REMEDIAL DESIGN DOCUMENT

Site:
"Former" Debbie Cleaners
3800-3808 Nostrand Avenue
Brooklyn, New York 11235
BCP Site # C224237

Prepared For:

New York State Department of Environmental Conservation
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Attn: Mr. Michael MacCabe, P.E. - Senior Environmental Engineer

On Behalf of:

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ACRONYMS AND ABBREVIATIONS

Acronym	**Definition**
AOC	Area of Concern
AS/SVE	Air Sparging/Soil Vapor Extraction
ATM	Atmosphere (atmospheric pressure)
BCA	Brownfield Cleanup Agreement
BCP	New York City Brownfield Cleanup Program
BOA	Brownfield Opportunity Area
CAMP	Community Air Monitoring Plan
C/D	Construction/Demolition
CFM	Cubic Feet Per Minute
COC	Contaminant of Concern
CQAP	Construction Quality Assurance Plan
CSM	Conceptual Site Model
CSOP	Contractors Site Operation Plan
cVOC	Chlorinated Volatile Organic Compound
DCR	Declaration of Covenants and Restrictions
DGW	Depth to Groundwater
DO	Dissolved Oxygen
ECs/ICs	Engineering and Institutional Controls
ft bgs	feet below ground surface
ft^3	Cubic Feet
GPD	Gallons Per Day
HASP	Health and Safety Plan
IRM	Interim Remedial Measure
IWC	Inches of Water Column
MNA	Monitored Natural Attenuation
NOC	Notice of Completion
NYCDEP	New York City Department of Environmental Protection
NYCDOHMH	New York State Department of Health and Mental Hygiene
NYCRR	New York Codes Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDEC DER	New York State Department of Environmental Conservation Division of Environmental Remediation

Acronym	**Definition**
NYSDOH	New York State Department of Health
NYS DOT	New York State Department of Transportation
ORC	Oxygen-Release Compound
OSHA	United States Occupational Health and Safety Administration
PE	Professional Engineer
PFD	Process Flow Diagram
PID	Photo Ionization Detector
PSIG	Pounds per Square Inch (Gauge)
QAPP	Quality Assurance Project Plan
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
SVE	Soil Vapor Extraction
SVOC	Semi-Volatile Organic Compound
µg	Microgram
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
VMP	Vacuum Monitoring Point
VOC	Volatile Organic Compound

1.0 CERTIFICATION

I, Michael Hauptmann, P.E., certify that I am currently a New York State registered professional engineer as defined in 6 NYCRR Part 375 and that this Remedial Design Document (RD) 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).

Signed and sealed:

Michael Hauptmann, P.E.
NYS Professional Engineering License # 082526

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2.0 INTRODUCTION

On behalf of ECA Buligo Nostrand Partners, LP, CNS Environmental Corp. (CNS) has prepared this Remedial Design Document (RD) for Brownfields Cleanup Program (BCP) Site # C224237 known as the "Former" Debbie Cleaners site located at 3800-3808 Nostrand Avenue in Brooklyn, NY ("Site"). See Figure 1: Site Location Map.

2.1 Purpose and Objectives

The Applicant's official role as part of the BCP is Volunteer. The purpose of this RD Document is to support remediation of the Site based upon the findings identified during the Remedial Investigation (RI) and Supplemental Remedial Investigation (SRI) activities, and as outlined within the Remedial Action Work Plan and Alternatives Analysis Report (RAWP/AA).

The *Remedial Investigation Report (RIR)* completed by CNS was dated March 2018 and was conducted in accordance with CNS's July 2017 *Remedial Investigation Work Plan (RIWP)*; and the *Supplemental Remedial Investigation Report (SRIR)* completed by CNS was dated September 2018 and was conducted in accordance with CNS's June 2018 *Supplemental Remedial Investigation Workplan* (SRIWP). The RAWP/AA completed by CNS dated July 2019 summarized the findings and recommendations of the Remedial Investigations completed for the Site and described the remedy selection process and recommended remedial alternative for the Site.

In July 2019, the NYSDEC prepared a Decision Document (DD) for the Site where the elements of the selected remedy were defined as:

1. Remedial Design Program to be implemented to provide details necessary for the construction, operations, optimization, maintenance and monitoring of the remedial program;
2. Excavation and off-site disposal of approximately 55-cubic yards of contaminated soil and contaminant source areas;
3. Backfill below the cover system;
4. Install and Maintain a Asphalt Cover System to allow of Commercial Use;
5. Air Sparge with Soil Vapor Extraction System to address the groundwater and soil vapor contamination plume
6. Vapor Mitigation via a Sub-slab Depressurization System or other acceptable measure to mitigate the migration of vapors into the building that may remain from soil and/or groundwater following the operation of the Air Sparge with Soil Vapor Extraction System
7. Institutional Control in the form of an Environmental Easement for Commercial Use
8. Site Management Plan

The purpose of this RD Document is to accomplish the following:

- Present the remedial excavation specifics for the excavation and disposal of contaminated soil and contaminant source areas;
- Present the remediation system design specifics for the focused remediation of chlorinated volatile organic compounds (cVOCs) and for mitigation of soil vapor intrusion through a Combined Air Sparging/Soil Vapor Extraction (AS/SVE) system to be implemented at the Site; and
- Present a general description of the Sub-slab Depressurization System (SSDS) to be implemented upon completion of the AS/SVE system, should residual vapor intrusion concerns remain.

This RD Document was prepared in accordance with the requirements in NYSDEC DER-10.

3.0 SITE LOCATION AND PHYSICAL SETTING

3.1 Site Location and Description

The BCP Site is approximately 11,152 square foot of tenant spaces and driveway behind the tenant spaces; all of which is located within the northernmost building of the Nostrand Place shopping center property located from 3780 through 3860 Nostrand Avenue in Brooklyn, Kings County, New York. The Site is abutted to the north and south by other commercial tenant spaces; to the east by Nostrand Avenue with a retail shopping center beyond; and by residential homes approximately 36.5-feet to the west.

The Site currently contains four (4) tenant spaces, a basement hallway and a rear driveway identified and occupied as follows:

Occupant	Address	Description
U.S. Army Career Center and Building Utilities	3800 Nostrand Ave.	Northern-most tenant space
Chase Bank	3804 Nostrand Ave.	Former Debbie Cleaners space; situated to South of 3800 and North of 3806
Academy of Dance and Creative Arts (ADACA)	3806 Nostrand Ave.	Situated to South of 3804 and North of 3808
Love 2 Sleep	3808 Nostrand Ave.	Southern-most tenant space assumed occupancy after completion of RI
Basement Hallway	--	Runs along west side of abovementioned tenant spaces with access provided from each tenant space basement, as well as from an exterior staircase at rear driveway.
Rear Driveway	--	Situated at Street-grade to the west of the abovementioned tenant spaces

See Figure 2: BCP Site Plans.

3.2 Site Features

According to the United States Geological Survey (USGS) Topographic Map, the Site lies at approximately 9-feet above Mean Sea Level. Land use immediately surrounding the Site consists of commercial properties to the north, northeast, east and south along Nostrand Avenue and residential homes to the west. Land use within a half-mile radius of the Site is mixed and consists of commercial use along main roads with residential use throughout the remaining area with several intermittently located public-owned facilities and institutions.

3.3 Geological Setting

Based on observations made during the collection of subsurface borings and monitoring well installations; the soil stratum consisted of 6" asphalt pavement (at street grade) or 4" concrete slab (at basement grade), with coarse to fine sand or fine sandy loam to the depths of 5-feet below basement grade. Indigenous urban fill (commonly found throughout the five-boroughs of New York City) was identified within the rear driveway (TW-4, TW-7 and TW-8) consisting of brick fragments, ash and fill materials to the depths of 5-7-feet bgs atop coarse to fine sand or fine sandy loam to the termination depth of 15-feet below street grade. Bedrock was not encountered during the investigations.

3.4 Hydrogeologic Setting

The Site is located approximately 0.5-miles north of Sheepshead Bay where groundwater has been determined to flow in a primarily southward locally controlled direction via a Colloidal Borescope Groundwater Flow Study. Previous investigations conducted at the Site identified groundwater at an average depth of 3-feet below basement grade and 12-feet below street grade.

3.5 Sensitive Receptors

No sensitive ecological receptors such as wetlands have been identified adjacent to or near the Site; however, a Rare Plants and Rare Animals area is located just under a quarter-mile to the southeast, associated with an endangered American Burying Beetle last documented in 1905. There are no drinking water wells documented within the area.

In addition, sensitive population receptors identified within the surrounding area consist of:

- Residential properties located approximately 50-feet west of the Site
- Bright Start Day Care located approximately 150-feet northwest of the Site
- Sheepshead Playground approximately 650-feet to the south beyond Avenue Z
- Public Elementary School # 52 Sheepshead Bay located approximately 1,200-feet to the south beyond Avenue Z and the Sheepshead Playground
- Yeshiva of Kings Bay Universal Pre-K approximately 1,000-feet to the southwest
- Playground # 286 approximately 500-feet to the east
- Junior High School # 14 Shell Bank/YMCA After-School Program approximately 1,000-feet to the northeast
- Sheepshead/Nostrand Community Center Pre-School and CCNS The Bay Neighborhood Senior Center approximately 1,100-feet to the north

3.6 Nearby Known Contaminated or Spill Sites

Based upon the most current data provided by the NYSDEC's Environmental Site Databases, there are no known active contaminated or spills sites identified within the immediate area of the Site.

4.0 BACKGROUND

4.1 Site History

From approximately 1959 through 1985, the tenant space currently occupied by Chase Bank was occupied by a dry cleaner (Debbie Cleaners), which appears to have led to the dry cleaning-related chlorinated Volatile Organic Compound (cVOC) contamination of groundwater and soil vapor, and a limited area of soil. The Site has been occupied by commercial tenants, and investigations within the "Former" Debbie Cleaners space were unable to be performed prior to the Remedial Investigation (RI).

4.2 Previous Environmental Investigations

The following previous Environmental Investigations and/or Reports have been prepared for the Site:

- *Phase I Environmental Site Assessment* prepared by LCS Inc. dated December 6, 2012;
- *Phase II Investigation Report* prepared by CNS dated May 28, 2013;
- *Groundwater Investigation Report* prepared by CNS dated December 5, 2013;
- *Soil Vapor Intrusion Investigation* prepared by CNS dated September 21, 2015
- *Supplemental Phase II Site Investigation* prepared by CNS dated November 17, 2015;
- *2nd Quarter 2014 Quarterly Groundwater Monitoring Report* prepared by CNS dated April 25, 2014;
- *3rd Quarter 2014 Quarterly Groundwater Monitoring Report* prepared by CNS dated July 30 2014;
- *4th Quarter 2014 Quarterly Groundwater Monitoring Report* prepared by CNS dated October 29, 2014;
- *1st Quarter 2015 Quarterly Groundwater Monitoring Report* prepared by CNS dated January 29, 2015;
- *2nd Quarter 2015 Quarterly Groundwater Monitoring Report* prepared by CNS dated June 10, 2015;
- *3rd Quarter 2015 Quarterly Groundwater Monitoring Report* prepared by CNS dated September 14, 2015;
- *4th Quarter 2015 Quarterly Groundwater Monitoring Report* prepared by CNS dated November 24, 2015;
- *1st Quarter 2016 Quarterly Groundwater Monitoring Report* prepared by CNS dated April 7, 2016;
- *Remedial Investigation Work Plan* prepared by CNS dated July 2017;
- *Draft Remedial Investigation Report* prepared by CNS dated March 2018;
- *Supplemental Remedial Investigation Work Plan* prepared by CNS dated June 2018;
- *Supplemental Remedial Investigation* prepared by CNS dated September 2018; and
- *Remedial Action Work Plan and Alternatives Analysis Report* prepared by CNS dated July 2019.

