH approved self-contained breathing apparatus, or respirator, and appropriate personal protection (rubber boots, safety goggles, and heavy rubber gloves).

6.2 Environmental Precautions: Take steps to avoid release into the environment, if safe to do so.

6.3 Methods and Material For Containment and Cleaning Up: Contain spill and collect, as appropriate. Transfer to a chemical waste container for disposal in accordance with local regulations.

Section 7. Handling and Storage

7.1 Precautions To Be Taken in Handling: Avoid breathing dust/fume/gas/mist/vapours/spray. Avoid prolonged or repeated exposure.

7.2 Precautions To Be Taken in Storing: Keep container tightly closed. Store in accordance with information listed on the product insert.

Section 8. Exposure Controls/Personal Protection

8.1 Exposure Parameters:

8.2 Exposure Controls:

8.2.1 Engineering Controls (Ventilation etc.): Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.

8.2.2 Personal protection equipment:

Eye Protection: Safety glasses

Protective Gloves: Compatible chemical-resistant gloves

Other Protective Clothing: Lab coat

Respiratory Equipment (Specify Type): NIOSH approved respirator, as conditions warrant.

Work/Hygienic/Maintenance Practices: Do not take internally. Facilities storing or utilizing this material should be equipped with an eyewash and a safety shower. Wash thoroughly after handling.

No data available.

Section 9. Physical and Chemical Properties

9.1 Information on Basic Physical and Chemical Properties

Physical States:	[ ] Gas [ ] Liquid [X] Solid
Appearance and Odor:	A solid
pH:	No data.
Melting Point:	No data.
Boiling Point:	No data.
Flash Pt:	No data.
Evaporation Rate:	No data.
Flammability (solid, gas):	No data available.
Explosive Limits:	LEL: No data. UEL: No data.
Vapor Pressure (vs. Air or mm Hg):	No data.
Vapor Density (vs. Air = 1):	No data.

	Specific Gravity (Water = 1):	No data.
	Solubility in Water:	No data.
	Solubility Notes:	Soluble (slightly) in: chloroform;
	Octanol/Water Partition Coefficient:	No data.
	Autoignition Pt:	No data.
	Decomposition Temperature:	No data.
	Viscosity:	No data.
9.2	**Other Information**	
	Percent Volatile:	No data.
	Molecular Formula & Weight:	C14H8Cl4 318.0

Section 10. Stability and Reactivity

10.1	**Reactivity:**	No data available.
10.2	**Stability:**	Unstable [ ] Stable [X]
10.3	**Stability Note(s):**	Stable if stored in accordance with information listed on the product insert.
	Polymerization:	Will occur [ ] Will not occur [X]
10.4	**Conditions To Avoid:**	No data available.
10.5	**Incompatibility - Materials To Avoid:**	strong bases strong oxidizing agents
10.6	**Hazardous Decomposition or Byproducts:**	carbon dioxide carbon monoxide hydrogen chloride gas

Section 11. Toxicological Information

11.1	**Information on Toxicological Effects:**	The toxicological effects of this product have not been thoroughly studied. p,p'-DDE - Toxicity Data: Oral LD50 (rat): 880 mg/kg; Oral LD50 (mouse): 700 mg/kg; Intraperitoneal LD50 (rat): 159 mg/kg; Intraperitoneal LD50 (mouse): 500 ug/kg;
	Chronic Toxicological Effects:	p,p'-DDE - Investigated as an agricultural chemical, mutagen, reproductive effector, and tumorigen. Only select Registry of Toxic Effects of Chemical Substances (RTECS) data is presented here. See actual entry in RTECS for complete information. p,p'-DDE RTECS Number: KV9450000

CAS #	Hazardous Components (Chemical Name)	NTP	IARC	ACGIH	OSHA
72-55-9	DDE {p,p'-DDE; 2,2-Bis(4-chlorophenyl)-1,1-dichloroethylene; 4,4-DDE}	n.a.	n.a.	n.a.	n.a.

Section 12. Ecological Information

12.1	**Toxicity:**	Avoid release into the environment. Runoff from fire control or dilution water may cause pollution.
12.2	**Persistence and Degradability:**	No data available.
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:**	No data available.

Section 13. Disposal Considerations

13.1 Waste Disposal Method: Dispose in accordance with local, state, and federal regulations.

Section 14. Transport Information

14.1 LAND TRANSPORT (US DOT):

DOT Proper Shipping Name: Environmentally hazardous substances, solid, n.o.s. (p,p'-DDE)
DOT Hazard Class: 9 CLASS 9
UN/NA Number: UN3077 **Packing Group:** III

14.1 LAND TRANSPORT (European ADR/RID):

ADR/RID Shipping Name: Environmentally hazardous substances, solid, n.o.s. (p,p'-DDE)
UN Number: 3077 **Packing Group:** III
Hazard Class: 9 - CLASS 9

14.3 AIR TRANSPORT (ICAO/IATA):

ICAO/IATA Shipping Name: Environmentally hazardous substances, solid, n.o.s. (p,p'-DDE)
UN Number: 3077 **Packing Group:** III
Hazard Class: 9 - CLASS 9 **IATA Classification:** 9

Additional Transport Information: Transport in accordance with local, state, and federal regulations.
When sold in quantities of less than or equal to 1 mL, or 1 g, with an Excepted Quantity Code of E1, E2, E4, or E5, this item meets the De Minimis Quantities exemption, per IATA 2.6.10. Therefore packaging does not have to be labeled as Dangerous Goods/Excepted Quantity.

Section 15. Regulatory Information

EPA SARA (Superfund Amendments and Reauthorization Act of 1986) Lists

CAS #	Hazardous Components (Chemical Name)	S. 302 (EHS)	S. 304 RQ	S. 313 (TRI)
72-55-9	DDE {p,p'-DDE; 2,2-Bis(4-chlorophenyl)-1,1-dichloroethylene; 4,4-DDE}	No	Yes 1 LB	No

CAS #	Hazardous Components (Chemical Name)	Other US EPA or State Lists
72-55-9	DDE {p,p'-DDE; 2,2-Bis(4-chlorophenyl)-1,1-dichloroethylene; 4,4-DDE}	CAA HAP,ODC: HAP; CWA NPDES: Yes; TSCA: No; CA PROP.65: Yes: RDTox(M)

Regulatory Information Statement: This SDS was prepared in accordance with 29 CFR 1910.1200 and Regulation (EC) No.1272/2008.

Section 16. Other Information

Revision Date:	06/25/2018
Additional Information About This Product:	No data available.
Company Policy or Disclaimer:	DISCLAIMER: This information is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes.

DDT
(dichlorodiphenyltrichloroethane)

TRADE OR OTHER NAMES: Trade or other names include Anofex, Cesarex, Chlorophenothane, Dedelo, p,pÕ-DDT, Dichlorodiphenyltrichloroethane, Dinocide, Didimac, Digmar, ENT 1506, Genitox, Guesapon, Guesarol, Gexarex, Gyron, Hildit, Ixodex, Kopsol, Neocid, OMS 16, Micro DDT 75, Pentachlorin, Rukseam, R50 and Zerdane (79,73).

REGULATORY STATUS: DDT is no longer registered for use in the United States, although it is still used in other (primarily tropical) countries. It is in EPA Toxicity Class II, moderately toxic (72). DDT was banned from use in the United States in 1972, and remains banned barring public health emergency (e.g., outbreak of malaria) (73).

CHEMICAL CLASS: Organochlorine

INTRODUCTION: DDT is an organochlorine insecticide used mainly to control mosquito-borne malaria; use on crops has generally been replaced by less persistent insecticides (79). It was extensively used during the Second World War among Allied troops and certain civilian populations to control insect typhus and malaria vectors, and was then extensively used as an agricultural insecticide after 1945 (73). DDT was banned for use in Sweden in 1970 and in the United States in 1972 (73). Many insect pests may have developed resistance to DDT (79). Unless otherwise specified, the toxicological, environmental effects and environmental fate and chemistry data presented here refer to the technical product DDT. Technical grade DDT is actually a mixture of three isomers of DDT, principally the p,p'-DDT isomer (ca. 85%), with the o,p'-DDT and o,o'-DDT isomers typically present in much lesser amounts (73).

FORMULATION: It is available in several different forms: aerosols, dustable powders, emulsifiable concentrates, granules and wettable powders (79, 72). It is reported to be compatible with many other pesticides and incompatible with
alkaline substances (79).

TOXICOLOGICAL EFFECTS

- **Acute Toxicity:** DDT is moderately to slightly toxic to studied mammalian species via the oral route. Reported oral LD50s range from 113 to 800 mg/kg in rats (79,73); 150-300 mg/kg in mice (79); 300 mg/kg in guinea pigs (73); 400 mg/kg in rabbits (73) ; 500-750 mg/kg in dogs (79) and greater than 1,000 mg/kg in sheep and goats (79). Toxicity will vary according to formulation (79). DDT is readily absorbed through the gastrointestinal tract, with increased absorption in the presence of fats (73). One-time administration of DDT to rats at doses of 50 mg/kg led to decreased thyroid function and a single dose of 150 mg/kg led to increased blood levels of liver-produced enzymes and changes in the cellular chemistry in the central nervous system of monkeys (73). Single doses of 50-160 mg/kg produced tremors in rats, and single doses of 160 mg/kg produced hind leg paralysis in guinea pigs (73). Mice suffered convulsions following a one-time oral dose of 200 mg/kg. Single administrations of low doses to developing 10-day old mice are reported to have caused subtle effects on their neurological development (73). DDT is slightly to practically non-toxic to test animals via the dermal route, with reported dermal LD50s of 2,500-3,000 mg/kg in female rats (79, 73), 1000 in guinea pigs (73) and 300 in rabbits (73). It is not readily absorbed through the skin unless it is in solution (73). It is thought that inhalation exposure to DDT will not result in significant absorption through the lung alveoli (tiny gas-exchange sacs) but rather that it is probably trapped in mucous secretions and swallowed by exposed individuals following the tracheo-bronchial clearance of secretions by the cilia (73). Acute effects likely in humans due to low to moderate exposure may include nausea, diarrhea, increased liver enzyme

activity, irritation (of the eyes, nose or throat), disturbed gait, malaise and excitability; at higher doses, tremors and convulsions are possible (73, 76). While adults appear to tolerate moderate to high ingested doses of up to 280 mg/kg, a case of fatal poisoning was seen in a child who ingested one ounce of a 5% DDT:kerosene solution (73).