The following narrative describes the environmental history of the Site:

CNS Environmental Corp reviewed a *Phase I Environmental Site Assessment (ESA)* completed by LCS, Inc. (LCS) in December of 2012 for the subject site; where based on CNS' review of the ESA, LCS identified a former drycleaner as an on-site Recognized Environmental Condition (REC), which was said to have operated from at least 1968 through 1996. LCS based this conclusion on a review of historical Sanborn Fire Insurance Maps, which identified the structure improved at 3796 Nostrand Avenue as occupied by a drycleaner. CNS reviewed the historical Sanborn Maps included in the ESA, which depicts the "dry cleaner" notation on the 1968 through 2007 maps; however as stated within the ESA, City Directories for the property were not reviewed because it was LCS' opinion that historical use was adequately determined based on Sanborn maps. LCS concluded that unless sufficient documentation is provided, a subsurface investigation is warranted to assess the environmental conditions on the subject site due to historic use as a drycleaner.

Due to the absence of additional documentation confirming the existence of a drycleaner at the subject site; CNS ordered City Directories, which covered each potential past or current address that may have been used by the property since its construction. The City Directories revealed that the address of 3796 Nostrand Avenue (currently occupied by Chop Stix Restaurant) was not identified with any dry-cleaning tenants based on its 1965 through 1992 listings; however, a drycleaner by the name of "Debbie Cleaners" was identified under the address of 3804 Nostrand Avenue (currently occupied by Chase Bank). This address identifies the drycleaner in its 1965 through 1973 listings; however, its actual occupancy may have occurred as early as 1959 when the building was constructed, through 1985 at which time the tenant is listed as "Flower Den".

In order to further investigate the discrepancy between the Sanborn Maps reviewed by LCS identifying a drycleaner at 3796 Nostrand Avenue, and the City Directories reviewed by CNS identifying a drycleaner at 3804 Nostrand Avenue; CNS compared the historical Sanborn Maps to a site plan showing the current division of tenant spaces within the northernmost building constructed in 1959. Based upon CNS's review, the division of tenant spaces shown on the Sanborn Maps is different from that of the current tenant spaces and were thus identified under different addresses. When the Sanborn Map is further compared to a current site plan, the drycleaner notation would appear within the current Chase Bank tenant space located at 3804 Nostrand Avenue; therefore, it is CNS's opinion that the current 3804 Nostrand Avenue tenant space was originally addressed as 3796 Nostrand Avenue, however remained uncorrected on the Sanborn Maps through the numerous tenant occupancy changes.

Based upon these findings, CNS agreed with LCS' recommendation that a subsurface investigation was warranted to assess the environmental conditions on the subject site due to historic use as a drycleaner; however, CNS recommended this investigation be completed within the vicinity of the current 3804 Nostrand Avenue occupant, Chase Bank, based upon its historical data. A site visit was conducted on Wednesday, February 27, 2013 to determine an appropriate investigation approach. During the site visit it was determined that access to the bank space would not be permitted due to the sensitivity of the operation; therefore, it was determined that in lieu of conducting the investigation within 3804 Nostrand Avenue, the investigation would take place immediately downgradient of the bank within the basement of the neighboring tenant space located at 3806 Nostrand Avenue, which was vacant at the time.

In response to the above-mentioned findings and recommendations, on Friday, April 12, 2013 CNS conducted a *Phase II Investigation* at the vacant 3806 Nostrand Avenue tenant space. The investigation involved the collection of soil samples and a groundwater sample from one (1) soil boring advanced within the basement, to investigate soil and groundwater quality at the subject site. Additionally, CNS collected one soil-gas sample, one indoor air sample and one ambient air sample to investigate soil vapor and indoor air quality at the subject site. The laboratory results identified that the groundwater and soil vapor contained dry cleaning compounds.

In August of 2013, CNS completed a *Groundwater Investigation* where three (3) permanent monitoring wells (NW1 through NW3) were installed and a total of eight (8) soil samples and three (3) groundwater samples were collected. Monitoring well NW1 was installed in the front sidewalk grade; NW2 was installed at the rear sidewalk grade; and monitoring well NW3 was installed in the basement of the 3806 Nostrand Avenue tenant space. Soil analytical results identified dry cleaning related compounds above the laboratory's minimum detection limit but below their respective NYSDEC Commercial SCO's. Groundwater analytical results identified dry-cleaning related cVOCs (cis-1,2-Dichloroethene [c-DCE], Tetrachloroethene [PCE], and Trichloroethene [TCE]) within monitoring well samples NW2-GW2A (Sidewalk grade to the west) and NW3-GW3A (Basement) exceeding their respective NYSDEC TOGS 1.1.1 GA values. Based upon the findings, CNS contacted the NYSDEC and was issued Spill #13-10667. Since that time, CNS had been conducting quarterly groundwater sampling events on monitoring wells NW1, NW2, and NW3.

In September of 2015, CNS completed a *Soil Vapor Intrusion Investigation* at the subject site, where one sub-slab soil-gas sample, one indoor air sample and one ambient air sample were collected. The indoor air levels were below air guidelines; however, as a result of elevated sub-slab levels of the cVOC constituents PCE and TCE, mitigation was identified under the NYSDOH Decision Matrix.

In October/November of 2015, CNS completed a *Supplemental Phase II Investigation* at the subject site, to delineate the identified dry cleaning related solvent plume in order to develop a Remedial Action Plan. On October 14th and 16th of 2015, CNS oversaw the installation of three (3) permanent monitoring wells (NW4, NW5, and NW6), and three (3) temporary wells (TW1, TW2 and TW3) at the subject site. Temporary wells TW1 and TW2 were installed in the northern portion of the basement of the 3808 Nostrand Avenue tenant space and TW3 was installed in the basement of 3800 Nostrand Avenue. Permanent monitoring well NW4 was installed in the common western basement hallway; and NW5 and NW6 was installed in the western back alley at street level. A total of sixteen (16) soil samples and three (3) groundwater samples were collected. Soil sample analytical did not identify any VOC constituents exceeding their respective NYSDEC Unrestricted SCO values. Groundwater sample analytical identified multiple VOC constituents exceeding their respective NYSDEC Groundwater standards values in all three (3) temporary wells.

Based on the laboratory analytical results, it was CNS's opinion that dry cleaning related cVOCs have impacted the groundwater at the subject site requiring remediation. CNS recommended that the three (3) temporary wells (TW1, TW2 and TW3) be made permanent and included in the quarterly sampling events starting in 2016; and a Remedial Action Work Plan be generated outlining current conditions and chemical injection remediation considerations that must be approved by the NYSDEC prior to implementation.

As stated herein, since Spill # 13-10667 was issued; CNS had been completing *Quarterly Groundwater Monitoring*. Previous sampling events occurred on November 21, 2013, April 14, 2014, July 14, 2014, October 23, 2014, January 8, 2015, June 3, 2015, September 8, 2015, October 30, 2015 and March 18, 2016. Note: The October 2015 sampling event also included the newly installed monitoring wells NW4, NW5 and NW6. Monitoring well sampling events consisted of collecting groundwater measurements for temperature, conductivity, pH, dissolved oxygen and oxygen-reduction potential (ORP) and collecting groundwater samples for VOC analysis via EPA Method 8260. Based upon the most recent sampling event, dry cleaning related cVOCs remain present within all six (6) monitoring wells. Contaminant increases were identified within monitoring wells NW1, NW2, and NW3; and monitoring wells NW4, NW5 and NW6 exhibited dry cleaning compounds consisting of c-DCE, PCE, and TCE.

This work was performed by CNS for the Applicant in an effort to address the environmental issues at the site. The matter was reported to the NYSDEC who contacted Acadia in 2016 regarding proceeding with further investigation.

From August 2017 through November 2017, CNS executed the approved RIWP dated July 2017, consisting of a Geophysical Investigation, Soil Investigation, Groundwater Investigation and Soil Vapor/Indoor Air Investigation. A total of twelve (12) soil borings were advanced at the Site, within the

U.S. Army Career Center and Building Utilities basement (3800); the Chase Bank ("Former" Debbie Cleaners) basement (3804); the Love 2 Sleep basement (3808); along the property line within the rear alleyway; and on the sidewalk along Avenue Y, respectively, where a total of thirteen (13) grab soil samples and thirteen (13) composite soil samples were collected. Ten (10) of these soil borings were subsequently converted to temporary groundwater monitoring well points and two (2) soil borings were converted to permanent monitoring wells (one located on the Avenue Y sidewalk and one centrally located in the basement of Chase Bank ("Former" Debbie Cleaners). In addition, CNS converted three (3) existing temporary groundwater well points into permanent monitoring wells and resampled the previously existing six (6) permanent monitoring wells.

Analytical results associated with soil samples did not identify any SVOCs, PCBs, Pesticides or Metals exceeding the Protection of Groundwater SCOs. The VOC constituents Acetone (samples TW4-S1A and TW8-S1A) and Tetrachloroethene (PCE) (samples TW6-S1A and TW8-S1A) were identified at levels slightly above the Protection of Groundwater SCOs; however, were below their respective Commercial SCOs.

Analytical results associated with the twenty-one (21) groundwater samples identified the cVOC contaminants of concern (COC) consisting of Cis-1,2-Dichloroethene (c-DCE), Tetrachloroethene (PCE) and Trichloroethene (TCE), respectively, exceeding the TOGS values in almost all monitoring wells, respectively. The highest concentrations of these compounds were identified within the southwestern portion of the Site. In addition, several low-level SVOCs exceeding the TOGS values were identified within two temporary monitoring wells installed the rear driveway, and two monitoring wells located within the southernmost vacant space basement (3808). No elevated levels of PCBs or Pesticides were identified, with exception to NW-8, also located within the southernmost vacant space basement (3808), where two low-level Pesticides exceeded the TOGS values. Lastly, elevated Unfiltered Metal constituents consisting of Chromium, Iron, Lead, Manganese, Nickel and Sodium were identified in all groundwater samples; however, Dissolved Metals results indicated exceedances of only Manganese and Sodium, respectively, which may likely be considered background levels for the area. Total PFOS and Total PFOA analytical results via ISO Method 25101 reported combined levels above the 2017 USEPA Health Advisory Limit/NYSDEC Groundwater Action Level of 70ppt; with each analytical result also exceeding the current NYS Maximum Contaminant Levels (MCLs) for Drinking Water of 10 ppt per each constituent.

The Soil Vapor and Indoor Air Investigation was performed within the U.S. Army Career Center and Building Utilities basement (3800); within the Chase Bank ("Former" Debbie Cleaners) basement (3804); the Love 2 Sleep basement (3808); along the property line within the rear alleyway; and on the sidewalk along Avenue Y, where a total of six (6) sub-slab samples, four (4) indoor air samples, five (5) soil vapor samples and three (3) outdoor ambient air samples were collected. Analytical results associated with sub-slab soil vapor samples identified the cVOC COCs consisting of c-DCE, PCE and TCE, respectively, exceeding their respective NYSDOH Minimum Decision Matrix Values, with the highest concentrations identified within the Chase Bank ("Former" Debbie Cleaners) basement. Exterior soil vapor samples identified both PCE and TCE at levels exceeding their USEPA Target Sub-slab and Exterior Soil Gas Concentrations, to the immediate west and southwest of the Chase Bank tenant space. Indoor Air sample analytical results did not identify any exceedances of the established NYSDOH Air Guidelines; however, c-DCE, PCE, TCE and Carbon Tetrachloride, respectively, were identified above their respective NYSDOH Minimum Decision Matrix Values.

Based upon the findings of the investigation, dry-cleaning related cVOCs were present above regulatory levels within the Site groundwater and soil vapor; however, analytical results both upgradient and downgradient of the source area ("Former" Debbie Cleaners <currently Chase Bank>) did not identify any SVOC, PCB or Pesticides contaminants. It was CNS's opinion that additional sampling was required in order to delineate the area of concern and determine appropriate remedial actions for the Site, which may potentially expand the Volunteer Brownfield Site boundaries. Based on this conclusion, CNS prepared a *Supplemental Remedial Investigation Work Plan* (SRIWP) dated June 2018 approved by the NYSDEC where CNS recommended additional soil, groundwater and soil vapor data be collected.

From July to August 2018, CNS executed the approved SRIWP, consisting of a Soil Investigation, Groundwater Investigation and Soil Vapor/Indoor Air Investigation. A total of fourteen (14) soil borings were advanced located in the street-grade northern rear parking area, the street-grade rear driveway to the immediate west of Chase Bank and within the Chase Bank basement, where a total of sixteen (16) grab soil samples were collected. No VOCs were detected in any of the collected soil samples above the NYSDEC Protection of Groundwater SCOs with exception to soil boring CB-SB02 advanced approximately 5-feet west of the Chase Bank rear exit door at street-grade which exhibited elevated levels of the cVOC COCs c-DCE, PCE and TCE; and soil boring CB-SB12 advanced in the northwestern portion of the Chase Bank basement which exhibited elevated levels of PCE. These constituents were below their respective NYSDEC Commercial SCOs with the exception to the elevated PCE exhibited in sample CB-SB02-S1A (4' bgs).

Groundwater samples were collected from five (5) temporary groundwater monitoring wells points installed within the street-grade northern rear parking area and the basement level parking garage, respectively; as well as from eleven (11) existing groundwater monitoring wells. Analytical results associated with the sixteen (16) groundwater samples collected identified the cVOC COCs c-DCE, PCE and TCE, respectively, exceeding the TOGS values in almost all monitoring wells, respectively. The highest concentrations of these compounds were identified within the western portion of the Site. No elevated levels of 1,4-Dioxane above the laboratory's reporting limit of 0.046 to 0.049 ppb were identified within any of the groundwater monitoring wells sampled; however, multiple Target PFAS Analytes exceeded the recommended laboratory reporting limit of 2 ppt (NYSDEC Groundwater Sampling for Emerging Contaminants Guidance-February 2018) within all monitoring wells. When comparing the detections of the Target PFAS Analytes to the current NYS Maximum Contaminant Levels (MCLs) for Drinking Water adopted on 8/26/2020; Perfluorooctanoic acid (PFOA) was found to be exceeding the 10 ppt limit in 13 of the 17 samples collected (15.7 to 172 ppt), and Perfluorooctanesulfonic Acid (PFOS) was found to be exceeding the 10 ppt limit in all 17 samples (20.3 to 5,450 ppt). Due to the fact that the groundwater beneath the Subject Site is not utilized for public drinking water, these results were also compared to the guidance values presented within the NYSDEC's *Sampling, Analysis and Assessment of PFAS under NYSDEC's Part 375 Remedial Programs* (October 2020), where although the individual PFOA and PFOS continued to exceed the 10 ppt guidance value; the total concentration of PFAS (including PFOA and PFOS) did not exceed 500 ppt within 15 of the 17 samples collected. In addition, all other individual PFAS (excluding PFOA and PFOS) did not exceed 100 ppt, with exception to several PFAS analytes within the sample collected from monitoring well TW18.

The Soil Vapor and Indoor Air Investigation was performed within the Healthy Fit Juice Shop basement (3788); the ChopStix basement (3790); the Love 2 Sleep basement (3808); the Vanka Café basement (3810); and within the basement parking garage, where a total of eight (8) sub-slab samples, eight (8) indoor air samples, and two (2) outdoor ambient air samples were collected. Analytical results associated with sub-slab soil vapor samples identified the cVOC COCs PCE and TCE, respectively, exceeding their respective NYSDOH Minimum Decision Matrix Values, with the highest concentrations identified within the southern abutting Vanka Cafe basement. Indoor Air sample analytical results did not identify any exceedances of the established NYSDOH Air Guidelines; however, c-DCE, PCE, TCE, Carbon Tetrachloride and Methylene Chloride, respectively, were identified above their respective NYSDOH Minimum Decision Matrix Values. Additionally, the VOC constituents Benzene and Ethylbenzene were identified at concentrations exceeding the USEPA Target Indoor Air Concentration within the Chopstix basement.

Based upon the findings of this investigation, dry-cleaning related cVOCs are present above regulatory levels within the Site groundwater and soil vapor, and in a suspected source area in the Site soil. As of the issuance of this RD, based on the guidance applicable to this Site pertaining to the assessment of PFAS (*NYSDEC's Sampling, Analysis, and Assessment Of Per- And Polyfluoroalkyl Substances (PFAS) under NYSDEC's Part 375 Remedial Programs* [October 2020]), both Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic Acid (PFOS) data collected from the Site indicate levels above the guidance value of 10ppt; however, the total concentration of PFAS (including PFOA and PFOS) did not exceed 500 ppt throughout the majority of the Site.

An analysis of the contaminant fate and transport identified little to no potential for the limited area of soil contamination to migrate off-site; however, dry cleaning contaminants may migrate in groundwater or soil vapor and result in volatilization from soil vapor into the basements of the nearby homes.

Based on the findings of the SRI and as evaluated within the RAWP/AA dated July 2019, it was CNS's opinion that a Soil Vapor Extraction (SVE) and Air Sparging (AS) System Remedial Action and Excavation of the soil "hot spot" were the most feasible options for the Site. As part of the RAWP/AA, CNS completed a AS/SVE System Communications Test (Pilot Test) in order to adequately design and evaluate the proposed remedial system and to determine the effective Radius of Influence (ROI) for the system design.

Based upon site conditions, the ROI was estimated to be approximately 25-feet; therefore, on Friday, November 23rd, 2018, CNS installed one (1) soil vapor extraction well (SVE-1) at the approximate center of the southern wall of the Chase Bank basement for the pilot test. The extraction well was constructed of a 4" diameter schedule 40 PVC riser with a 4" diameter 0.010-inch slotted schedule 40 PVC screen. The well was installed to the maximum depth of 2'4" bgs to accommodate the shallow groundwater level of 3' bgs.

CNS also utilized the three (3) existing sub-slab soil vapor sampling locations in the Chase Bank basement (SS-4, SS-5 and SS-6) and the existing sub-slab soil vapor sample location located in the southern abutting tenant space (SS-1); as well as installed two (2) additional temporary vapor monitoring points (OH-1 and OH-2) at incremental distances from the extraction well inside the Chase Bank basement as vapor monitoring points. All vapor monitoring points were sealed with 4-inches of cement/bentonite grout to prevent short circuiting of the airflow.

In order to assess the AS system, CNS utilized the existing groundwater monitoring well NW-9 located approximately 16' 9" from the extraction well SVE-1, as an air sparging point. In addition, CNS utilized the two (2) additional existing monitoring wells located in the Chase Bank basement (TW-10 and TW-11), as well as the existing monitoring well in the southern abutting tenant space (NW-3), as groundwater observation wells during the pilot test.

From Thursday, December 20th through Friday, December 21st of 2018, CNS completed the pilot test in three separate steps: an isolated SVE system test, an isolated AS system test, and a combined AS/SVE system test. Prior to conducting the pilot test, all existing floor penetrations were sealed with concrete to ensure that interference from creating a vacuum was eliminated.

Hand-held, digital micromanometers with the ability to measure Inches of Water Column (IWC) of pressure to the ten thousandth of an inch of a water column (with an accuracy of one percent) were placed in the vapor monitoring points to evaluate/measure pressure differentials while a vacuum was applied at the extraction well. The duration of each step of the test lasted between 15 minutes to 4 hours, with data collected every 15 minutes for the first hour, followed by every 30 minutes thereafter. In addition, VOC emissions were also collected from the SVE exhaust, as well as from the groundwater observation wells during AS testing.

A target vacuum of -0.025 IWC measured at each vapor monitoring point was selected as the minimum vacuum required to show an adequate response from extraction well SVE-1. Based on the measured vacuums, all vapor monitoring points within 25-feet of the extraction well achieved at least -0.025 IWC at the extraction well vacuum of 40 IWC.

Based on the pilot test activities, the ROI was confirmed to be approximately 25-feet; therefore, CNS proposed that a total of seven (7) soil vapor extraction wells and seven (7) air sparging wells be installed at the site, to effectively remediate the Site and achieve the RAOs. The pilot test results were included within the RAWP/AA.

4.3 Contaminants of Concern

Based upon the findings of investigations completed and historical dry-cleaning operations, the Contaminants of Concern (COCs) identified at the site consist of dry-cleaning related cVOCs within soil, groundwater and soil vapor including cis-1,2-Dichloroethene (c-DCE), Tetrachloroethene (PCE), and Trichloroethene (TCE). In addition, PFOA and PFOS are also considered COCs pending additional data.

5.0 SOIL EXCAVATION

The first element of the proposed remedy is Soil Excavation and Off-Site Disposal in the area of soil boring CB-SB02 located approximately 5-feet west of the Chase Bank rear exit door at street grade; where Tetrachloroethene (PCE) was identified at 504 ppm at the depth of 4 feet bgs.

The Professional Engineer overseeing the remedial action remedy will ensure that the presence of utilities and/or easements on the Site have been investigated and any identified risks are addressed; oversee the remedial work, excavation and load-out of excavated material; ensure all loaded outbound trucks are inspected and cleaned if necessary, before leaving the Site; ensure that all egress points for truck and equipment transport are accessible and kept clean of Site-derived materials during the excavation remedy; and ensure compliance with the Health and Safety Plan,

5.1 Mobilization and Equipment Staging

Mobilization includes field personnel orientation, equipment mobilization, marking/staking sampling locations and utility mark-outs. Each field team member will attend an orientation meeting to become familiar with the general operation of the Site, health and safety requirements, and field procedures.

Equipment and materials will be stored and staged in a manner that complies with applicable laws and regulations.

5.2 Soil Excavation, Screening and Stockpile Methods

Based upon the identified 4' bgs depth of impact above the Commercial SCOs, the volume of estimated soil requiring excavation and off-site disposal is approximately 55 cubic yards. An estimated 290 square feet of concrete and asphalt would require removal to access the impact soil. See Figure 5: Street Level Remedial Design – Soil Excavation.