- **Chronic Toxicity**: DDT has caused chronic effects on the nervous system, liver, kidneys,and immune systems in experimental animals (73, 74). Effects on the nervous system observed in test animals include: tremors in rats at doses of 16-32 mg/kg/day over 26 weeks; tremors in mice at doses of 6.5-13mg/kg/day over 80-140 weeks; changes in cellular chemistry in the central nervous system of monkeys at doses of 10 mg/kg/day over 100 days, and loss of equilibrium in monkeys at doses of 50 mg/kg/day for up to 6 months (73). The main effect on the liver seen in animal studies was localized liver damage. This effect was seen in rats given 3.75 mg/kg/day over 36 weeks, rats exposed to 5 mg/kg/day over 2 years and dogs at doses of 80 mg/kg/day over the course of 39 months (73). In many cases lower doses produced subtle changes in liver cell physiology, and in some cases higher doses produced more severe effects (73). In mice doses of 8.33 mg/kg/day over 28 days caused increased liver weight and increased liver enzyme activity (73). Liver enzymes are commonly involved in detoxification of foreign compounds, so it is unclear whether increased liver enzyme activity in itself would constitute an adverse effect. In some species (monkeys and hamsters), doses as high as 8-20 mg/kg/day caused no observed adverse effects over exposure periods as long as 3.5-7 years (73). Kidney effects observed in animal studies include adrenal gland hemorrhage in dogs at doses of 138.5 mg/kg/day over 10 days and adrenal gland damage at 50 mg/kg day over 150 days in dogs (73). Kidney damage was also seen in rats at doses of 10 mg/kg/day over 27 months (73). Immunological effects observed in test animals include: reduced antibody formation in mice following administration of 13 mg/kg/day for 3-12 weeks and reduced levels of immune cells in rats at doses of 1 mg/kg/day (73). No immune system effects were observed in mice at doses of 6.5 mg/kg/day for 3-12 weeks (73). Dose levels at which effects were observed in test animals are very much higher than those which may be typically encountered by humans (74). The most significant source of exposure to individuals in the United States is occupational, occurring only to those who work or worked in the production or formulation of DDT products for export (75). Analysis of U. S. market basket surveys showed approximately a 30-fold decrease in detected levels of DDT and metabolites in foodstuffs from 1969-1974, and another threefold drop from 1975-1981, with a final estimated daily dose of approximately 0.002 mg/person/day (73). Based on a standard 70-kg person, this results in a daily intake of approximately 0.00003 mg/kg/day. Due to the persistence of DDT and its metabolites in the environment, very low levels may continue to be detected in foodstuffs grown in some areas of prior use (73). It has been suggested that, depending on patterns of international DDT use and trade, it is possible that dietary exposure levels may actually increase over time (73). Persons eating fish contaminated with DDT or metabolites may also be exposed via bioaccumulation of the compound in fish (73). Even though current dietary levels are quite low, past and current exposures may result in measurable body burdens due to its persistence in the body (73). More information on the metabolism and storage of DDT and its metabolites in mammalian systems is provided below (Fate in Humans and Animals). Adverse effects on the liver, kidney and immune system due to DDT exposure have not been demonstrated in humans in any of the studies which have been conducted to date (73).
- **Reproductive Effects:** There is evidence that DDT causes reproductive effects in test animals. No reproductive effects were observed in rats at doses of 38 mg/kg/day administered at days 15-19 of gestation (73). In another study in rats, oral doses of 7.5 mg/kg/day for 36 weeks resulted in sterility (73). In rabbits, doses of 1 mg/kg/day administered on gestation days 4-7 resulted in decreased fetal weights and 10 mg/kg/day on days 7-9 of gestation resulted in increased resorptions (73). In mice, doses of 1.67 mg/kg/day resulted in decreased embryo implantation and irregularities in the estrus cycle over 28 weeks (73). It is thought that many of these observed effects may be the result of disruptions in the endocrine (hormonal) system (73). Available epidemiological evidence from two studies does not indicate that reproductive effects have occurred in humans as a result of DDT exposure (73). No associations between maternal blood levels of DDT and miscarriage nor premature rupture of fetal membranes were observed in two separate studies (73, 77, 78). One study did report a significant

association between maternal DDT blood levels and miscarriage, but the presence of other organochlorine chemicals (e.g., PCBs) in maternal blood which may have accounted for the effect make it impossible to attribute the effect to DDT and its metabolites (79).

- **Teratogenic Effects:** There is evidence that DDT causes teratogenic effects in test animals as well. In mice, maternal doses of 26 mg/kg/day DDT from gestation through lactation resulted in impaired learning performance in maze tests (73). In a two-generational study of rats, 10 mg/kg/day resulted in abnormal tail development (73). Epidemiological evidence regarding the occurance of teratogenic effects as a result of DDT exposure are unavailable (73). It seems unlikely that teratogenic effects will occur in humans due to DDT at likely exposure levels.
- **Mutagenic Effects**: The evidence for mutagenicity and genotoxicity is contradictory. In only 1 out of 11 mutagenicity assays in various cell cultures and organisms did DDT show positive results (73). Results of in vitro and in vivo genotoxocity assays for chromosomal aberrations indicated that DDT was genotoxic in 8 out of 12 cases, and weakly genotoxic in 1 case (73). In humans, blood cell cultures of men occupationally exposed to DDT showed an increase in chromosomal damage. In a separate study, significant increases in chromosomal damage were reported in workers who had direct and indirect occupational exposure to DDT (73). Thus it appears that DDT may have the potential to cause genotoxic effects in humans, but does not appear to be strongly mutagenic. It is unclear whether these effects may occur at exposure levels likely to be encountered by most people.
- **Carcinogenic Effects**: The evidence regarding the carcinogenicity of DDT is equivocal. It has been shown to cause increased tumor production (mainly in the liver and lung) in test animals such as rats, mice and hamsters in some studies but not in others (73) In rats, liver tumors were induced in three separate studies at doses of 12.5 mg/kg/day over periods of 78 weeks to life, and thyroid tumors were induced at doses of 85 mg/kg/day over 78 weeks (73). In mice, lifetime doses of 0.4 mg/kg/day resulted in lung tumors in the second generation and leukemia in the third generation; liver tumors were induced at oral doses of 0.26 mg/kg/day in two separate studies over several generations. In hamsters, significant increases in adrenal gland tumors were seen at doses of 83 mg/kg/day in females (but not males) , and in males (but not females) at doses of 40 mg/kg/day (73). In other studies, however, no carcinogenic activity was observed in rats at doses less than 25 mg/kg/day; no carcinogenic activity was seen in mice with at doses of 3-23 mg/kg/day over an unspecified period, and in other hamster studies there have been no indications of carcinogenic effects (73). The available epidemiological evidence regarding DDTÕs carcinogenicity in humans, when taken as a whole, does not suggest that DDT and its metabolites are carcinogenic in humans at likely dose levels (73). In several epimiological studies, no significant associations were seen between DDT exposure and disease, but in one other study, a weak association was observed (73, 80). In this latter study, which found a significant association between long-term, high DDT exposures and pancreatic cancers in chemical workers, there were questions raised as to the reliability of the medical records of a large proportion of the cancer cases (73,80).
- **Organ Toxicity:** Acute human exposure data and animal studies reveal that DDT can affect the nervous system, liver, kidney (73). Increased tumor production in the liver and lung has been observed in test animals (73). An association with pancreatic cancer was suggested in humans in one study (73, 80).
- **Fate in Humans & Animals:** DDT is very slowly transformed in animal systems (74). Initial degradates in mammalian systems are 1,1-dichloro-2,2-bis(p-dichlorodiphenyl)ethylene (DDE) and 1,1-dichloro-2,2-bis(p-chlorophenyl)ethane (DDD), which are very readily stored in fatty tissues (73). These compounds in turn are ultimately transformed into bis(dichlorodiphenyl) acetic acid (DDA) via other metabolites at a very slow rate (73). DDA, or conjugates of DDA, are readily excreted via the urine (73). Available data from analysis of human blood and fat tissue samples collected in the early 1970s showed detectable levels in all samples, but a downward trend in the levels over time (73). Later study of blood samples collected in the latter half of the 1970s showed that blood levels were declining further, but DDT or metabolites were still seen in a very high proportion of the samples (73). Levels of DDT or metabolites may occur in fatty tissues (e.g. fat cells, the brain, etc.) at levels of up to several hundred times that seen in the blood (73). DDT or metabolites may also be elminated via motherÕs milk by lactating women (73).

ECOLOGICAL EFFECTS

- **Effects on Birds**: DDT may be slightly toxic to practically non-toxic to birds. Reported dietary LD50s range from greater than 2,240 mg/kg in mallard, 841 mg/kg in Japanese quail and 1,334 mg/kg in pheasant (81). Other reported dietary LD50s in such species as bobwhite quail, California quail, red-winged blackbird, cardinal, house sparrow, blue jay, sandhill crane and clapper rail also indicate slight toxicity both in acute 5-day trials and over longer periods of up to 100 days (82). In birds, exposure to DDT occurs mainly through the food web through predation on aquatic and/or terrestrial species having body burdens of DDT, such as fish, earthworms and other birds (82). There has been much concern over chronic exposure of bird species to DDT and effects on reproduction, especially eggshell thinning and embryo deaths (82). The mechanisms of eggshell thinning are not fully understood. It is thought that this may occur from the major metabolite, DDE, and that predator species of birds are the most sensitive to these effects (82). Laboratory studies on bird reproduction have demonstrated the potential of DDT and DDE to cause subtle effects on courtship behavior, delays in pairing and egg laying and decreases in egg weight in ring doves and Bengalese finches (82). The implications of these for long-term survival and reproduction of wild bird species is unclear. There is evidence that synergism may be possible between DDTÕs metabolites and organophosphate (cholinesterase-inhibiting) pesticides to produce greater toxicity to the nervous system and higher mortality (82). Aroclor (polychlorinated biphenyls, or PCBs) may result in additive effects on eggshell thinning (82).
- **Effects on Aquatic Species:** DDT is very highly toxic to many aquatic invertebrate species. Reported 96-hour LC50s in various aquatic invertebrates (e.g., stoneflies, midges, crayfish, sow bugs) range from 0.18 ug/L to 7.0 ug/L, and 48-hour LC50s are 4.7 ug/L for daphnids and 15 ug/L for sea shrimp (55). Other reported 96-hour LC50s for various aquatic invertebrate species are from 1.8 ug/L to 54 ug/L (82). Early developmental stages are more susceptible than adults to DDTÕs effects (82). The reversibility of some effects, as well as the development of some resistance, may be possible in some aquatic invertebrates (55). DDT is very highly toxic to fish species as well. Reported 96-hour LC50s are less than 10 ug/L in coho salmon (4.0 ug/L), rainbow trout (8.7 ug/L), northern pike (2.7 ug/L), black bullhead (4.8 ug/L), bluegill sunfish (8.6 ug/L), largemouth bass (1.5 ug/L), and walleye (2.9 ug/L) (55). The reported 96-hour LC50s in fathead minnow and channel catfish are 21.5 ug/L and 12.2 ug/L respectively (55). Other reported 96-hour LC50s in largemouth bass and guppy were 1.5 ug/L and 56 ug/L respectively (82). Observed toxicity in coho and chinook salmon was greater in smaller fish than in larger (82). It is reported that DDT levels of 1 ng/L in Lake Michigan were sufficient to affect the hatching of coho salmon eggs (3). DDT may be moderately toxic to some amphibian species and larval stages are probably more susceptible than adults (81, 82). In addition to acute toxic effects, DDT may bioaccumulate significantly in fish and other aquatic species, leading to long-term exposure. This occurs mainly through uptake from sediment and water into aquatic flora and fauna, and also fish (82). Fish uptake of DDT from the water will be size-dependent with smaller fish taking up relatively more than larger fish (82). A half-time for elimination of DDT from rainbow trout was estimated to be 160 days (82). The reported bioconcentration factor for DDT is 1,000 to 1,000,000 in various aquatic species (83), and bioaccumulation may occur in some species at very low environmental concentrations (55). Bioaccumulation may also result in exposure to species which prey on fish or other aquatic organisms (e.g., birds of prey).
- **Effects on Other Animals (Nontarget species):** Earthworms are not susceptible to acute effects of DDT and its metabolites at levels higher than those likely to be found in the environment, but they may serve as an exposure source to species that feed on them (82). DDT is non-toxic to bees; the reported topical LD50 for DDT in honeybees is 27 ug/bee (82). Laboratory studies indicate that bats may be affected by DDT released from stored body fat during long migratory periods (82).

ENVIRONMENTAL FATE

- **Breakdown in Soil and Groundwater:** DDT is very highly persistent in the environment, with a reported half life of between 2-15 years (83, 84) and is immobile in most soils. Routes of loss and

degradation include runoff, volatilization, photolysis and biodegradation (aerobic and anaerobic) (73). These processes generally occur only very slowly. Breakdown products in the soil environment are DDE and DDD, which are also highly persistent and have similar chemical and physical properties (82, 84). Due to its extremely low solubility in water, DDT will be retained to a greater degree by soils and soil fractions with higher proportions of soil organic matter (82). It may accumulate in the top soil layer in situations where heavy applications are (or were) made annually; e.g., for apples (72). Generally DDT is tightly sorbed by soil organic matter, but it (along with its metabolites) has been detected in many locations in soil and groundwater where it may be available to organisms (82, 83). This is probably due to its high persistence; although it is immobile or only very slightly mobile, over very long periods of time it may be able to eventually leach into groundwater, especially in soils with little soil organic matter. Residues at the surface of the soil are much more likely to be broken down or otherwise dissipated than those below several inches (3). Studies in Arizona have shown that volatilization losses may be significant and rapid in soils with very low organic matter content (desert soils) and high irradiance of sunlight, with volatilization losses reported as high as 50% in 5 months (85). In other soils (Hood River and Medford) this rate may be as low as 17-18% over 5 years (85). Volatilization loss will vary with the amount of DDT applied, proportion of soil organic matter, proximity to soil-air interface and the amount of sunlight (82).

- **Breakdown of Chemical in Surface Water:** DDT may reach surface waters primarily by runoff, atmospheric transport, drift, or by direct application (e.g. to control mosquito-borne malaria) (73). The reported half-life for DDT in the water environment is 56 days in lake water and approximately 28 days in river water (83). The main pathways for loss are volatilization, photodegradation, adsorption to water-borne particulates and sedimentation (73) Aquatic organisms, as noted above, also readily take up and store DDT and its metabolites. Field and laboratory studies in the United Kingdom demonstrated that very little breakdown of DDT occurred in estuary sediments over the course of 46 days (82). DDT has been widely detected in ambient surface water sampling in the United States at a median level of 1 ng/L (part per trillion) (73, 76).
- **Breakdown of Chemical in Vegetation**: DDT does not appear to be taken up or stored by plants to a great extent. It was not translocated into alfalfa or soybean plants, and only trace amounts of DDT or its metabolites were observed in carrots, radishes and turnips all grown in DDT-treated soils (82). Some accumulation was reported in grain, maize and riceplants, but little translocation occured and residues were located primarily in the roots (73).

PHYSICAL PROPERTIES AND GUIDELINES

Physical Properties:

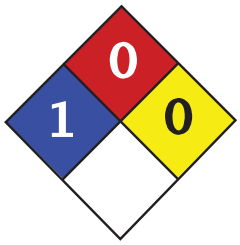
- **Appearance:** The physical appearance of technical product p,pÕ-DDT is a waxy solid, although in its pure form it consists of colorless crystals (79)
- **Chemical Name:** 1,1'-(2,2,2-trichloroethylidene)bis[4-chlorobenzene]; 1,1,1- trichloro-2,2-bis(4-chlorophenyl) ethane (79)
- **CAS Number:** 50-29-3 (79)
- **Molecular Weight:** 354.51 (79)
- **Water Solubility:** < 1 mg/L @ 20 degrees C (79)
- **Solubility in Other Solvents:** cyclohexanone v.s., dioxane v.s., benzene v.s., xylene v.s., trichloroethylene v.s., dichloromethane v.s., acetone v.s., chloroform v.s., diethyl ether v.s., ethanol s. and methanol s. (79).
- **Melting Point:** 108.5-109 degrees C (79)
- **Vapor Pressure:** 0.025 mPa @ 25 degrees C (79)
- **Partition Coefficient:** Not available
- **Adsorption Coefficient:** 100,000 (84)

Exposure Guidelines:

- **ADI:** 0.02 mg/kg/d (73)
- **MCL**: Not Available
- **RfD:** 0.0005 mg/kg/day (73)
- **PEL:** 1 mg/meters cubed (8-hour) (73)
- **HA**: Not Available
- **TLV**: Not Available

BASIC MANUFACTURER

No manufacturer review was available.



Health	1
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Lead MSDS

Section 1: Chemical Product and Company Identification

Product Name: Lead

Catalog Codes: SLL1291, SLL1669, SLL1081, SLL1459, SLL1834

CAS#: 7439-92-1

RTECS: OF7525000

TSCA: TSCA 8(b) inventory: Lead

CI#: Not available.

Synonym: Lead Metal, granular; Lead Metal, foil; Lead Metal, sheet; Lead Metal, shot

Chemical Name: Lead

Chemical Formula: Pb

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
Lead	7439-92-1	100

Toxicological Data on Ingredients: Lead LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

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

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (permeator).
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to blood, kidneys, central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

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

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

Serious Skin Contact: Not available.

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

Serious Inhalation: Not available.

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: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

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

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

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: When heated to decomposition it emits highly toxic fumes of lead.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. 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 dust. Wear suitable protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

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

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: Safety glasses. 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:
TWA: 0.05 (mg/m3) from ACGIH (TLV) [United States]
TWA: 0.05 (mg/m3) from OSHA (PEL) [United States]
TWA: 0.03 (mg/m3) from NIOSH [United States]
TWA: 0.05 (mg/m3) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

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

Odor: Not available.

Taste: Not available.

Molecular Weight: 207.21 g/mole

Color: Bluish-white. Silvery. Gray

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

Boiling Point: 1740°C (3164°F)

Melting Point: 327.43°C (621.4°F)

Critical Temperature: Not available.

Specific Gravity: 11.3 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, excess heat

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Can react vigorously with oxidizing materials.
Incompatible with sodium carbide, chlorine trifluoride, trioxane + hydrogen peroxide, ammonium nitrate, sodium azide, disodium acetylide, sodium acetylide, hot concentrated nitric acid, hot concentrated hydrochloric acid, hot concentrated sulfuric acid, zirconium.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

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

Toxicity to Animals:
LD50: Not available.
LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC.
May cause damage to the following organs: blood, kidneys, central nervous system (CNS).

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:
Acute Potential:
Skin:
Lead metal granules or dust: May cause skin irritation by mechanical action.
Lead metal foil, shot or sheets: Not likely to cause skin irritation
Eyes:
Lead metal granules or dust: Can irritate eyes by mechanical action.

Lead metal foil, shot or sheets: No hazard. Will not cause eye irritation.
Inhalation:
In an industrial setting, exposure to lead mainly occurs from inhalation of dust or fumes.
Lead dust or fumes: Can irritate the upper respiratory tract (nose, throat) as well as the bronchi and lungsby mechanical action. Lead dust can be absorbed through the respiratory system. However, inhaled lead does not accumulate in the lungs. All of an inhaled dose is eventually abssorbed or transferred to the gastrointestinal tract. Inhalation effects of exposure to fumes or dust of inorganic lead may not develop quickly. Symptoms may include metallic taste, chest pain, decreased physical fitness, fatigue, sleep disturbance, headache, irritability, reduces memory, mood and personality changes, aching bones and muscles, constipation, abdominal pains, decreasing appetite. Inhalation of large amounts may lead to ataxia, deliriuim, convulsions/seizures, coma, and death.
Lead metal foil, shot, or sheets: Not an inhalation hazard unless metal is heated. If metal is heated, fumes will be released. Inhalation of these fumes may cause "fume metal fever", which is characterized by flu-like symptoms. Symptoms may include metallic taste, fever, nausea, vomiting, chills, cough, weakness, chest pain, generalized muscle pain/aches, and increased white blood cell count.
Ingestion:
Lead metal granules or dust: The symptoms of lead poisoning include abdominal pain or cramps (lead cholic), spasms, nausea, vomiting, headache, muscle weakness, hallucinations, distorted perceptions, "lead line" on the gums, metallic taste, loss of appetite, insomnia, dizziness and other symptoms similar to that of inhalation. Acute poisoning may result in high lead levels in the blood and urine, shock, coma and death in extreme cases.
Lead metal foil, shot or sheets: Not an ingestion hazard for usual industrial handling.

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: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
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: Lead
California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (female) which would require a warning under the statute: Lead
California prop. 65: This product contains the following ingredients for which the State of California has found to

cause reproductive harm (male) which would require a warning under the statute: Lead
California prop. 65 (no significant risk level): Lead: 0.0005 mg/day (value)
California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Lead
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: Lead
Connecticut hazardous material survey.: Lead
Illinois toxic substances disclosure to employee act: Lead
Illinois chemical safety act: Lead
New York release reporting list: Lead
Rhode Island RTK hazardous substances: Lead
Pennsylvania RTK: Lead

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

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R20/22- Harmful by inhalation and if swallowed.
R33- Danger of cumulative effects.
R61- May cause harm to the unborn child.
R62- Possible risk of impaired fertility.
S36/37- Wear suitable protective clothing and gloves.
S44- If you feel unwell, seek medical advice (show the label when possible).
S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

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

Health: 1

Flammability: 0

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.

Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:21 PM

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

Material Safety Data Sheet
Mercury MSDS

Section 1: Chemical Product and Company Identification

Product Name: Mercury

Catalog Codes: SLM3505, SLM1363

CAS#: 7439-97-6

RTECS: OV4550000

TSCA: TSCA 8(b) inventory: Mercury

CI#: Not applicable.

Synonym: Quick Silver; Colloidal Mercury; Metallic Mercury; Liquid Silver; Hydragyrum

Chemical Name: Mercury

Chemical Formula: Hg

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
Mercury	7439-97-6	100

Toxicological Data on Ingredients: Mercury LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (corrosive, permeator). Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Hazardous in case of skin contact (permeator).
CARCINOGENIC EFFECTS: Classified A5 (Not suspected for human.) by ACGIH. 3 (Not classifiable for human.) by IARC.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to blood, kidneys, liver, brain, peripheral nervous system, central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a 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. 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 for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

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 immediately.

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 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: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

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

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
When thrown into mercury vapor, boron phosphodiiodide ignites at once.
Flame forms with chlorine jet over mercury surface at 200 deg to 300 deg C.
Mercury undergoes hazardous reactions in the presence of heat and sparks or ignition.

Special Remarks on Explosion Hazards:
A violent exothermic reaction or possible explosion occurs when mercury comes in contact with lithium and rubidium.
CHLORINE DIOXIDE & LIQUID HG, WHEN MIXED, EXPLODE VIOLENTLY.
Mercury and Ammonia can produce an explosive compound.
A mixture of the dry carbonyl and oxygen will explode on vigorous shaking with mercury.
Methyl azide in the presence of mercury was shown to be potentially explosive.

Section 6: Accidental Release Measures

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

Large Spill:
Corrosive liquid. Poisonous liquid.
Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. 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, metals.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 25°C (77°F).

Section 8: Exposure Controls/Personal Protection

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

Personal Protection:
Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

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: 0.025 from ACGIH (TLV) [United States] SKIN
TWA: 0.05 CEIL: 0.1 (mg/m3) from OSHA (PEL) [United States] Inhalation
TWA: 0.025 (mg/m3) [United Kingdom (UK)]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Heavy liquid)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 200.59 g/mole

Color: Silver-white

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

Boiling Point: 356.73°C (674.1°F)

Melting Point: -38.87°C (-38°F)

Critical Temperature: 1462°C (2663.6°F)

Specific Gravity: 13.55 (Water = 1)

Vapor Pressure: Not available.

Vapor Density: 6.93 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

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

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Ground mixtures of sodium carbide and mercury, aluminum, lead, or iron can react vigorously.
A violent exothermic reaction or possible explosion occurs when mercury comes in contact with lithium and rubidium.
Incompatible with boron diiodophosphide; ethylene oxide; metal oxides, metals(aluminum, potassium, lithium, sodium, rubidium); methyl azide; methylsilane, oxygen; oxidants(bromine, peroxyformic acid, chlorine dioxide, nitric acid, tetracarbonynickel, nitromethane, silver perchlorate, chlorates, sulfuric acid, nitrates,); tetracarbonylnickel, oxygen, acetylinic compounds, ammonia, ethylene oxide, methylsiliane, calcium,

Special Remarks on Corrosivity:
The high mobility and tendency to dispersion exhibited by mercury, and the ease with which it forms alloys

(amalga) with many laboratory and electrical contact metals, can cause severe corrosion problems in laboratories.
Special precautions: Mercury can attack copper and copper alloy materials.

Polymerization: Will not occur.

Section 11: Toxicological Information

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

Toxicity to Animals:
LD50: Not available.
LC50: Not available.

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A5 (Not suspected for human.) by ACGIH. 3 (Not classifiable for human.) by IARC.
May cause damage to the following organs: blood, kidneys, liver, brain, peripheral nervous system, central nervous system (CNS).

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
May affect genetic material.
May cause cancer based on animal data.
Passes through the placental barrier in animal.
May cause adverse reproductive effects(paternal effects- spermatogenesis; effects on fertility - fetotoxicity, post-implantation mortality), and birth defects.