Visual, olfactory and PID soil screening and assessment will be performed during invasive work under the supervision of the project Professional Engineer and/or Qualified Environmental Professional and will be reported in the Final Engineering Report (FER).

Excavated soil from the soil excavation area will be stockpiled separately and will be segregated from clean soil and construction materials while awaiting proper characterization for off-site disposal. Stockpile(s) will be used only when necessary and will be removed as soon as practicable. While stockpiles are in place, they will be inspected daily, and before and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection. Excavated soils will be stockpiled on, at a minimum, double layers of 8-mil minimum sheeting, will be kept covered at all times with appropriately anchored plastic tarps, and will be routinely inspected. Broken or ripped tarps will be promptly replaced. All stockpile activities will be compliant with applicable laws and regulations. Hay bales or equivalent will surround soil stockpiles except for areas where access by equipment is required. Silt fencing and hay bales will be used as needed near catch basins, surface waters and other discharge points.

5.3 Characterization of Excavated Soil

As reported in August 2020, CNS completed waste characterization soil sampling in the area of soil boring CB-SB02 located approximately 5-feet west of the Chase Bank rear exit door at street grade, in preparation for soil remediation. A total of one (1) grab soil sample was collected at 4-feet bgs; and one (1) 8-point composite soil sample was collected from 0-5' bgs in accordance with typical soil disposal facility protocols. The samples were placed in laboratory-supplied glassware, packed in an ice-filled cooler accompanied by chain-of-custody documentation and transported to American Analytical Laboratories LLC (ELAP # 11418) located at 56 Toledo Street in Farmingdale, NY.

Analytical results from the waste characterization sampling were received on September 3, 2020, where all analytical results were reported below both the NYSDEC Unrestricted SCOs, as well as the NJDEP Residential Direct Contact Soil Remediation Standards – with exception to 4,4′-DDD, 4,4′-DDE, 4,4′-DDT and Total Lead which were reported slightly above the NYSDEC Unrestricted SCOs; however, were below NYSDEC Residential SCOs.

5.4 Stormwater Pollution Prevention

Applicable laws and regulations pertaining to storm-water pollution prevention will be addressed during the remedial program. Erosion and sediment control measures (silt fences and barriers, and hay bale checks) will be installed around the perimeter of the remedial area and inspected daily and after every storm event to ensure that they are operating appropriately. Discharge locations will be inspected to determine whether erosion control measures are effective in preventing significant impacts to receptors. Results of inspections will be recorded in a logbook, maintained at the Site and available for inspection. All necessary repairs shall be made immediately. Accumulated sediments will be removed as required to keep the barrier and hay bale check functional. Undercutting or erosion of the silt fence anchor will be repaired immediately with appropriate backfill materials. Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

5.5 Materials Transport

Loaded vehicles leaving the Site will comply with all applicable materials transportation requirements (including appropriate covering, manifests, and placards) in accordance with applicable laws and regulations, including use of licensed haulers in accordance with 6 NYCRR Part 364. If loads contain wet material capable of causing leakage from trucks, truck liners will be used. Queuing of trucks will be performed on-Site, when possible, in order to minimize off Site disturbance. Off-Site queuing will be minimized.

Outbound truck transport routes will take into account the following factors: (a) limiting transport through residential areas and past sensitive sites; (b) use of mapped truck routes; (c) minimizing 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. To the extent possible, all trucks loaded with Site materials will travel from the Site using the most feasible truck routes. Trucks will not stop or idle in the neighborhood after leaving the project Site.

5.6 Off-site Materials Disposal

Following receipt and review of waste characterization analytical results, a letter and/or application will be completed and submitted to each disposal facility identifying the Site location and a description of the material to be disposed of, accompanied by the waste characterization analytical results; requesting written acceptance of the material. Prior to off-site disposal, a formal acceptance letter will be obtained from the final disposal facility.

All impacted soil/fill or other waste excavated and removed from the Site will be managed as regulated material and will be disposed in accordance with applicable laws and regulations. A manifest system for off-Site transportation of exported materials will be employed and will be reported in the FER. Hazardous wastes derived from on-Site (if encountered) will be stored, transported, and disposed of in compliance with applicable laws and regulations.

The FER will include an itemized account of the destination of all material removed from the Site during this remedial action. Documentation associated with disposal of all material will include records and approvals for receipt of the material.

5.7 Dewatering

Due to the encountered groundwater levels in the areas surrounding the excavation area (12' bgs), dewatering will not be necessary.

5.8 Post-Excavation Confirmatory Sampling

Removal actions under this remedy will be performed in conjunction with post-excavation confirmatory end-point sampling. After the initial excavation, confirmatory grab soil samples will be collected and submitted for laboratory analysis to verify that the Track 2 Commercial Use SCOs have been met. Additional soil will be removed if any post-excavation confirmatory sample analytical results exceed the Commercial SCOs.

A total of five (5) post-excavation confirmatory end-point samples will be collected and analyzed for the cVOC COCs via EPA Method 8260. Based on the projected size of the excavation area (20-feet x 14.5-feet x 5-feet depth), a total of four (4) post-excavation sidewall endpoint samples and one (1) post-excavation bottom endpoint sample are anticipated. In the event the excavation area is expanded, additional endpoint samples may be collected in accordance with DER-10.

5.9 Quality Assurance/Quality Control

Appropriate Quality Assurance/Quality Control (QA/QC) procedures will be utilized during implementation of all field activities, including but not limited to use of disposable vinyl gloves during sampling. The auger equipment will be cleaned prior to the commencement of collecting each soil sample. Field blanks will be collected as part of this investigation in addition to disposable sampling equipment being utilized during sampling/sample compositing. All cuttings will be placed within a steel drum and properly disposed of in compliance with NYSDEC guidelines. In accordance with DER-10, CNS will collect QA/QC blanks as part of the sample collection in the form of trip blanks and/or laboratory duplicates.

5.10 Import of Clean Fill/Backfill

All imported fill material used below and within the cover layer to meet the pre-excavation elevations and grades, will meet DER-10 backfill and cover soil quality objectives for the site.

Sources of backfill and/or cover soil to be imported to the Site will be evaluated by the Professional Engineer and will be uncontaminated, clean soil that meets the more stringent of the Unrestricted Use SCOs or Protection of Groundwater SCOs.

The imported uncontaminated, clean material will be from an approved source/facility and will be evaluated by the Professional Engineer to ensure:

- That a segregated stockpile (approximately 55 cubic yards) is properly maintained at the source and will not be comingled with any other material prior to importing and grading the clean soil material at the Site;
- That the material does not include any solid waste, including construction and demolition material;
- That screening for evidence of contamination by visual, olfactory and PID soil screening practices prior to testing at the source as well as upon importing to the Site for grading is completed; and
- That samples will be collected from the segregated stockpile at the source, and analyzed for the following parameters:
  - Volatile Organic Compounds (VOCs) via EPA Method 8260
  - Semi-Volatile Organic Compounds (SVOCs) via EPA Method 8270
  - Polychlorinated Biphenyls (PCBs) via EPA Method 8082
  - Pesticides via EPA Method 8081
  - Target Analyte List (TAL) Metals + Hexavalent Chromium & Cyanide via EPA Method 6010

Based upon the estimated volume of soil to be imported (55 cubic yards), two (2) grab samples and one (1) five-point composite sample are projected.

Recycled concrete aggregate (RCA) will be imported from facilities permitted or registered by NYSDEC. Facilities will be identified in the RCR. The PE and/or QEP will be responsible to ensure that the facility is compliant with 6 NYCRR Part 360 registration and permitting requirements for the period of acquisition of RCA. RCA imported from compliant facilities will not require additional testing, unless required by NYSDEC under its terms for operation of the facility. RCA imported to the Site must be derived from recognizable and uncontaminated concrete. RCA material is not acceptable for and will not be used as cover material.

Prior to the proposed imported fill material being brought on Site, documentation of the source will be provided to the NYSDEC for approval, which will include the source location, sample analytical results and any state or local approvals as a fill source or brief history of where the source soil originated from.

Materials approved and imported to the Site will be subject to inspection, as follows:

- Trucks with imported fill material will be in compliance with applicable laws and regulations and will enter the Site at designated locations;
- The Professional Engineer will ensure that every truck load of imported material is inspected for evidence of contamination via visual, olfactory and PID screening of the material for evidence of contamination; and
- Fill material will be free of solid waste including pavement materials, debris, stumps, roots, and other organic matter, as well as ashes, oil, perishables or foreign matter.

All materials received for import to the Site will be approved by the Professional Engineer and will be in compliance with provisions in this RAWP. The FER will report the source of the fill, evidence that an inspection was performed on the source, analytical results, frequency of testing, a Site map indicating the locations where backfill or soil cover was placed and Bills of Lading.

5.11 Site Restoration

The Site will be regraded after backfilling is completed and prepared for surficial restoration. Disturbed areas will be restored with concrete and/or asphalt. Prior to fill imported, CNS will ascertain and review analytical results to determine the materials meet NYSDEC requirements.

6.0 AIR SPARGING/SOIL VAPOR EXTRACTION SYSTEM DESIGN

6.1 System Overview

Soil and groundwater testing performed under the RI identified elevated concentrations of dry-cleaning related chlorinated Volatile Organic Compounds (cVOCs) within the Site's groundwater, soil vapor, indoor air and a limited area of soil. The suspected source area has been identified as the area of soil boring CB-SB02 located approximately 5-feet west of the Chase Bank rear exit door at street grade, where Tetrachloroethene (PCE) was identified at 504 ppm at the depth of 4 feet bgs. The source area will be excavated following the procedures outlined within the preceding Section 5.0.

The Combined Air Sparging/Soil Vapor Extraction (AS/SVE) system will be installed to substantially reduce the concentrations of the cVOC COCs present in the subsurface as well as the indoor air. The system will be installed so that all elevated soil vapor concentrations and groundwater cVOCs will be mitigated and remediated by the AS/SVE system by applying sparging air flow into the aquifer with the required vacuum from the blower system. The combined use of these systems will allow the cVOCs in groundwater to be sparged from the saturated zone to the unsaturated zone, with the contaminants captured and removed by the SVE system while also controlling vapor migration into the on-site building via applied vacuum. As detailed within the RAWP/AA, the pilot test provided information on the necessary capacity for the blowers and electrical equipment for the full-scale design. Based on the established radius of influence (ROI) for each component in the system (Air Sparging and Soil Vapor Extraction), the dimensions of the treatment area and the structural elements and configuration of the building consisting of seven (7) air sparging wells and seven (7) soil vapor extraction wells was selected.

The SVE extraction wells will be installed just above the water table so that the entire vadose zone will be subject to the reduced vapor pressure as much as possible without drawing excess moisture into the system from the water table. The AS points will be installed in the water table so devolatilization of cVOCs will occur.

Contaminants from the unsaturated and saturated zones will be captured by the SVE system for removal from the subsurface environment until the NYSDOH Minimum Decision Matrix Values and NYSDEC Groundwater Standards are met, respectively. If asymptotic conditions are reached during the active vapor extraction phase, a technical impracticability waiver may be requested to discontinue the active vapor removal. Monitored natural attenuation may be implemented at that time.