Special Remarks on other Toxic Effects on Humans:

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 8: Corrosive material

Identification: : Mercury UNNA: 2809 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: Mercury
California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Mercury
Connecticut hazardous material survey.: Mercury
Illinois toxic substances disclosure to employee act: Mercury
Illinois chemical safety act: Mercury
New York acutely hazardous substances: Mercury
Rhode Island RTK hazardous substances: Mercury
Pennsylvania RTK: Mercury
Minnesota: Mercury
Massachusetts RTK: Mercury
New Jersey: Mercury
New Jersey spill list: Mercury
Louisiana spill reporting: Mercury
California Director's List of Hazardous Substances.: Mercury
TSCA 8(b) inventory: Mercury
SARA 313 toxic chemical notification and release reporting: Mercury
CERCLA: Hazardous substances.: Mercury: 1 lbs. (0.4536 kg)

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

Other Classifications:

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

DSCL (EEC):
R23- Toxic by inhalation.
R33- Danger of cumulative effects.
R38- Irritating to skin.
R41- Risk of serious damage to eyes.
R50/53- Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
S2- Keep out of the reach of children.
S7- Keep container tightly closed.
S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S39- Wear eye/face protection.
S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S46- If swallowed, seek medical advice immediately and show this container or label.
S60- This material and its container must be disposed of as hazardous waste.

S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 0

Personal Protection:

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

Health: 3

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Full suit.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Face shield.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:22 PM

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

Health	2
Fire	0
Reactivity	0
Personal Protection	G

Material Safety Data Sheet
Tetrachloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Tetrachloroethylene

Catalog Codes: SLT3220

CAS#: 127-18-4

RTECS: KX3850000

TSCA: TSCA 8(b) inventory: Tetrachloroethylene

CI#: Not available.

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

Chemical Name: Ethylene, tetrachloro-

Chemical Formula: C2-Cl4

Contact Information:

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

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

Order Online: ScienceLab.com

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

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

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

Section 2: Composition and Information on Ingredients

Composition:

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

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

Section 3: Hazards Identification

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

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (anticipated carcinogen) by NTP.
MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast.
TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to kidneys, liver, peripheral nervous system, respiratory tract, skin, central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

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

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

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

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

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

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

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

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

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

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

Section 7: Handling and Storage

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

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

Section 8: Exposure Controls/Personal Protection

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

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

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

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

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Ethereal.

Taste: Not available.

Molecular Weight: 165.83 g/mole

Color: Clear Colorless.

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

Boiling Point: 121.3°C (250.3°F)

Melting Point: -22.3°C (-8.1°F)

Critical Temperature: 347.1°C (656.8°F)

Specific Gravity: 1.6227 (Water = 1)

Vapor Pressure: 1.7 kPa (@ 20°C)

Vapor Density: 5.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 5 - 50 ppm

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

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

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

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

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

Corrosivity: Non-corrosive in presence of glass.

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

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

Polymerization: Will not occur.

Section 11: Toxicological Information

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

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

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

skin, central nervous system (CNS).

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

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

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

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

Section 12: Ecological Information

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

BOD5 and COD: Not available.

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

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

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

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Tetrachloroethylene UNNA: 1897 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

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

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

Other Classifications:

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

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

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: g

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

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

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

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:29 PM

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

SAFETY DATA SHEET

Trichloroethylene

Section 1. Identification

GHS product identifier : Trichloroethylene

Chemical name : trichloroethylene

Other means of identification : trichloroethene; Ethene, 1,1,2-trichloro-; Ethene, trichloro-; Trichlorethylene; Ethylene, trichloro-

Product use : Synthetic/Analytical chemistry.

Synonym : trichloroethene; Ethene, 1,1,2-trichloro-; Ethene, trichloro-; Trichlorethylene; Ethylene, trichloro-

SDS # : 001206

Supplier's details : Airgas USA, LLC and its affiliates
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

24-hour telephone : 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification of the substance or mixture : SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2A
GERM CELL MUTAGENICITY - Category 2
CARCINOGENICITY - Category 1
AQUATIC HAZARD (LONG-TERM) - Category 3

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Causes serious eye irritation.
Causes skin irritation.
May cause cancer.
Suspected of causing genetic defects.
Harmful to aquatic life with long lasting effects.

Precautionary statements

General : Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

Prevention : Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Wear protective gloves. Wear eye or face protection. Wear protective clothing. Avoid release to the environment. Wash hands thoroughly after handling.

Response : IF exposed or concerned: Get medical attention. IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing and wash it before reuse. If skin irritation occurs: Get medical attention. 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 attention.

Storage : Store locked up.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

Section 2. Hazards identification

Hazards not otherwise classified : None known.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : trichloroethylene

Other means of identification : trichloroethene; Ethene, 1,1,2-trichloro-; Ethene, trichloro-; Trichlorethylene; Ethylene, trichloro-

CAS number/other identifiers

CAS number : 79-01-6

Product code : 001206

Ingredient name	%	CAS number
trichloroethylene	100	79-01-6

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes skin irritation.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Ingestion : No known significant effects or critical hazards.

Section 4. First aid measures

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:, pain or irritation, watering, redness

Inhalation : No specific data.

Skin contact : Adverse symptoms may include the following:, irritation, redness

Ingestion : No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.

Specific treatments : No specific treatment.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media : Use an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : In a fire or if heated, a pressure increase will occur and the container may burst. This material is harmful to aquatic life with long lasting effects. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
halogenated compounds
carbonyl halides

Special protective actions for fire-fighters : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

For emergency responders : If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Section 6. Accidental release measures

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). Water polluting material. May be harmful to the environment if released in large quantities.

Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not ingest. Avoid breathing vapor or mist. Avoid release to the environment. If during normal use the material presents a respiratory hazard, use only with adequate ventilation or wear appropriate respirator. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

trichloroethylene

ACGIH TLV (United States, 3/2016).
STEL: 25 ppm 15 minutes.
TWA: 10 ppm 8 hours.
OSHA PEL 1989 (United States, 3/1989).
STEL: 1080 mg/m³ 15 minutes.
STEL: 200 ppm 15 minutes.
TWA: 270 mg/m³ 8 hours.
TWA: 50 ppm 8 hours.
OSHA PEL Z2 (United States, 2/2013).
AMP: 300 ppm 5 minutes.
CEIL: 200 ppm
TWA: 100 ppm 8 hours.

Section 8. Exposure controls/personal protection

Appropriate engineering controls : If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.

Skin protection

Hand protection : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.

Body protection : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection : Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance

Physical state : Liquid. [Watery liquid.]

Color : Colorless.

Molecular weight : 131.38 g/mole

Molecular formula : C2-H-Cl3

Boiling/condensation point : 86.7°C (188.1°F)

Melting/freezing point : -84.8°C (-120.6°F)

Critical temperature : Not available.

Odor : Characteristic.

Odor threshold : Not available.

pH : Not available.

Flash point : Not available.

Burning time : Not applicable.

Burning rate : Not applicable.

Evaporation rate : 6.39 (butyl acetate = 1)

Flammability (solid, gas) : Not available.

Section 9. Physical and chemical properties

Lower and upper explosive (flammable) limits : Lower: 8%
Upper: 10.5%

Vapor pressure : 9.9 kPa (74.256033302 mm Hg) [room temperature]

Vapor density : 4.5 (Air = 1)

Specific Volume (ft ^{3}/lb) : 0.6849

Gas Density (lb/ft ^{3}) : 1.46

Relative density : 1.5

Solubility : Not available.

Solubility in water : 1.1 g/l

Partition coefficient: n-octanol/water : 2.53

Auto-ignition temperature : 410°C (770°F)

Decomposition temperature : Not available.

SADT : Not available.

Viscosity : Dynamic (room temperature): 0.58 mPa·s (0.58 cP)

Section 10. Stability and reactivity

Reactivity : No specific test data related to reactivity available for this product or its ingredients.

Chemical stability : The product is stable.

Possibility of hazardous reactions : Under normal conditions of storage and use, hazardous reactions will not occur.

Conditions to avoid : No specific data.

Incompatible materials : No specific data.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
trichloroethylene	LC50 Inhalation Vapor LD50 Dermal LD50 Oral	Rat Rabbit Rat	140700 mg/m³ >20 g/kg 4920 mg/kg	1 hours - -

IDLH : 1000 ppm

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
trichloroethylene	Eyes - Moderate irritant Skin - Severe irritant	Rabbit Rabbit	- -	24 hours 20 milligrams 24 hours 2 milligrams	- -

Sensitization

Not available.

Section 11. Toxicological information

Mutagenicity

Not available.

Carcinogenicity

Not available.

Classification

Product/ingredient name	OSHA	IARC	NTP
trichloroethylene	-	1	Reasonably anticipated to be a human carcinogen.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : Causes serious eye irritation.

Inhalation : No known significant effects or critical hazards.

Skin contact : Causes skin irritation.

Ingestion : No known significant effects or critical hazards.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:, pain or irritation, watering, redness

Inhalation : No specific data.

Skin contact : Adverse symptoms may include the following:, irritation, redness

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Long term exposure

Potential immediate effects : Not available.

Potential delayed effects : Not available.

Potential chronic health effects

Not available.

General : No known significant effects or critical hazards.

Carcinogenicity : May cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity : Suspected of causing genetic defects.

Section 11. Toxicological information

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Product/ingredient name	Result	Species	Exposure
trichloroethylene	Acute EC50 95000 µg/l Marine water	Algae - Skeletonema costatum	96 hours
	Acute EC50 36.5 mg/l Fresh water	Algae - Chlamydomonas reinhardtii - Exponential growth phase	72 hours
	Acute LC50 20 mg/l Marine water	Crustaceans - Elminius modestus	48 hours
	Acute LC50 18 mg/l Fresh water	Daphnia - Daphnia magna	48 hours
	Acute LC50 3100 µg/l Fresh water	Fish - Jordanella floridae - Juvenile (Fledgling, Hatchling, Weanling)	96 hours
	Chronic EC10 12.3 mg/l Fresh water	Algae - Chlamydomonas reinhardtii - Exponential growth phase	72 hours
	Chronic NOEC 10 mg/l Fresh water	Daphnia - Daphnia magna	21 days

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
trichloroethylene	2.53	17	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Section 13. Disposal considerations

United States - RCRA Toxic hazardous waste "U" List

Ingredient	CAS #	Status	Reference number
Trichloroethylene; Ethene, trichloro-	79-01-6	Listed	U228

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1710	UN1710	UN1710	UN1710	UN1710
UN proper shipping name	TRICHLOROETHYLENE	TRICHLOROETHYLENE	TRICHLOROETHYLENE	TRICHLOROETHYLENE	TRICHLOROETHYLENE
Transport hazard class(es)	6.1 	6.1 	6.1 	6.1 	6.1 
Packing group	III	III	III	III	III
Environment	No.	No.	No.	No.	No.
Additional information	**Reportable quantity** 100 lbs / 45.4 kg [8. 2147 gal / 31.096 L] Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements. **Limited quantity** Yes. **Packaging instruction** **Passenger aircraft** Quantity limitation: 60 L **Cargo aircraft** Quantity limitation: 220 L **Special provisions** IB3, N36, T4, TP1, T1	Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.26-2.36 (Class 6). **Explosive Limit and Limited Quantity Index** 5	-	-	**Passenger and Cargo Aircraft** Quantity limitation: 60 L **Cargo Aircraft Only** Quantity limitation: 220 L **Limited Quantities - Passenger Aircraft** Quantity limitation: 2 L

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : **TSCA 5(a)2 final significant new use rules**: trichloroethylene
TSCA 8(a) CDR Exempt/Partial exemption: Not determined
TSCA 12(b) one-time export: trichloroethylene
United States inventory (TSCA 8b): This material is listed or exempted.
Clean Water Act (CWA) 307: trichloroethylene
Clean Water Act (CWA) 311: trichloroethylene

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Immediate (acute) health hazard
Delayed (chronic) health hazard

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
trichloroethylene	100	No.	No.	No.	Yes.	Yes.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	trichloroethylene	79-01-6	100
Supplier notification	trichloroethylene	79-01-6	100

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts : This material is listed.

New York : This material is listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

California Prop. 65

WARNING: This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

Section 15. Regulatory information

Ingredient name	Cancer	Reproductive	No significant risk level	Maximum acceptable dosage level
trichloroethylene	Yes.	Yes.	14 µg/day (ingestion) 50 µg/day (inhalation)	No.

International regulations

International lists

National inventory

Australia : This material is listed or exempted.
Canada : This material is listed or exempted.
China : This material is listed or exempted.
Europe : This material is listed or exempted.
Japan : This material is listed or exempted.
Malaysia : This material is listed or exempted.
New Zealand : This material is listed or exempted.
Philippines : This material is listed or exempted.
Republic of Korea : This material is listed or exempted.
Taiwan : This material is listed or exempted.

Canada

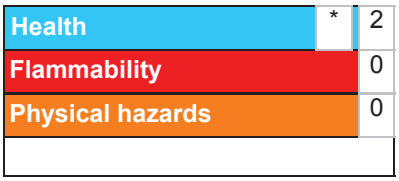
WHMIS (Canada) : Class D-1B: Material causing immediate and serious toxic effects (Toxic).
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

CEPA Toxic substances: This material is listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements : Class D-1B: Material causing immediate and serious toxic effects (Toxic).
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

Hazardous Material Information System (U.S.A.)



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

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

Section 16. Other information

Reprinted with permission from NFPA 704-2001, Identification of the Hazards of Materials for Emergency Response Copyright ©1997, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

Procedure used to derive the classification

Classification	Justification
Skin Irrit. 2, H315	Expert judgment
Eye Irrit. 2A, H319	Expert judgment
Muta. 2, H341	Expert judgment
Carc. 1, H350	Expert judgment
Aquatic Chronic 3, H412	Expert judgment

History

Date of printing : 11/21/2016

Date of issue/Date of revision : 11/21/2016

Date of previous issue : No previous validation

Version : 0.01

Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

References : Not available.

Indicates information that has changed from previously issued version.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

HORSEHEAD CORPORATION
Leading the World in Zinc Recycling

MSDS FOR ZINC METAL: SPECIAL HIGH GRADE, HIGH GRADE ZC-M002

SECTION I - GENERAL INFORMATION

NAME: ZINC METAL

MANUFACTURER:
HORSEHEAD CORPORATION
300 Frankfort Road
Monaca, PA 15061
724-774-1020

TRANSPORTATION EMERGENCY:
CHEMTREC: 800-424-9300

TRADE NAME AND SYNONYMS: Special high grade or high grade zinc

CHEMICAL FAMILY: Nonferrous Heavy Metal

CAS NO.: 7440-66-6

FORMULA: Zn

DOT HAZARD CLASS: Not listed **UN NO.:** NAIF* **NA NO.:** NAIF*

ISSUE DATE: 2/25/88

REVISION DATE: 4/6/05

* NAIF - No applicable information found.

SECTION II - INGREDIENTS

MATERIAL	CAS NO.	%
ZINC	7440-66-6	99.9

SECTION III PHYSICAL DATA

BOILING POINT (760 MM HG): 1665° F

MELTING POINT: 788° F

SPECIFIC GRAVITY: 7.12

EVAPORATION RATE (=1): N/A

VAPOR DENSITY (air = 1): N/A

SOLUBILITY IN WATER: Negligible

PERCENT VOLATILE BY VOLUME (%): N/A

VAPOR PRESSURE AT 909° F: 0.13kPa

APPEARANCE AND ODOR: Silver-white, or Bluish-white metal

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Zinc does not introduce a serious fire hazard in sheets, castings, or other massive forms because of the difficulty of ignition, although once ignited (above 1665° F), large pieces burn vigorously.

FLASH POINT (METHOD USED): N/A

NFPA FIRE RATING

FLAMMABLE LIMITS: LEL: N/A
UEL: N/A

HEALTH	0
FLAMMABILITY	0
REACTIVITY	0

EXTINGUISHING MEDIA: Smother and cool with a suitable dry extinguishing agent (class D fires) such as dry powder (Ansul Met-L-X), zinc oxide or dry sand. Water should not be used; however wherever it is necessary to cool exposures, extreme caution should be taken to prevent contact with molten zinc or burning zinc products.

SPECIAL FIRE FIGHTING PROCEDURES: Use NIOSH/MSHA approved self-contained breathing apparatus.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Heating of metal beyond boiling point results in evolution of zinc vapors, which immediately reacts with air to form zinc oxide fume. Slabs must be completely dry before charging into molten metal to prevent a steam explosion.

SECTION V - HEALTH HAZARD DATA

MATERIAL	FORM	OSHA-PEL	ACGIH-TLV	
		TWA mg/m^3	TWA mg/m^3	STEL mg/m^3
ZINC	Oxide Fume	5	2	10

ROUTES OF ENTRY

PRIMARY: Inhalation, if material has been heated above the boiling point, driving off zinc fume.

SECONDARY: Ingestion of dusts.

EFFECTS OF SHORT TERM OVEREXPOSURE:

ZINC: Inhalation of high levels of zinc vapor (zinc oxide fumes) may result in tightness of chest, metallic taste, cough, dizziness, fever, chills, headache, nausea, and dry throat. Overexposure may produce symptoms known as metal fume fever or "zinc shakes"; an acute, self-limiting condition without recognized complications. Symptoms of metal fume fever include: chills, fever, muscular pain, nausea and vomiting.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Inhalation of dust may be an irritant to pre-existing respiratory conditions.

EMERGENCY AND FIRST AID PROCEDURES: Symptoms resulting from inhalation overexposure usually disappear within 24 hours. Symptomatic treatment, such as bed rest and possibly aspirin is recommended to provide relief from fever and chills. In all cases, consult physician for medical attention.

EFFECTS OF LONG TERM OVEREXPOSURE:

ZINC: Chronic exposure to zinc may cause respiratory tract irritation with nasopharyngitis and laryngitis.

CARCINOGENIC ASSESSMENT:

NTP? No **IARC MONOGRAPH?** No **OSHA?** No

SECTION VI - REACTIVITY DATA

STABILITY: ( ) Unstable
(X) Stable

CONDITIONS TO AVOID: None

INCOMPATIBILITY (MATERIALS TO AVOID): Avoid contact with acids and alkalis.

HAZARDOUS DECOMPOSITION PRODUCTS: Zinc boils off as vapor at elevated temperatures.

HAZARDOUS POLYMERIZATION: ( ) May occur
(X) Will not occur

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Material should be contained for recycling.

WASTE DISPOSAL METHOD: Material may be recycled or disposed of in accordance with Federal, State, and Local Environmental Regulations. This material may be regulated under CERCLA, TSCA, SARA, and/or RCRA Regulations.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (SPECIFY TYPE): Use NIOSH/MSHA approved type respirator for protection against dust and metal fume.

VENTILATION: Local exhaust or other ventilation that will reduce dust concentrations to less than permissible exposure limits.

PROTECTIVE GLOVES: Recommended to prevent skin irritation in hypersensitive individuals.

EYE PROTECTION: Use safety eyewear for protection against airborne particulate matter.

OTHER PROTECTIVE EQUIPMENT: To prevent burns from contact with molten metal, appropriate protective garments should be worn. Such garments may include aprons, face shields, leggings, etc., depending on conditions of use.

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: Store in a dry location, separate from acids and alkalis. Keep metal dry so it does not contain any moisture when ready for use.

OTHER PRECAUTIONS: Damp slabs placed in molten metal may result in a steam explosion. Always practice good personal hygiene when working in areas where this material exists.

DISCLAIMER: As the conditions or methods of use are beyond our control, we do not assume any responsibility and expressly disclaim any liability for any use of the material. Information contained herein is believed to be true and accurate but all statements or suggestions are made without any warranty, express or implied, regarding accuracy of the information, the hazards connected with the use of the material or the results to be obtained from the use thereof.

J:\Msds MSWord\METAL\ZCM002.doc

Appendix C Quality Assurance Project Plan

APPENDIX C: QUALITY ASSURANCE PROJECT PLAN

This Quality Assurance Project Plan (QAPP) presents the objectives, functional activities, methods, and QA/QC requirements associated with sample collection and laboratory analysis for characterization activities at the 1731 West Farms Road property. The QAPP follows requirements detailed in New York State Department of Environmental Conservation (NYSDEC) DER-10, Section 2.

2.0 PROJECT ORGANIZATION

The investigative efforts defined in this RAWP will be implemented by MECC on behalf of 1731 West Farms Road LLC. The following identifies the responsibilities of various organizations supporting the RAWP:

- The NYSDEC Project Manager will be responsible for reviewing and approving this RAWP and QAPP, coordinating approval of requested modifications, and providing guidance on regulatory requirements.
- The MECC Program Manager (Frank Galdun) will provide technical expertise for review of the project plans, reports and ongoing field activities.
- The MECC Quality Assurance Manager (Maryann Wegh) will confirm the quality of work associated with the project is in accordance with all project plans.
- MECC Project Manager (Karen Tyll) will be responsible for project engineering support and for the planning and implementation of remedial activities. The Project Manager is responsible for ensuring that the requirements of this RAWP are implemented.
- MECC Field Team Leader (Frank Galdun or designee) will be responsible for sample collection, oversight of subcontractor personnel, and coordination of daily field activities.
- A NYSDOH Environmental Laboratory Accreditation Program (ELAP) certified laboratory (Hampton Clarke-Veritech) will be contracted to perform required analyses and reporting, including Analytical Services Protocol (ASP) Category B Deliverables, which will allow for data validation.
- An independent third-party data validator will be contracted to perform data validation and prepare a Data Usability Summary Report (DUSR) in accordance with Section 3.7.
- Subcontractors will perform surveying, drilling, and/or sampling at the direction of the Field Team Leader in accordance with this work plan.

Qualifications for the project team are included in the RAWP.

3.0 LABORATORY ANALYSIS

Requirements for sample analysis are described below. All samples will be submitted to a NYSDOH ELAP certified laboratory) for analysis. Analytical methods, preservation, container requirements, and holding times are summarized below:

ANALYTICAL **METHODS** (SOIL)

Analyte/ Analyte Group	**Matrix**	**Method/ SOP**	**Container(s)** (number, **size** & **type** per sample)	**Preservation**	**Preparation Holding** Time	**Analytical Holding Time**	**Estimated Number of Samples to be Collected**
TAL Metals	Soil	EPA 6010C	1 x 2 oz, glass	Metals ex	6 months	6 months	12 to 24
TCL VOCs	Soil	EPA 8260C	3 x 40 ml VOA, glass vial	1 x Methanol 2 x DI H2O Cool < 6 ^{oC}	48 hours	14 Days	12 to 24
TCL SVOCs	Soil	EPA 8270D	1 x 8 oz, glass	Cool < 6 ^{o}C	14 days	40 days	12 to 24
PCBs	Soil	EPA 8082A	1 x 8 oz, glass	Cool < 6 ^{o}C	14 days	40 Days	12 to 24
Cyanide	Soil	EPA 9010C/9012B	1 x 250 ml, plastic	Cool < 6 ^{o}C	14 days	14 days	12 to 24
Pesticides	Soil	EPA 8081B	1 x 8 oz, glass	Cool < 6 ^{o}C	14 days	40 days	12 to 24
*SIM Mode only necessary if EPA 8260 analysis cannot meet a MDL of 0.1 mg/kg							

ANALYTICAL **METHODS (GROUNDWATER)**

Analyte/ Analyte Group	**Matrix**	**Method/ SOP**	**Container(s)** (number, **size** & **type** per sample)	**Preservation**	**Preparation Holding** Time	**Analytical Holding Time**	**Estimated Number of Samples to be Collected**
VOCs	Water	EPA 8260C	3 x 40 ml VOA, glass vial	HCl Cool < 6 ^{oC}	48 hours	14 Days	2 on a biannual basis

3.1 Soil Samples

Soil samples will be collected as described in the RAWP. Analysis will conform to NYSDEC Analytical Services Protocol (ASP) Category B data deliverables in accordance with NYSDEC DER-10, Appendix 2B, 1.0 (b), including calibration standards, surrogate recoveries, and chromatograms.