6.2 Soil Vapor Extraction System Design Specifications

According to the pilot test results, a ROI of 25-feet can be achieved with a remedial system output of 100 cfm with 50 inches water column (IWC) at each well point. Full coverage of the impacted area using a design ROI of 25 feet requires seven (7) Soil Vapor Extraction (SVE) wells.

Each basement level SVE well will be installed to a total depth of 2-feet below the basement grade. The basement level SVE wells will be constructed with 12-inches of 4-inch diameter 0.010-inch slotted Schedule 40 PVC well screen with approximately 1-foot of 4-inch diameter Schedule 40 PVC riser below grade with an additional 2 to 3-feet of 4-inch diameter Schedule 40 PVC riser above grade, which will transition to 2-inch diameter Schedule 40 PVC using a Schedule 40 PVC reducing tee. The annular space between the borehole and the well screen will be backfilled with #2 porous sand, with a 6-inch hydrated bentonite seal installed above the sand, with the remainder of the annular space grouted to the surface. Piping from each individual basement level SVE well will be run vertically into the plenum (between the basement ceiling and floor above), routed parallel to and above the basement ceiling into the basement hallway to intercept the SVE main extraction header ("headline").

The street level SVE well will be installed to a total depth of 9-feet below street grade. The street level SVE well will be constructed with 5-feet of 4-inch diameter 0.010-inch slotted Schedule 40 PVC well screen with approximately 4-feet of 4-inch diameter Schedule 40 PVC riser. The SVE piping to the headline will consist of 2-inch diameter Schedule 40 PVC connected to the well with a Schedule 40 PVC reducing tee. The annular space between the borehole and the well screen will be backfilled with #2 porous sand, with a 6-inch hydrated bentonite seal installed above the sand, with the remainder of the annular space grouted to the surface. Trenching will be required for the street-grade SVE well piping which will be installed below grade at an approximate depth of 2.5-feet bgs and routed through the foundation wall to intercept the SVE headline in the basement. A 2' x 2' manhole will be installed within the street-grade rear driveway in order to access the gate valve and vacuum gauge on the SVE well line.

The wellheads will be completed with a 4-inch to 2-inch PVC reducer, a vacuum gauge, and a 2-inch PVC gate valve to isolate the well from the system and allow flow rates to be balanced between the seven extraction wells. The wells will be connected to a common 3-inch diameter PVC main extraction header which will run along the basement ceiling (parallel to the building foundation) and be routed vertically through a first-floor bathroom and subsequently routed out through the foundation wall to the remedial system located in a lockable equipment trailer on the north side of the building atop the below-grade parking garage.

To further increase the SVE effectiveness and assist in providing an adequate negative pressure field further preventing soil vapor intrusion during operation of the SVE system, all cracks, perforations, drains or other slab penetration shall be properly sealed, and the basement slabs will be sealed with a low-VOC epoxy vapor barrier during construction and installation of the system.

Based on the results of the pilot test, an air flow rate of 100 cfm at 50 IWC of system output is required to achieve the design ROI of 25-feet at each wellhead. To meet these design criteria a 5 HP regenerative blower (Rotron DR757 or equivalent) with particulate filter and vapor trap was selected. To monitor the ROI efficiency, permanent flush-mount Vapor Pins® Pressure Field Extension (PFE) testing points will be installed approximately 15' and 25' from extraction points to determine the radius at which the system extraction point is creating a negative pressure in the sub-slab. A micro-manometer with a minimum accuracy of 0.01"w.c. will be used to make pressure differential measurements. The specific objective of this mapping is to produce a design that will generate a vacuum field with a minimum coverage of a -0.05"w.c. pressure differential between the indoor space and sub-slab material with the slab itself being the defining barrier.

The layout of the AS/SVE system and the locations of its associated permanent soil vapor monitoring points previously installed during the RI is provided in Figures 4, 6 and 7; and SVE well and monitoring point details are depicted in Figures 8 and 9. Equipment details and specifications are provided in Appendix A, B and C.

6.3 Air Sparging System Design Specifications

The pilot test results indicated an effective ROI of 25-feet for a sparging well operating at 10% above breakout pressure. Full coverage of the impacted area using a design ROI of 25 feet requires seven (7) Air Sparging (AS) wells.

Each basement level AS well will be installed to a total depth of 3-feet into the groundwater table (approximately 6-feet below basement grade). The basement level AS wells will be constructed of 5-feet of 2-inch diameter, 0.010-inch slotted Schedule 40 PVC well screen with approximately 1-foot of 2-inch diameter Schedule 40 PVC riser below grade with an additional 2 to 3-feet of 2-inch diameter Schedule 40 PVC riser above grade, which will transition to 1-inch diameter 200 Degree (min.) rated hosing using a Schedule 40 PVC reducing tee and transition adapter. The annular space between the borehole and the well screen will be backfilled with #2 porous sand, with a 6-inch hydrated bentonite seal installed above the sand, with the remainder of the annular space grouted to the surface. Piping from each individual basement level AS well will be run vertically into the plenum (between the basement ceiling and floor above), routed parallel to and above the basement ceiling into the basement hallway to intercept the AS main manifold).

The existing groundwater monitoring wells NW-2 and NW-5 located within the street level rear driveway will be converted to AS wells. These wells are currently installed at the depth of approximately 10-feet into the groundwater table (approximately 20-feet below street grade), with 10-feet of 2-inch diameter, 0.010-inch slotted Schedule 40 PVC well screen and 10-feet of -inch diameter Schedule 40 PVC riser. The AS piping to the main manifold will consist of 1-inch diameter 200 Degree (min.) rated hosing using a Schedule 40 PVC reducing tee and transition adapter. Trenching will be required for the street-grade AS well piping which will be installed below-grade at an approximate depth of 2.5' bgs and routed through the foundation wall to intercept the main manifold in the basement.

The wellheads will be completed with a 2 inch to 1-inch PVC reducer connected to a transition adaptor. The wells will then be connected to a main manifold mounted on the basement hallway wall, which will be fed by a common 1.5-inch diameter main pressure line to be run along the basement ceiling (parallel to the building foundation) and be routed vertically through a first-floor bathroom and subsequently routed out through the foundation wall and connected to a 15 HP Rietschle DLR 150 rotary claw compressor located in the equipment trailer at the north side of the building.

Based on the results of the pilot test, an air flow rate of 6 cfm at 6.5 psi is required to achieve the design ROI of 2-feet. To meet these design criteria a 15 HP rotary claw compressor (Rietschle DLR 150 blower or equivalent) with inlet / outlet silencers and a pressure relief valve is specified.

The layout of AS SVE system is shown in Figures 4, 5 and 6. Well and monitoring point details are depicted in Figure 7. The layout of the AS/SVE system and the locations of its associated permanent soil vapor monitoring points previously installed during the RI is provided in Figures 4, 6 and 7; and AS well and monitoring point details are depicted in Figures 8 and 9. Equipment details and specifications are provided in Appendix A, B and C.

6.4 Treatment System

VOCs from the SVE effluent air stream will be treated with vapor phase granular activated carbon (GAC) before discharge to the atmosphere. The selected GAC treatment system is a (2x) VFD-85 Vapor Phase GAC Filter which includes 250lbs of 4x10 React Vapor Phase GAC Fill and two 85-gallon General Carbon Corp. canisters arranged in series. Specifications for the GAC Filter are provided in Appendix A.

6.5 Equipment Trailer

The equipment will be located in a prefabricated trailer to be placed on the north side of the building atop the below-grade parking garage. The 6' x 12' trailer will house both the AS and SVE equipment and the carbon drums and will include motor starters for each blower and a power panel. The equipment trailer will be equipped with a Dayton Exhaust fan for ventilation. See Figures 4 through 7 and Appendix C.

7.0 TRENCHING AND SOIL MANAGEMENT AND DISPOSAL

7.1 Trenching

Sub-grade piping from the exterior street-grade AS and SVE wells to the basement headlines will be placed in trenches. Prior to initiating any site-related drilling and/or construction activities, all municipal and private underground utilities will be identified.

CNS will oversee all trenching activities completed by the Contractor. If excavated trench spoils are deemed unsuitable as pipe bedding, pea gravel will be imported for use as bedding material. For the remaining backfill of trenches above the bedding layer, trench spoils may be utilized and mechanically compacted. A traceable wire/marking tape shall be installed at a depth of approximately 12-inches bgs in all trenches containing below-grade SVE and AS piping.

Below-grade AS piping may utilize the same trenches as SVE piping. AS piping will also be installed within a pipe bedding material layer and shall maintain a minimum depth of 2.5 feet bgs.

The proposed AS/SVE system layout, including the location of the proposed below-grade pipe routes, is depicted on Figures 4, 6 and 7.

7.2 Waste Management

The excavated soil from the trenching locations will be field screened with a PID for VOCs and also visually inspected for VOC impacts. If none are detected, then trench spoils will be utilized as backfill if deemed suitable. Each of the well installation soil cuttings will be placed in drums or in a roll-off container, characterized via sampling for site-specific contaminants and disposal parameters required by the selected disposal facility.

Spent media generated from remedial system operation will be shipped offsite for regeneration or disposal in accordance with all applicable local, state and federal regulations. Likewise, any groundwater generated during remedial system operation will be disposed of in accordance with applicable regulations.

8.0 SYSTEM OPERATION AND MAINTENANCE

8.1 Start-up

The AS/SVE system can begin operation once all of the components (piping, equipment, electrical connections, etc.) have been installed and determined to be functional. Following installation of the system, the following items will be inspected to ensure proper operation:

1. Check all exposed/visible piping for evidence of damage, cracks, or leaks.
2. Turn the SVE blower on and off to ensure the start box is functioning properly and then leave blower on;
3. Record vacuum reading at the SVE blower;
4. Record vacuum readings at each extraction wellhead;
5. Record vacuum readings at each Vapor Pin® (Suction Field Extension Test); Balance the vacuum between the extraction wells by adjusting the gate valves;
6. Take PID readings before, in-between and after carbon vessels;
7. Turn the AS blower on and off to ensure the start box is functioning properly and then leave blower on;
8. Adjust the air pressure at each sparge wellhead to 10 -15% above that required to overcome the water column in the well (break-out pressure).

The system testing described above will be conducted if, in the course of the AS/SVE system lifetime, the system goes down or significant changes are made to the system and the system must be restarted.

8.2 System Inspections and Adjustments

The AS system will need to be adjusted in response to changes in water level. Such changes will either increase or decrease the amount of pressure needed to overcome the water column and maintain optimal operating conditions. The SVE portion of the system will not require periodic adjustment once the extraction wells are properly balanced.

A visual inspection of the complete system will be conducted during each monitoring event. AS/SVE system components to be monitored include, but are not limited to, the following:

- Vacuum blower;
- AS Blower;
- General system piping;
- Vacuum gauges at blower;
- Pressure relief valve;
- Control switches;
- PID Readings from influent line, between carbon drums and at the discharge stack.

The adjustment procedures for the AS system are as follows:

Method 1 (if sparging lines are not airtight and there is access to each sparge point wellhead)

1. Turn off sparge blower
2. Take depth to water readings & total depth (if not known) at each sparge point.
3. Determine displacement pressure & operating pressure for each point according to following

example:

4. Displacement pres. (psi) = ((T.D. - DTW) - 2.4) x 0.43302 Operating pres. (psi) = Disp. pres. x 1.15 (for 15% over)
5. Turn on sparge blower and adjust each point to calculate operating pressure.
6. Record vacuum/pressure readings at vent wells and observation wells. Balance out vacuum at SVE wells. Take PID readings at SVE emission stack.