3.2 Groundwater Samples

Groundwater samples will be collected as described in the RAWP. Analysis will conform to NYSDEC Analytical Services Protocol (ASP) Category B data deliverables in accordance with NYSDEC DER-10, Appendix 2B, 1.0 (b), including calibration standards, surrogate recoveries, and chromatograms.

3.3 Field/Laboratory Data Control Requirements

Quality Control (QC) procedures will be followed in the field and at the laboratory to facilitate that reliable data are obtained. When performing field sampling, care shall be taken to prevent the cross-contamination of sampling equipment, sample bottles, and other equipment that could compromise sample integrity. QC samples will include the following:

- Blind Duplicates ─ one per 20 environmental samples for each matrix sampled.
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) - one per 20 environmental samples for each matrix sampled.
- Equipment Blank ─ one per day for each matrix sampled.

- Field Blank – one per day when PFAS samples are collected.
- Trip Blank – one per day.

QA/QC Sample analysis will conform to NYSDEC ASP Category B data deliverables in accordance with NYSDEC DER-10, Appendix 2B, 1.0 (b), including calibration standards, surrogate recoveries, and chromatograms.

3.4 Special Sampling Considerations for PFAS Sampling

In the event that PFAS samples are collected, special consideration must be made to avoid cross contamination. There are several potential sources of PFAS that could contribute to the cross-contamination of environmental samples collected during the RI. Weatherproof clothing, pens, logbooks, cosmetics, personal hygiene products, insect repellents, and sampling equipment could contain PFAS that could lead to false positive sampling results.

To ensure that the analytical results obtained are representative of the actual site conditions several measures should be taken:

- Collection of appropriate field QA/QC samples (blanks, duplicates, equipment rinsate samples, etc.) as detailed in Section 5.3.
- Analysis by the analytical laboratory using established laboratory QA/QC procedures and methods as detailed in Section 5.3.
- During decon, non-dedicated equipment to be used for PFAS sampling will be rinsed with PFAS free water supplied by the laboratory. Equipment will be allowed to fully air dry before use.
- New high-density polyethylene (HDPE) tubing shall be used at each sample location.
- Groundwater samples will be collected in laboratory supplied HDPE containers.
- New nitrile gloves shall be worn between each sample interval.
- Only clean cotton or synthetic clothes shall be worn – preferably washed more than six times, and without the use of fabric softeners. No waterproof or insecticide treated clothing, boots or rain jackets made or treated with Teflon products shall be used at the collection site. This includes all Gore-Tex® and Tyvek® products.
- Do not apply moisturizers or hand creams to hands or face on the day of sampling. No sunblock or insect repellants. Do not bring packaged food to the work site or use aluminum foil.
- Field notes shall be taken using a computer tablet or by using ink pens on non-water proof plain paper attached to a metal clipboard. Do not use Sharpies or markers. Transcribe field notes to Chain-of-Custody forms and official field books when back in the office after the collection process.
- For groundwater samples use only laboratory supplied 250 ml polypropylene sample bottles. Sample bottles should be pre-preserved by the laboratory, if dictated by the analysis method.
- Print labels before going into the field and apply to the sample containers.
- Use only laboratory supplied PFAS-free water for trip, field and equipment blanks.
- Place each sample container in a separate polypropylene zip-lock bag.
- For the shipping coolers, use only regular crushed ice packaged in polypropylene zip-lock plastic bags.

- Use only laboratory supplied shipping coolers that were used to ship sample containers for this project. Tape the cooler shut before shipping samples to the laboratory.

3.5 Sample Identification

Each sample will be identified with a set of information relating individual sample characteristics. Required information consists of Sample Designation, Depth, Date, Time, and Matrix.

Sample frequency, locations, depths, and nomenclature may change subject to field decisions and professional judgment.

3.6 Chain-of-Custody, Sample Packaging and Shipment

Each day that samples are collected, a chain-of-custody/request for analysis form will be completed and submitted to the laboratory with samples to be analyzed. A copy of the chain-of-custody will be retained by the Project Manager. The chain-of-custody will include the project name, sampler's signature, sample IDs, date and time of sample collection, and analysis requested.

Samples will be packaged and shipped in a manner that maintains sample preservation requirements during transport (i.e., ice to keep samples cool until receipt at the laboratory), ensures that sample holding times can be achieved by the laboratory, and prevents samples from being tampered with.

If a commercial carrier ships samples, a bill of lading (waybill) will be used as documentation of sample custody. Receipts for bills of lading and other documentation of shipment shall be maintained as part of the permanent custody documentation. Commercial carriers are not required to sign the chain-of-custody as long as it is enclosed in the shipping container and evidence tape (custody seal) remains in place on the shipping container.

3.7 Data Usability and Validation

The main purpose of the data is for use in defining the extent of contamination at the site, to aid in evaluation of potential human health and ecological exposure assessments, and to support remedial action decisions. Based upon this, data usability and validation will be performed as described below. Complete data packages will be archived in the project files, and if deemed necessary additional validation can be performed using procedures in the following sections.

3.7.1 Data Usability and Validation Requirements

Data usability and validation are performed on analytical data sets, primarily to confirm that sampling and chain-of-custody documentation are complete, sample IDs can be tied to specific sampling locations, samples were analyzed within the required holding times, and analyses are reported in conformance with NYSDEC ASP, Category B data deliverable requirements as applicable to the method utilized.

3.7.2 Data Usability and Validation Methods

A designee of the Project Manager will complete a data usability evaluation for the data collected during the RI and a data usability summary report (DUSR) will be prepared. The DUSR will be prepared in accordance with NYSDEC DER-10, Appendix 2B.

Independent third-party data validation will be performed on 5% of the sample data, or on one sample from each sample delivery group (SDG), whichever is greater. Data validation will be performed by a qualified subcontractor independent of the project.

4.0 FIELD EQUIPMENT CALIBRATION

Equipment will be inspected and approved by the Field Team Leader before being used. Equipment will be calibrated to factory specifications, if required. Monitoring equipment will be calibrated following manufacturers recommended schedules. Daily field response checks and calibrations will be performed as necessary (i.e. PID calibrations) following manufacturers standard operating procedures. Equipment calibrations will be documented in a designated field logbook.

5.0 EQUIPMENT DECONTAMINATION

In order to minimize the potential for cross-contamination, non-dedicated drilling and sampling equipment shall be properly decontaminated prior to and between sampling/drilling locations.

5.1 General Procedures

Drilling equipment will be decontaminated in a designated area. Sampling equipment and probes will be decontaminated in an area covered with plastic sheeting near the sampling location. Waste material generated during decontamination activities will be containerized, stored and disposed of in accordance with the procedures detailed in Section 5.9. Decontamination of sampling equipment shall be kept to a minimum, and wherever possible, dedicated sampling equipment shall be used. Personnel directly involved in equipment decontamination shall wear appropriate personal protective equipment (PPE).

5.2 Drilling Equipment

Drilling equipment shall be decontaminated prior to performance of the first boring/excavation and between all subsequent borings/excavations. This shall include hand tools, casing, augers, drill rods, temporary well material and other related tools and equipment. Water used during drilling and/or steam cleaning operations shall be from a potable source.

5.3 Sampling Equipment

Sampling equipment (i.e., trowels, knives, split-spoons, bowls, hand augers, etc...) will be decontaminated prior to each use as follows:

- Laboratory-grade glassware detergent and tap water scrub to remove visual contamination
- Generous tap water rinse
- Distilled water rinse

5.4 Meters and Probes

All meters and probes that are used in the field (other than those used solely for air monitoring purposes, e.g., PID meters) will be decontaminated between uses as follows:

- Laboratory-grade detergent and tap water solution wash
- Tap water rinse
- Distilled water rinse (triple rinse)

6.0 FIELD DOCUMENTATION

Documentation will take place on either appropriate forms or in a dedicated site logbook. Permanent black or blue ink will be used to record information in the logbook. Errors in field documentation will be lined through, initialed, dated, and corrected. Forms will be kept by the Field Team Leader during the field activities. Field activities will be documented in the field logbook. The logbook will contain waterproof pages that are consecutively numbered and be permanently bound with a hard cover. Upon completion of daily activities, unused portions of pages will be lined-through and initialed.

The primary purpose of the field logbook is to document the daily field activities and to provide descriptions of each activity. All entries in the field logbook will be recorded and dated by person making the entry.

Appendix D Community Air Monitoring Plan

APPENDIX D

Community Air Monitoring Plan, 1731 West Farms Road, Bronx, New York

Real-time air monitoring for volatile organic compounds (VOCs) and particulate levels at the perimeter of the exclusion zone or work area will be performed. Continuous monitoring will be performed for all ground intrusive activities and during the handling of contaminated or potentially contaminated media. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pit excavation or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be performed 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, for instance, will consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well bailing/purging, and taking a reading prior to leaving a sample location. Depending upon the proximity of potentially exposed individuals, continuous monitoring may be performed 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. Exceedances of action levels observed during performance of the Community Air Monitoring Plan (CAMP) will be reported to the NYSDEC Project Manager and included in the Daily Report.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) will be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis during invasive work. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work will be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment will be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment will be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- 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 will be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities will resume with continued monitoring.
- 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 will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the total organic vapor level 200 feet downwind of the 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.
- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities will be shutdown.

All 15-minute readings must be recorded and be available for NYSDEC personnel to review. Instantaneous readings, if any, used for decision purposes will also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations will be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment will 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.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work will continue with dust suppression techniques provided that downwind PM-10

particulate levels do not exceed 150 mcg/m3 above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m3 above the upwind level, work will be stopped and a re-evaluation of activities initiated. Work will resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m3 of the upwind level and in preventing visible dust migration.

Appendix E Citizen Participation Plan

APPENDIX E

CITIZEN PARTICIPATION PLAN

The New York State Department of Environmental Conservation (NYSDEC) and 1731 West Farms Road LLC have established this Citizen Participation Plan because the opportunity for citizen participation is an important component of the NYS Brownfield Cleanup Program. This Citizen Participation Plan describes how information about the project will be disseminated to the Community during the remedial process. As part of its obligations under the NYS BCP, 1731 West Farms Road LLC will maintain a repository for project documents and provide public notice at specified times throughout the remedial program. This Plan also takes into account potential environmental justice concerns in the community that surrounds the project Site. Under this Citizen Participation Plan, project documents and work plans are made available to the public in a timely manner. Public comment on work plans is strongly encouraged during public comment periods. Work plans are not approved by the NYSDEC until public comment periods have expired and all comments are formally reviewed. An explanation of cleanup plans in the form of a public meeting or informational session is available upon request to NYSDEC's project manager assigned to this Site, TBD, who can be contacted about these issues or any others questions, comments or concerns that arise during the remedial process at PHONE NUMBER.

Project Contact List: NYSDEC has established a Site Contact List for this project to provide public notices in the form of fact sheets to interested members of the Community. Communications will include updates on important information relating to the progress of the cleanup program at the Site as well as to request public comments on the cleanup plan. The Project Contact List includes owners and occupants of adjacent buildings and homes, principal administrators of nearby schools, hospitals and day care centers, the public water supplier that serves the area, established document repositories, the representative Community Board, City Council members, other elected representatives and any local Brownfield Opportunity Area (BOA) grantee organizations. Any member of the public or organization will be added to the Site Contact List on request. A copy of the Site Contact List is maintained by NYSDEC's project

manager. If you would like to be added to the Project Contact List, contact NYSDEC at PHONE NUMBER or by email at EMAIL ADDRESS.