Method 2 (if lines are airtight)

1. Close off air supply (gate valve) to first sparge point in system. Watch pressure gauge and wait for stabilization (approx. 4-4.5 psi for a 10-foot water column). Stabilization psi = displacement psi. Calculate operating psi as described above.
2. Perform procedure 6 as detailed above.

8.3 Operation and Maintenance

Upon installation of the Combined AS/SVE system, the unit will be monitored on a daily basis for the initial week by the CNS, along with pressure field extension testing to determine the effectiveness of the ROI. The Site superintendent will also be advised of any system malfunctions by the AS/SVE system's alarm system. The AS/SVE system will also be inspected monthly to ensure it is operational and properly maintained, with pressure field extension testing completed to ensure an effective ROI. Repairs or adjustments will be made as necessary. A comprehensive *Operations, Maintenance, and Monitoring Plan* (OMMP) will be compiled for the site upon installation, start-up/balancing and the baseline sampling event. The OMMP will include the corrective actions (if any) required to address soil and groundwater contamination at the Site.

9.0 REMEDIAL PERFORMANCE MONITORING

9.1 Effluent Air Sampling

Effluent air samples will initially be collected on a monthly basis to evaluate the performance of the AS/SVE system during the first 3 months of operation going to semi-annually thereafter.

PID readings will be collected from the system influent (before carbon), between the carbon canisters, and from the system discharge (after carbon). Air samples will be collected and submitted to a NYSDOH certified environmental laboratory for analysis of VOCs by USEPA method TO15.

Air samples will be collected from the system influent and effluent using tedlar bags or SUMMA canisters. If using SUMMA canisters, the canister will be connected to the effluent sampling port using silicone tubing. The sampling port will then be opened as well as the valve on the summa canister. When the vacuum in the canister approaches 10" hg the valve will be closed. If using tedlar bags a vacuum pump will be used to fill the bag. When the bag is half full, pumping will be stopped and the valve on the bag closed.

Initial effluent concentrations will be high as accumulated vapors are removed resulting in accelerated carbon depletion rates; however, carbon usage will rapidly diminish over time (1-2 weeks) as the accumulated vapors are removed and effluent concentration is determined by transfer from the sorbed to the vapor phase. Carbon drums will be set up in series with the between vessel PID readings utilized to determine when break through occurs at the first drum. The threshold PID reading would be 200 ppm and would confirm breakthrough has occurred. Typically, readings of 200 ppm and higher confirm contamination is present with this instrument. Lower readings with this instrument can be impacted by weather or equipment malfunctions. When this occurs, the drum will be changed out and shipped back to the supplier for regeneration. If nuisance odors are observed from the discharge at any time, operation of the system will be temporarily halted until the situation is remedied by changing out the carbon or through other necessary repairs / actions (loose valve / fitting, broken pipe, etc.).

9.2 Indoor Air Sampling

Indoor air samples will initially be collected after the AS/SVE System has stabilized on a monthly basis, concurrently with pressure field extension testing, to evaluate the performance of the system during the first 3 months of operation and to ensure that vapors are not escaping into the indoor air of the basement. Following the initial three months of operation, indoor air sampling will occur concurrently with pressure field extension testing on a semi-annual basis or on a bi-annual basis as summarized in Table 1: Proposed System Effectiveness Monitoring/Sampling Locations and Frequency.

Indoor air samples will be collected in dedicated, laboratory-supplied "batch certified clean" six (6)-liter stainless steel Summa canisters at rates no greater than 0.2 L/min, with an average target fill-time of eight (8) hours per canister to reflect the potential exposure scenario on-site at a height of 3 to 5-feet to represent a typical breathing zone/occupant seating height. Each set of indoor air samples will be accompanied by a single outdoor ambient air control sample.

CNS will send the indoor and outdoor air samples to the NYSDOH-certified laboratory for analysis of VOCs by EPA Method TO-15. The reporting limits will meet the specification required via TO-15. Analytical results will be compared against the applicable values presented within the NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York dated October 2006.

Based on the data collected, system adjustments and/or additional work may be warranted and indoor air sampling would be repeated following such adjustments.

9.3 Groundwater and Soil Vapor Sampling

Groundwater and soil vapor monitoring will be performed to determine the influence of the soil source removal and the operation of the Combined AS/SVE system on the COC groundwater and soil vapor concentrations.

After the initial start-up of the AS/SVE system, CNS will collect one (1) set of baseline groundwater samples from groundwater monitoring wells NW-1, NW-3, TW-4, TW-5, TW-6, NW-7, NW-8, TW-10, TW-13 and TW-15.

Groundwater monitoring wells NW-3, TW-4, TW-5, TW-6, NW-7, NW-8 and TW-10 will be sampled semi-annually (twice per year) and analyzed for the cVOC COCs as summarized in Table 1: Proposed System Effectiveness Monitoring/Sampling Locations and Frequency and depicted within Figures 4, 6 and 7. CNS's basis for selecting these locations is based on the concentrations of COCs identified in groundwater and soil vapor, as well as providing suitable aerial coverage of the impacted portion of the subsurface.

Groundwater monitoring wells NW-1, TW-13 and TW-15 will be sampled bi-annually (once every two years) and analyzed for the cVOC COCs as summarized in Table 1: Proposed System Effectiveness Monitoring/Sampling Locations and Frequency and depicted within Figures 4, 6 and 7. These wells were selected as sentinel wells to verify that high concentrations of groundwater and soil vapor contaminants are not migrating from their current location.

The sampling intervals for these monitoring locations were chosen due to the extremely flat groundwater gradient at the site where a significant migration of contaminants is not expected.

Groundwater samples will be analyzed for the cVOCs via EPA Method 8260 and Target PFAS constituents via EPA 537M. Groundwater for VOCs analysis will be preserved by acidification to a pH of <2 using hydrochloric acid (HCl), cooled to 4°C, and maintained at this temperature until time of analysis. Immediately following collection of the samples, they will be placed in a cooler with "freezer-pats" in order to maintain sample integrity, all volatile sample bottles to be filled to capacity with no headspace for volatilization. If necessary, to meet a maximum recommended holding time, the samples are to be shipped by overnight courier to the NYSDOH-certified laboratory.

Soil vapor samples will be collected only when AS/SVE system modifications and/or shutdowns are considered. Soil Vapor samples will be collected in dedicated, laboratory-supplied "batch certified clean" six (6)-liter stainless steel Summa canisters at rates no greater than 0.2 L/min, with an average target fill-time of eight (8) hours per canister to reflect the potential exposure scenario on-site. Indoor and outdoor air samples will also be collected concurrently during each soil vapor sampling event at a height of 3 to 5-feet to represent a typical breathing zone/occupant seating height.

CNS will send the sub-slab soil vapor, indoor and outdoor air samples to the NYSDOH-certified laboratory for analysis of VOCs by EPA Method TO-15. The reporting limits will meet the specification required via TO-15. Analytical results will be compared against the applicable values presented within the NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York dated October 2006.

9.4 Quality Control/Quality Assurance

The fundamental QA objective with respect to accuracy, precision, and sensitivity of analysis for laboratory analytical data is to achieve the QC acceptance of the analytical protocol. The accuracy, precision and completeness requirements will be addressed by the ELAP-certified laboratory for all data generated.

Collected samples will be appropriately packaged, placed in coolers and shipped via overnight courier or delivered directly to the ELAP-certified analytical laboratory by field personnel. Samples will be stored in the field in a cooler containing ice or cold-pak(s) to maintain a temperature of 4 degrees C. Samples will be containerized in appropriate laboratory provided glassware and shipped in plastic coolers. Samples will be preserved through the use of ice or cold-pak(s) to maintain a temperature of 4oC, +/- 2 oC.

Dedicated disposable sampling materials will be used during groundwater samples, eliminating the need to prepare field equipment (rinsate) blanks. However, if non-disposable equipment is used, field rinsate blanks will be prepared at the rate of 1 per day. Field blanks will be prepared by pouring distilled or deionized water over decontaminated equipment and collecting the water in laboratory provided containers. Trip blanks will accompany samples each time they are transported to the ELAP-certified laboratory. Matrix spike and matrix spike duplicates (MS/MSD) will be collected at the rate of one per 20 samples submitted to the laboratory.

The ELAP-certified laboratory will conduct necessary QC calculations that will be summarized in final laboratory reports. Copies of the analytical data will be provided to the NYSDEC as Category B deliverables. Following data validation and reporting, all project-generated and compiled data and information will be reconciled with the project objectives to assess the overall success of sampling activities.

Refer to Appendices D and E for the Quality Assurance Project Plan (QAPP) and Health and Safety Plan (HASP).

10.0 SUB-SLAB DEPRESSURIZATION SYSTEM (SSDS)

The third element of the remedy to address residual vapor intrusion concerns is a Sub-slab Depressurization System (SSDS) proposed to be installed at the Site, if applicable. As indicated herein, in the event that the subsurface COCs are adequately addressed by the AS/SVE system operation and accepted by the NYSDEC and NYSDOH, the proposed succeeding SSDS shall not apply.

The SSDS would consist of utilizing the existing four-inch diameter PVC extraction points in the sub-base beneath the building slab and connecting to the existing manifold system which will be exhausted above the building roof-line. A sealable sampling port will be installed at the base of the unit for future sampling purposes. Additionally, an in-line magnahelic dial vacuum gauge will be installed on the unit to ensure proper functioning.

If applicable, vapor from the system will be treated by activated carbon prior to atmospheric discharge. Operations and maintenance sampling will be performed to ensure that contaminant breakthrough does not occur prior to carbon changeout. When sampling indicates carbon changeout is needed the system will be temporarily turned off.

For protection from weather, the vapor extraction pump carbon treatment will be housed in a shed or similar structure that may also be heated electrically. The container will also help to reduce ambient noise levels in the vicinity of the system.

10.1 SSDS Remedial Design Communications Testing (Pilot Test)

A pilot test will be completed utilizing a single existing SSDS point; along with several vapor monitoring points at incremental radial distances from the venting point to measure vacuum response to evaluate ROI.

Vacuum gauges will then be connected with the pilot test conducted by venting the subsurface at different flow rates. Measurements of vacuum, flow rate and temperature shall be collected, as well as VOC levels at the SSDS point and exhaust discharge points.

Based on the results of this pilot test, CNS will determine if additional SSDS points or horizontal piping will be required.

If an SSDS is deemed necessary based upon the level of effectiveness of the AS/SVE system and a review by the NYSDEC and NYSDOH, prior to the implementation of this system, a SSDS Remedial Design Work Plan will be submitted to the NYSDEC and NYSDOH for approval.

11.0 EXISTING MONITORING WELL ABANDONMENT

CNS proposes to permanently abandon the monitoring wells NW-4, NW-6, NW-9, NW-11, TW-8, TW-9, TW-11 and TW-18.

Monitoring well abandonment shall be completed in accordance with NYSDEC CP-43: Groundwater Monitoring Well Decommissioning Policy, with details included in the FER.