Repositories: A document repository is maintained online. Internet access to view OER's document repositories is available at public libraries. This document repository is intended to house, for community review, all principal documents generated during the cleanup program including Remedial Investigation plans and reports, Remedial Action work plans and reports, and all public notices and fact sheets produced during the lifetime of the remedial project. The libraries nearest to the Site are:

West Farms Library
2085 Honeywell avenue, Bronx, NY 10460
(718) 367-5376
Hours of Operation:
Monday 10 am to 7 pm
Tuesday 10 am to 7 pm
Wednesday 10 am to 7 pm
Thursday 10 am to 7 pm
Friday 10 am to 5 pm
Saturday 10 am to 5 pm

Morrisania Library
610 East 169th Street, Bronx, NY 10456
(718) 589-9268
Hours of Operation:
Monday 10 am to 7 pm
Tuesday 10 am to 7 pm
Wednesday 10 am to 7 pm
Thursday 10 am to 7 pm
Friday 10 am to 5 pm
Saturday 10 am to 5 pm

Digital Documentation: NYSDEC requires the use of digital documents in our repository as a means of minimizing paper use while also increasing convenience in access and ease of use.

Issues of Public Concern: The issues of concern to the public will be the potential impacts of nuisance odors and dust during disturbance of historic fill material at the Site. This work will be performed in accordance with procedures that will specified under a detailed remedial program, which identifies issues of concern and implements preventive measures for exposure to workers at the Site, occupants at adjoining properties and pedestrians during construction. Detailed plans to monitor potential the potential for exposure including a Construction Health and Safety Plan

and a Community Air Monitoring Plan are required components of the remedial program. Implementation of these plans will be overseen by the NYSDEC.

The aforementioned plans will specify the following worker and community health and safety activities during remedial activity at the Site:

- On-Site air monitoring for worker protection
- Perimeter air sampling for community protection

The Health and Safety Plan and Community Air Monitoring Plan prepared as part of the Remedial Action Work Plan will be available for public review at the document repository.

Public Notice and Public Comment: Public notice to all members of the Project Contact List is required at three major steps during the performance of the cleanup program (listed below) and at other points that may be required by NYSDEC. Notices will include Fact Sheets with descriptive project summaries, updates on recent and upcoming project activities, repository information, and important phone and email contact information. All notices will be reviewed and approved by NYSDEC prior to distribution and mailed by the Enrollee. Public comment is solicited in public notices for all work plans developed under the NYS Brownfield Cleanup Program. Final review of all work plans by NYSDEC will consider all public comments. Approval will not be granted until the public comment period has been completed.

Citizen Participation Milestones: Public notice and public comment activities occur at several steps during a typical NYS BCP project. These steps include:

- **Public Notice of the availability of the Remedial Investigation Report and Remedial Action Work Plan and a 30-day public comment period on the Remedial Action Work Plan:** Public notice in the form of a Fact Sheet is sent to all parties listed on the Site Contact List announcing the availability of the Remedial Investigation Report and Remedial Action Work Plan and the initiation of a 30-day public comment period on the Remedial Action Work Plan. The Fact Sheet summarizes the findings of the RIR and provides details of the RAWP. The public comment period will be extended an

additional 15 days upon public request. A public meeting or informational session will be conducted by OER upon request.

- **Public Notice announcing the approval of the RAWP and the start of remediation:** Public notice in the form of a Fact Sheet is sent to all parties listed on the Site Contact List announcing the approval of the RAWP and the start of remediation.
- **Public Notice announcing the completion of remediation, designation of Institutional and Engineering Controls and issuance of the Notice of Completion:** Public notice in the form of a Fact Sheet is sent to all parties listed on the Site Contact List announcing the completion of remediation, providing a list of all Institutional and Engineering Controls implemented for to the Site and announcing the issuance of the Notice of Completion.

Appendix F Resumes of Key Personnel

Karen G. Tyll, P.E.

President

Fields of Competence

Ms. Tyll applies her knowledge of civil and environmental engineering related to water supply, stormwater management, site design, compliance, permitting, and remediation projects. Ms. Tyll's background is an interesting mix of design, site grading, drainage and utility design, environmental investigations, forensic engineering, and permitting/ regulatory compliance.

Experience Summary

Twenty two years of experience: President with Tyll Engineering and Consulting PC, Senior Engineer with J.R. Holzmacher, PE LLC, Senior Engineer with Roux Associates, Inc./Remedial Engineering, P.C.; Senior and Project Engineer at P.W. Grosser Consulting; Project Engineer at Vollmuth & Brush; Project Engineer at Anderson & Associates.

Credentials

B.S.C.E., Civil Engineering with Environmental Option, Virginia Tech
Professional Engineer: New York (079520), North Carolina (044315), Florida (81892)
OSHA Health & Safety 40 Hour Training
NYC OER Turbo Training Gold/Bronze Certification

Professional Affiliations

American Society of Civil Engineers
National Society of Professional Engineers
Society of Women Engineers, Section Treasurer 1999-2002
Society of Women Engineers, Section President, 2002-2005
Engineers Joint Committee of Long Island, Rube Goldberg Chair

Key Projects

Remediation:

- Providing professional engineering services to assist other environmental consulting firms' clients and directly to land owners to fulfill needs for PE involvement with NYSDEC, NYCOER, and NYCDEP driven projects.
- Completed outdoor, ambient, and sub-slab air sampling for office building with passive SSDS in Melville, NY. Completed design to turn passive system to active system, completed necessary reports, and supported consent order issues.
- Project Manager to complete investigation and remediation at historic aircraft part facility in New Jersey. Oversaw staff that completed multiple, large sampling events, test pits, and reporting to the NJDEP.
- Project Manager on multiple remediation sites requiring investigations, tank removals, remedial action activities, compliance reporting, and monitoring.

Stormwater Experience:

- Senior Engineer to design stormwater collection structures during design upgrades to 10 acres of an existing storm drain system at a former fuel terminal in Buffalo, New York. Responsible for laying out system, selecting sizes based upon angles and minimum distances between pipes.
- Senior Engineer to design an alternative Part 360 cap for an industrial landfill near Albany, New York. The cap incorporated lined swales and ponds, trees planted for phytoremediation purposes. An education center was also designed for the Site and was responsible for designing a cistern system that would capture both rainwater and treated effluent from a groundwater treatment system.
- Project Engineer to complete a computer hydraulic model and evaluation of a stormwater collection system at a national laboratory facility in Upton, NY. The storm drain study included multiple modeling and design scenarios to evaluate flood reduction. Potential solutions included the installation of additional dry wells and the removal of paved parking areas to increase infiltration.
- Senior Engineer to design a second overflow weir which would help to regulate the height of water in a stormwater wetland, to provide an additional outfall to prevent flooding, and to revegetate a wetlands area in the receiving creek. This project involved the evaluation of the 12 square mile watershed area that contributed to the stormwater wetland, the design of the weir structure, apron, and spillway to route the water between two bridge abutments, and the analysis to determine the height of water over each of the weirs during various storm events.
- Senior Engineer to complete multiple smaller investigations regarding stormwater management at residential, commercial, and industrial facilities.

- Senior Engineer to complete multiple Stormwater Pollution Prevention Plans (SWPPP) and their required inspections. Completed multiple State Pollution Discharge Elimination System (SPDES) permit packages for new systems and modifications.

Forensic Engineering/Expert Witness:

- Engineer to complete over two hundred post-storm forensic investigations from 2011 to the present to assist insurance companies in assigning coverage to Insureds. Responsible for determining cause and origin of damage and wind vs. water determinations in flooding situations.
- Engineer to complete multiple residential and commercial forensic investigations not related to storms. Claim matters included stormwater drainage from off-site sources causing flooding, wood floor damage, pipe breaks, and pool failure (both gunite and vinyl lined).
- Have been involved with multiple cases as expert witness where the subject of the claims are SuperStorm Sandy, environmental contamination, or personal injury related.

Permitting/Compliance:

- Project Manager for providing engineering and environmental services to four machining facilities that specialize in the manufacturing of parts for aircraft. Responsible for completing Suffolk County Department of Health Services toxic and hazardous waste storage permits, assisting with RCRA Hazardous Material storage issues and reporting, preparing and participating in SCDHS variance hearing, strategizing with client to come up with best solutions for the facility permits, completing Emergency Action Plan and SPCC Plan, assisting in with follow up tasks from in house third party audits, and assisting facility environmental personnel with day-to-day issues.
- Interim Environmental Health and Safety (EHS) Officer for large laboratory/R&D facility undergoing large construction project. Acted as EHS Officer by being onsite two days a week and being available by phone and email, when not on-site. Was responsible for maintaining compliance with local, state and federal compliance and reporting requirements, reviewing chemicals, attending construction meetings, completing Stormwater Pollution Prevention Plan (SWPPP) inspections, completing a State Pollution Discharge Elimination System (SPDES) modification, participating in an ISO 14001 audit, interfaced with laboratory and facility personnel to complete internal projects, completed bi-weekly construction safety inspections, and provided facility with strategy regarding compliance needs for both long term and short term.
- Senior Engineer to complete the facility's air facility registration form and accompanying data for their Hauppauge, NY location. Responsibilities included completing a site visit, preparing a spreadsheet to compute the facility emissions, preparing a site plan of the facility including the emissions points, interfacing with the client, facility contact, and regulator.
- Senior Engineer to complete state facility permit modification for bulk fuel supplier in Westchester, NY. Responsibilities included devising methodology for determining VOC emissions previously used in permit due to former gasoline operations, preparing complex spreadsheet for multiple alternatives, reviewing the current permit to verify that all current conditions are beneficial to the Client, provided professional engineering requirements for the submittal, coordinating with NYSDEC case manager and prepare responses to comments from NYSDEC.
- Environmental Compliance Audit team member for numerous healthcare facilities in New York. Coordinated with the facilities' environmental staff to develop audit scope of work and reporting format. Assessed facilities' compliance with federal, state and local regulations including CAA, CWA, EPCRA, RCRA, SARA Title III, and TSCA. A specialized software tool, Dakota Auditor, was utilized to help complete the audits and to stay abreast of the changing regulations.
- Project Manager for the completion of the Emergency Planning and Community Right-to-Know Act's (EPCRA) Toxic Release Inventory (TRI) reporting for nine, airport-based, aviation-fueling facilities as required by the USEPA for the reporting years 1998 - 2001. The project included the identification and quantification of chemical and petroleum usage at each facility, a review of the facility's MSDS sheets, and the determination of the threshold levels of each of the EPCRA Section 313-listed chemicals found in the fuel. Tank and fugitive emissions were calculated using the tank and fueling system information supplied by the client. Stormwater discharge quantities were calculated and

reported using analytical data. The resulting information was compiled, and the necessary forms were completed.

- Project Engineer to complete a Facility Response Plan (FRP) to be submitted and approved by the USEPA for an aviation fueling facility in San Juan, Puerto Rico. The FRP preparation included a site visit to collect site data, review of the applicable regulations, and preparation of site, evacuation, and drainage drawings.
- Senior Engineer to complete the joint permit application and associated documents for a maintenance dredging project in a small incorporated village on the north fork of Long Island. Tasks included digitally determining dredging volumes, preparing sediment sampling plan, preparing site drawings, preparation of application and associated documents, and coordination with agencies, Owners, and contractors.

Project Management

- Project Manager for a comprehensive audit program for an airport services company with locations in the United States and Canada. The audits covered environmental, health and safety aspects of the operations (fueling, maintenance, food services). Responsibilities included interfacing with the client and attorneys, devising an audit report template, coordinating team deployments, review audit findings and audit reports, and supported follow up work to resolve findings.
- Senior Engineer to oversee installation of a sub-slab depressurization system on a former manufacturing facility in Hicksville, New York. Responsible for overseeing the survey completed before the initial indoor, outdoor and sub-slab testing.
- Project Manager for a multi-faceted project including the preparation of design drawings and specifications for a proposed soil vapor extraction (SVE) system, providing an overall engineering review of the asbestos abatement, health and safety plans, and continued sampling activities, and the completion of the many NYSDEC required letters and reports regarding the project. The treatment system was designed to remove BTEX and dry cleaning fluids from the soil to the stringent standards required by the NYSDEC. The SVE system included a multi-zone system with two explosion proof regenerative blowers along with the system piping embedded in a one-foot gravel bed.
- Project Manager for the design and construction management of a new filtration system for the jet fuel to be stored at the bulk fuel storage facility at a NYC airport. The project included preparation of detailed design drawings and specifications, which included piping schematics, system layout plans, concrete design, and system details in accordance with NYC building code and the Port Authority of New York and New Jersey's requirements.