12.0 REPORTING

In accordance with DER-10, CNS will submit periodic progress reports documenting the progress of the remedial actions accomplished during the reporting period, which will include, but will not be limited to, the following:

- Project progress and significant activities
- Planned significant activities for the following reporting period
- Remedial action schedule, including any proposed modifications or changes
- Any problems and/or delays (if encountered)
- Proposed actions to identify and mitigate problems and/or delays (if encountered)

These periodic progress reports shall initially be submitted on a monthly basis; however, their frequency may be subject to change based on future activities and/or directives by the NYSDEC and/or NYSDOH.

13.0 HEALTH AND SAFETY

Invasive work performed at the Site will be completed in accordance with applicable local, state, and federal regulations to protect worker and public health and safety.

The proposed tasks will be completed under the supervision of the Professional Engineer pursuant to the Site Health and Safety Plan (HASP) provided in within the RAWP/AA and Appendix E of this document. The HASP also outlines the Community Air Monitoring that will be conducted during the short-term invasive activities associated with the soil excavation and AS/SVE system installation.

Access to the active construction area will be controlled using cones, barricades and/or barricade tape. Open trenches not actively worked shall be covered or protected by steel plates or fencing.

14.0 SCHEDULE

Below is a schedule of all work associated with mitigation, remedial actions, and the installation of the AS/SVE remediation system.

Tasks	**Task Duration**	**Projected Due Date**
NYSDEC Review of Final Remedial Design Document	1 Month	7/30/2021
Finalize Remedial Design Document	1 Week	7/30/2021
Preparation of Fact Sheet (NYSDEC)	1 Week	8/6/2021
Clean Basements including asbestos abatement to Prep for Foundation Slab Sealing	4 Weeks	9/3/2021
Soil Remediation, AS/SVE Piping Installation, Seal and Epoxy Slab and Equipment Build	≤ 8 Weeks	10/8/2021
AS/SVE System Installation* and System Start-up & Balancing	2-3 Weeks	10/29/2021
AS/SVE System Inspection	Monthly	--
AS/SVE System Monitoring/Sampling	--	10/2021 (Baseline after Start-up) + TBD: Each subsequent event at frequency designated in Section 8.0
Prepare AS/SVE Operations & Maintenance Manual, Prepare Site Management Plan and Prepare Final Engineering Report	4 Weeks	TBD

*We will notify NYSDEC at least one week prior to installing the system.

15.0 KEY PROJECT CONTACT LIST

Name	Title	Phone #	Email
Mr. Michael D. MacCabe, P.E.	NYSDEC Project Manager	(718) 482-4900	michael.maccabe@dec.ny.gov
Ms. Angela Martin	NYSDOH Project Manager	(518) 402-7860	angela.Martin@health.ny.gov
Mr. Charles Powers	CNS Project Manager	(516) 932-3228	cpowers@cnsenviro.com
Mr. Elliot Sasson, ECA Buligo Nostrand Partners, LP	Volunteer	(212) 213-1132	elliot@eastcoastacq.com
James P. Rigano	Attorney for Volunteer	(631) 756-5900	jrigano@riganollc.com

16.0 REFERENCES

1. New York State Department of Environmental Conservation - Office of Remediation and Materials Management DER-10 Technical Guidance for Site Investigation and Remediation, May 2010;

2. New York State Department of Environmental Conservation - Division of Environmental Remediation, 6 NYCRR Part 375 Environmental Remediation Programs, December 2006;

3. New York State Department of Environmental Conservation - Division of Water Technical and Operational Guidance Series (1.1.1), Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, (as revised June 1998);

4. New York State Department of Environmental Conservation - Office of Remediation and Materials Management, DER-23 Citizen Participation Handbook for Remedial Programs, January 2010;

5. New York State Department of Environmental Conservation – Office of Remediation and Materials Management, 6 NYCRR Part 360 Solid Waste Facilities, 1992

6. New York State Department of Environmental Conservation – Office of Remediation and Materials Management, 6 NYCRR Part 364 Waste Transporters, 1989

7. New York State Department of Health - Center for Environmental Health - Bureau of Environmental Exposure Investigation, Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006;

8. LCS Inc., Phase I Environmental Site Assessment, December 6, 2012;

9. CNS Management Corp., Phase II Investigation Report, May 28, 2013;

10. CNS Management Corp., Groundwater Investigation Report, December 5, 2013;

11. CNS Management Corp., 2nd Quarter 2014 Quarterly Groundwater Monitoring Report, April 25, 2014;

12. CNS Management Corp.,3rd Quarter 2014 Quarterly Groundwater Monitoring Report, July 30 2014;

13. CNS Management Corp.,4th Quarter 2014 Quarterly Groundwater Monitoring Report, October 29, 2014;

14. CNS Environmental Corp., 1st Quarter 2015 Quarterly Groundwater Monitoring Report, January 29, 2015;

15. CNS Environmental Corp., 2nd Quarter 2015 Quarterly Groundwater Monitoring Report, June 10, 2015;

16. CNS Environmental Corp., 3rd Quarter 2015 Quarterly Groundwater Monitoring Report, September 14, 2015;

17. CNS Environmental Corp., Soil Vapor Intrusion Investigation, September 21, 2015;

18. CNS Environmental Corp., Supplemental Phase II Site Investigation, November 17, 2015;

19. CNS Environmental Corp., 4th Quarter 2015 Quarterly Groundwater Monitoring Report, November 24, 2015;

20. CNS Environmental Corp., 1st Quarter 2016 Quarterly Groundwater Monitoring Report, April 7, 2016;

21. CNS Environmental Corp., Remedial Investigation Work Plan, July 2017;

22. CNS Environmental Corp., Draft Remedial Investigation Report, March 2018;

23. CNS Environmental Corp., Supplemental Remedial Investigation Work Plan, June 2018;

24. CNS Environmental Corp., Supplemental Remedial Investigation Report, September 2018.

25. CNS Environmental Corp., Remedial Action Work Plan and Alternatives Analysis Report, July 2019

FIGURE 1

Site Location Map

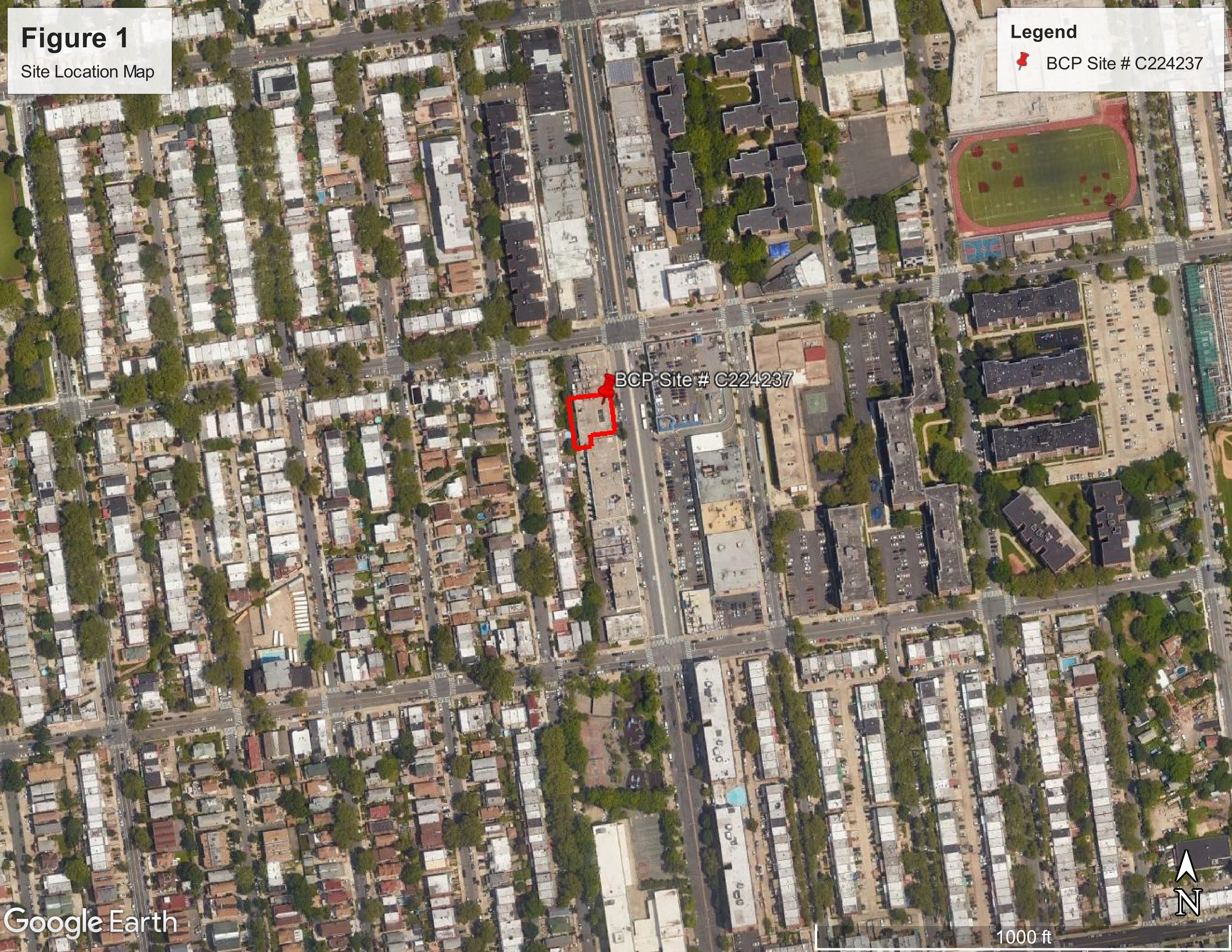

Figure 1
Site Location Map

FIGURE 2

BCP Site Plans

GENERAL

◎ = TREE/PLANTER

⊡ = SUMP PUMP

◉ = FLOOR DRAIN

□ ○ ⊡ ⊟ ▯ = COLUMNS

☁ = STAIN

∫ = FLOOR/WALL CRACK

• = FLOOR PENTRATION (CHASE BANK)

▯ = RODENTCIDE (CHASE BANK)