Design Experience:

- Senior Engineer responsible for the design of retention pond to be constructed inside former industrial lagoons to store stormwater from the former industrial facility near Albany, New York. The project included the optimization of the design (varying shape, slopes, and depths) to provide the necessary volume of storage for a 25 year 24 hour storm, overseeing the preparation of the specifications, coordinating with the landscape architects, and completing volume calculations to determine the different quantities of soil needed for the bid documents.
- Senior Engineer for the design of stormwater and sanitary sewers at and around a former fuel terminal in Brooklyn, New York. Responsible for laying out the existing utilities confirming their locations using over a hundred paper maps and laying out the proposed piping as per New York City Department of Environmental Protection
- Project Engineer for the site design of three "streetscape" road improvement projects for the City of Yonkers Planning Department. The designs included utilities, plantings, and parking and incorporated both local historical features along with the Americans with Disabilities Act (ADA) compliant components.
- Project Engineer responsible for completing the site and utility design for the first phase of athletic fields, the associated parking lots, and access road for a private school being built on the East End of Long Island. The project included the coordination with the architects, contractors, the owner's representatives, and local governmental agencies. Responsibilities also included the design and planning of the associated traffic controls, water supply, drainage, and sanitary systems.

Frank Galdun
Project Geologist

EDUCATION

1987, MS, Environmental Science, Adelphi University
1985, BS, Geology, SUNY, Buffalo

PROFESSIONAL REGISTRATIONS

1995, Registered Geologist, Tennessee

PROFESSIONAL SUMMARY

- Project Manager on various soil and ground water quality investigations for clients such as Toys 'R' Us, TCW Realty Advisers, Metropolitan Life Insurance Co., RREEF, and LaSalle Partners. These investigations included evaluation of soil and ground water quality relating to potential impact on property acquisitions and development. In addition, several studies were performed within known contaminated areas in order to meet regulatory agency requirements. Projects of this type included negotiations with local and state agencies on the necessity or required extent of any clean-up tasks. The subsurface investigations were performed in a variety of geologic conditions with several types of drilling methods (Hollow Stem Auger, Mud Rotary, Air Rotary, Geoprobe).

- Project manager for large national clients. Mr. Galdun provided direction to local offices, conducted quality control/quality assurance tasks on all reports issued to the client, and advised the client on potential financial impact associated with properties that were found to contain contamination prior to acquisition. Mr. Galdun also has served as a client coordinator for property developers on a national basis, and has assisted clients during numerous contaminated property redevelopment projects across the country.

- Directly designed and implemented soil and groundwater remediation projects. Specifically, these projects consisted of reagent injection at dry cleaning operations.

- Prepared and submitted site management plans to New York State Department of Environmental Conservation for properties entered into the Voluntary Cleanup Program.

- Directly responded to numerous hazardous material and petroleum product spills and directly supervised cleanups and remediation activities. All of these projects included regulatory agency reporting and regulatory agency negotiation in connection with site-specific cleanup goals.

- Conducted on-site soil quality monitoring and consulting at large construction project in New York City. These tasks included a daily presence to assess soil quality as excavations progressed, responding to conditions as they were uncovered (i.e., discovery of underground storage tanks, areas of varying contaminant types), regulatory agency reporting, soil disposal tracking.

- Directly conducted annual environmental audits for a national client on all of their properties located on the East Coast. These audits serve to assess tenant activities in order to determine if they complied with federal, state, and local regulations pertaining to the storage, use and disposal of hazardous materials. The types of tenant operations included in the audit process are printers, metal platers, weapons systems manufacturers and other military contractors, electronic printed circuit board fabricators, biomedical production laboratories, dry cleaners and various other commercial and industrial activities.

- Directly supervised over 70 underground storage tank removals in New York, New Jersey, Pennsylvania, Virginia and Maryland. Assisted clients in developing regional underground storage tank management programs. Mr. Galdun has also acted as project manager and technical director on approximately 100 additional underground storage tank removal projects. Project management services include regulatory agency negotiations, supervision of employees, development of specifications, soil/groundwater sampling, remedial activities and report preparation.

- Evaluation of properties for asbestos content; this includes written reports and specifications for numerous projects involving the assessment and removal of asbestos-containing building materials.

- Working knowledge of CERCLA, SARA, RCRA, NESHAPS, OSHA, AHERA and other pertinent federal regulations and programs, in addition to experience with state and local environmental regulations several states across the country.

- Directly performed in excess of 300 Phase I Environmental Site Assessments of industrial, commercial and residential properties for various clients in connection with a variety of transactions (refinancing, new financing, acquisitions, forward commitments). These studies were conducted in VA, MD, DE, OH, NJ, NY, MA, CT.

- Conducted training and seminars on environmental due diligence for a variety of clients, including law firms, real estate investment firms, BOMA, as well as in-house employees.

TRAINING AND CERTIFICATIONS

- OSHA 40-Hour Health and Safety Training
- Registered Professional Geologist, State of Tennessee

PROFESSIONAL EXPERIENCE

- **Prudential Real Estate Investors**. Client manager on a national basis for due diligence projects during property acquisitions, forward commitments and financing. Responsible for project management, client communications, technical correctness and accuracy of projects.

- **Toys 'R' Us and Metropolitan Life Insurance Co.** Regional client manager responsible for environmental risk management during acquisitions.

- **RREEF Funds.** Regional client manager responsible for environmental due diligence during property acquisitions. In addition, conducted site characterization/remediation and environmental audits for client-owned properties throughout New York, New Jersey, Connecticut, Massachusetts, Pennsylvania, and Maryland.

- **LaSalle Partners.** Project coordinator and lead designer for environmental due diligence of various sites in the New York City metropolitan area.

- **Safeguard Storage Properties LLC and Extra Space Development LLC.** Acted as a national client coordinator during property acquisition and redevelopment projects.

- **Federated Department Stores Inc**. Conducted subsurface investigations, remediation, underground storage tank removals, and other environmental services at existing warehouse/distribution facilities in the New York area. Mr. Galdun has also negotiated site-

specific cleanup criteria with state regulatory agencies, and has designed and implemented successful remedial technologies.

Appendix G Vapor Barrier Specifications

RadonAway®
The world's leading radon fan manufacturer

HS Series

Radon Mitigation Fan

HS fans offer a proven solution for tough radon mitigation jobs, providing up to 25 times the suction of inline tube fans to deal with sand, tight soil or clay sub-slab material.

Features

- Internal condensate bypass
- Brackets for vertical mounting indoors and outdoors
- Inlet: 3.0" PVC / Outlet: 2.0" PVC
- Weight: 18 lbs.
- Size: 15.5"W x 13.3"H x 8.2"D
- Warranty: 1 year (3-year option available)

MODEL	WATTS	SOUND RATING (dBA)			RECOM. MAX. OP. PRESSURE "WC	TYPICAL CFM* vs. STATIC PRESSURE WC					
		OPEN	1/2	CLOSED		0"	10"	15"	20"	25"	35"
HS2000 with cord	174-307	56.5	56.2	51.9	14	63	37	12	-	-	-
HS3000 with cord	120-250	47.9	48.0	46.2	21	39	30	25	19	-	-
HS5000 with cord	223-385	56.0	55.3	53.1	35	44	37	33	29	25	16
HS2000E with switch box	174-307	56.5	56.2	51.9	14	63	37	12	-	-	-
HS3000E with switch box	120-250	47.9	48.0	46.2	21	39	30	25	19	-	-
HS5000E with switch box	223-385	56.0	55.3	53.1	35	44	37	33	29	25	16

* Made in the USA with U.S. and imported parts.

* CFM measured through suction.

For Further Information, Contact Your Radon Professional:

Rev C 0517
P/N 02002

UNDER-SLAB GAS BARRIER / VAPOR RETARDER
(Class A)

PART 1 – GENERAL

1.1 SUMMARY
- A. Products Supplied Under This Section
  1. Gas Barrier / Vapor Retarder, Seam Tape, and Pipe Boots

1.2 REFERENCES
- A. American Society for Testing and Materials (ASTM)
  1. ASTM E 1745 Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil Or Granular Fill Under Concrete Slabs
  2. ASTM E 154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs
  3. ASTM E 96 Standard Test Methods for Water Vapor Transmission of Materials
  4. ASTM E 1643 Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs
  5. ASTM D 1434 Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting
- B. Radon Diffusion Coefficient K124/02/95
- C. American Concrete Institute (ACI)
  1. ACI 302.1R-6 & 7 Section 3.2.3 Vapor Retarder

1.3 SUBMITTALS
- A. Testing/Specifications
  1. Laboratory test results showing compliance with ASTM & ACI Standards.
  2. Manufacturer's samples, literature.
  3. Manufacturer's installation instructions for placement and seaming.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Provide a Gas Barrier / Vapor Retarder that meets the following:

1. ASTM E-1745 Standard for Plastic Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs
   a) Must meet all Class "A" criteria.

2. ASTM D 1434 Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting
   a) Methane Permeance:
   1.7×10^{-10} $m^2/d \cdot atm$ or 0.32 GTR $ml/m^2 \bullet D \bullet ATM$

3. K124/02/95 Radon Diffusion Coefficient: $< 1.1 \times 10^{-13}$ m^2/s

- VaporBlock® Plus™ 20 by Raven Industries – 800-635-3456

Other Manufacturer accepted meeting the above specification:

- CETCO Liquid Boot Company - 714-384-0111

2.2 ACCESSORIES

A. Seam Tape
   1. VaporSeal™ Tape by Raven Industries, 800-635-3456 or other 4” and 12” wide gas barrier tape approved by the gas barrier / vapor retarder manufacturer.
   2. VaporBoot Tape by Raven Industries, 800-635-3456 or other 2” wide stretchable butyl rubber tape.
   3. Butyl Seal Tape by Raven Industries, 800-635-3456 or other 2” wide double-sided reinforced butyl rubber seaming tape.

B. Pipe Boots
   1. Raven VaporBoot Plus pipe boots or other manufacturer’s supplied pipe boot system.

PART 3 – EXECUTION

3.1 PREPARATION

A. Ensure that subsoil is approved by architect
   1. Level and tamp or roll aggregate, sand or tamped earth base.

3.2 INSTALLATION

A. Install Gas Barrier / Vapor Retarder:
   1. Installation shall be in accordance with manufacturer’s instructions and ASTM E 1643. (Instructions on architectural or structural drawings should be reviewed and followed.)

      A. Unroll VaporBlock® Plus™ with the longest dimension parallel with the direction of the pour and pull open all folds to full width.
      B. Lap VaporBlock® Plus™ over footings and seal to the vertical foundation walls with 2-Sided Raven Butyl Seal tape.
      C. Overlap joints a minimum of 12 inches—it is optional to seal in-between overlap with 2-Sided Raven Butyl Seal tape—then center the Raven VaporSeal™ Tape or other 4” wide gas barrier tape approved by gas barrier / vapor retarder manufacturer over the seal overlap.
      D. Seal around sewer pipes, support columns or any other penetration with Raven VaporBoot Plus pipe boots or at minimum a combination of VaporBlock® Plus™ and VaporSeal™ Tape or VaporBoot Tape, creating a monolithic membrane between the surface of the slab and moisture sources below as well as at the slab perimeter. Optional, Raven’s POUR-N-SEAL™ can also be used to seal around difficult to reach penetrations.
      E. When VaporBlock® Plus™ gas barrier is used as a part of an active control system for radon gas and other VOCs, a ventilation system will be required. When installed as a passive system it is still recommended to include a ventilation system that could be converted to an active system later.
      F. Repair damaged areas by applying 12” wide VaporSeal™ tape directly over the center of the hole or tear and apply pressure to create a seal.

      NOTE: See manufacturers full-length VaporBlock® Plus™ Installation Guidelines located at www.ravenefd.com for complete details.