REMEDIAL INVESTIGATION

— - - — = BCP SITE BOUNDARY

▲ = PERMANENT GROUNDWATER MONITORING WELL/GROUNDWATER SAMPLE LOCATION

△ = TEMPORARY GROUNDWATER MONITORING WELL/GROUNDWATER SAMPLE LOCATION

◕ = SOIL BORING/SAMPLE LOCATION

● = SUB-SLAB (SS) SOIL VAPOR IMPLANT/SAMPLE LOCATION

● = INDOOR AIR (IA) SAMPLE LOCATION

● = AMBIENT OUTDOOR AIR (AA) SAMPLE LOCATION

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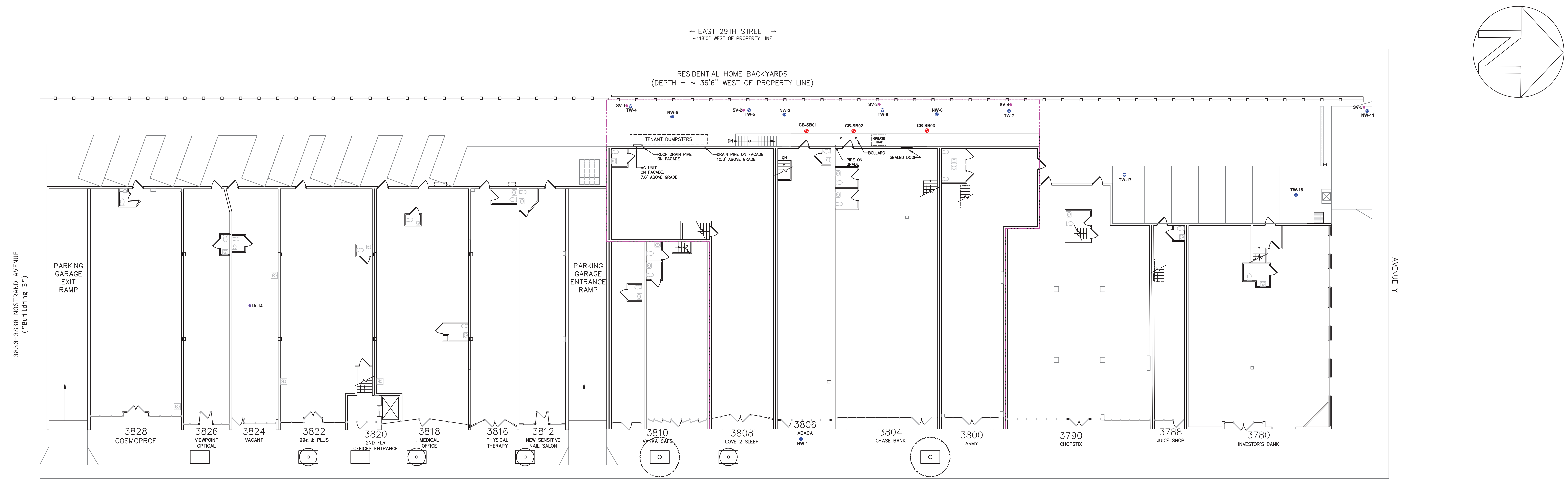
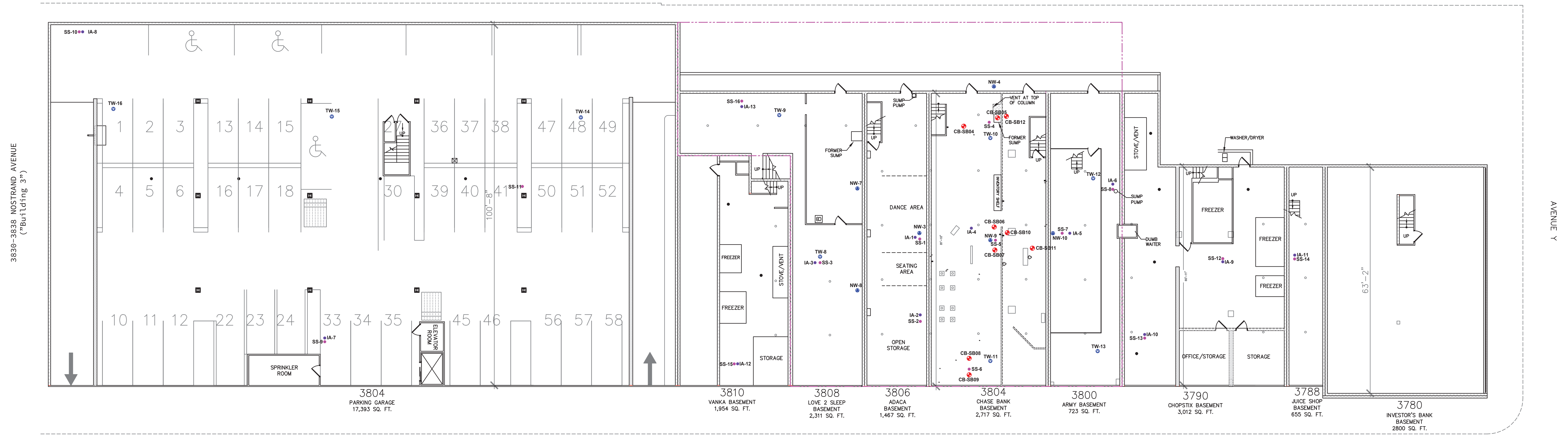
FIGURE 2.0

LEGEND

PREPARED FOR:	Acadia 3780-3858 Nostrand Avenue, LLC 411 Theodore Fremd Avenue, Suite 300, Rye, New York 10580				
SITE:	“Former” Debbie Cleaners 3800-3808 Nostrand Avenue Brooklyn, New York 11235 BCP Site # C224237				
SCALE:	1” = 16’	DATE:	10/2018	CNS JOB #:	D196
DWN BY:	JL	CHKD BY:	CP	APPRVD BY:	MH



STREET LEVEL



BASEMENT LEVEL

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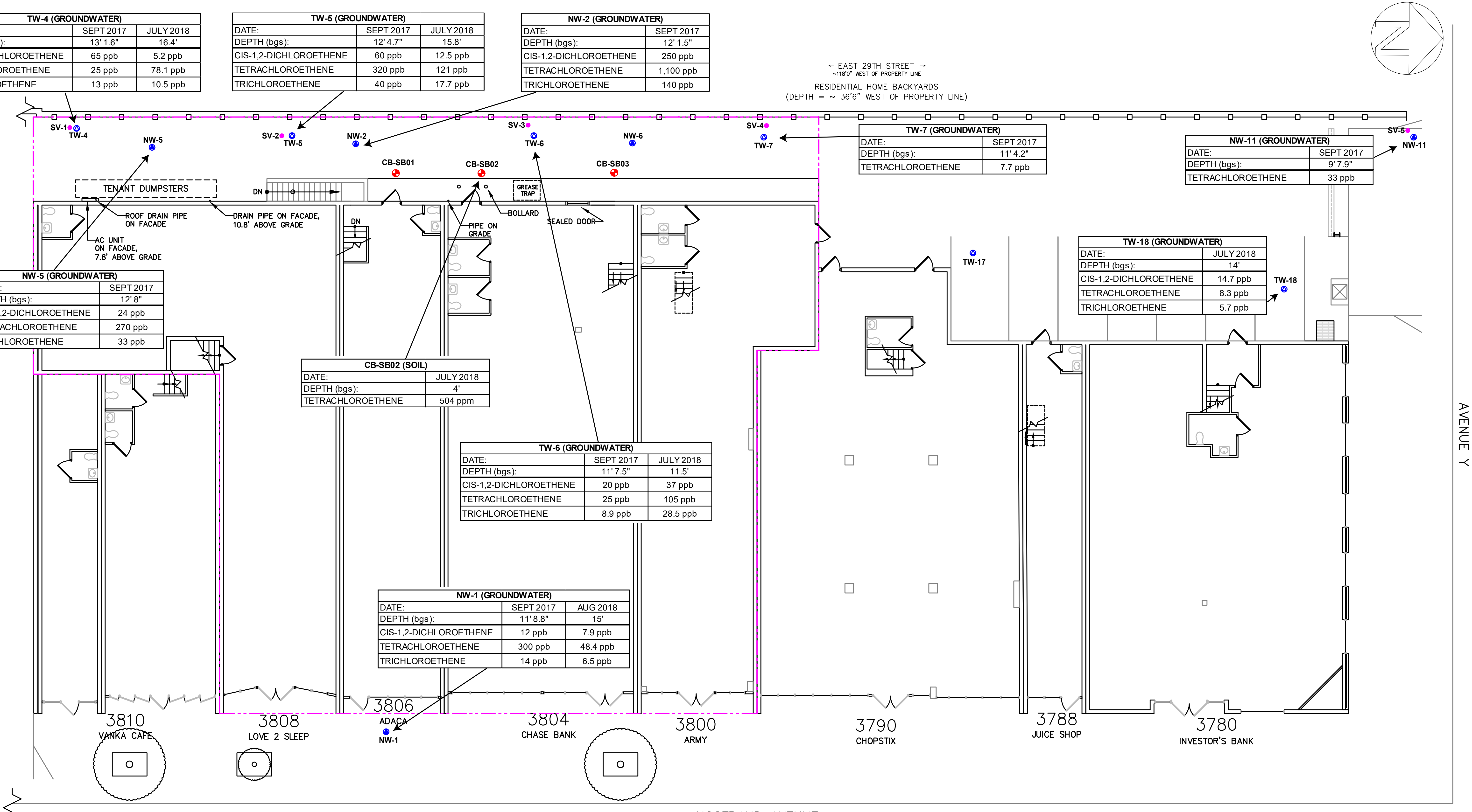
FIGURE 2.1

OVERALL SITE PLAN

PREPARED FOR:	Acadia 3780-3858 Nostrand Avenue, LLC 411 Theodore Fremd Avenue, Suite 300, Rye, New York 10580				
SITE:	"Former" Debbie Cleaners 3800-3808 Nostrand Avenue Brooklyn, New York 11235 BCP Site # C224237				
SCALE:	1" = 16'	**DATE:**	10/2018	**CNS JOB #:**	D196
DWN BY:	JL	**CHKD BY:**	CP	**APPRVD BY:**	MH



TW-4 (GROUNDWATER)		
DATE:	SEPT 2017	JULY 2018
DEPTH (bgs):	13' 1.6"	16.4'
CIS-1,2-DICHLOROETHENE	65 ppb	5.2 ppb
TETRACHLOROETHENE	25 ppb	78.1 ppb
TRICHLOROETHENE	13 ppb	10.5 ppb

TW-5 (GROUNDWATER)		
DATE:	SEPT 2017	JULY 2018
DEPTH (bgs):	12' 4.7"	15.8'
CIS-1,2-DICHLOROETHENE	60 ppb	12.5 ppb
TETRACHLOROETHENE	320 ppb	121 ppb
TRICHLOROETHENE	40 ppb	17.7 ppb

NW-2 (GROUNDWATER)	
DATE:	SEPT 2017
DEPTH (bgs):	12' 1.5"
CIS-1,2-DICHLOROETHENE	250 ppb
TETRACHLOROETHENE	1,100 ppb
TRICHLOROETHENE	140 ppb

TW-7 (GROUNDWATER)	
DATE:	SEPT 2017
DEPTH (bgs):	11' 4.2"
TETRACHLOROETHENE	7.7 ppb

NW-11 (GROUNDWATER)	
DATE:	SEPT 2017
DEPTH (bgs):	9' 7.9"
TETRACHLOROETHENE	33 ppb

TW-18 (GROUNDWATER)	
DATE:	JULY 2018
DEPTH (bgs):	14'
CIS-1,2-DICHLOROETHENE	14.7 ppb
TETRACHLOROETHENE	8.3 ppb
TRICHLOROETHENE	5.7 ppb

NW-5 (GROUNDWATER)	
DATE:	SEPT 2017
DEPTH (bgs):	12' 8"
CIS-1,2-DICHLOROETHENE	24 ppb
TETRACHLOROETHENE	270 ppb
TRICHLOROETHENE	33 ppb

CB-SB02 (SOIL)	
DATE:	JULY 2018
DEPTH (bgs):	4'
TETRACHLOROETHENE	504 ppm

TW-6 (GROUNDWATER)		
DATE:	SEPT 2017	JULY 2018
DEPTH (bgs):	11' 7.5"	11.5'
CIS-1,2-DICHLOROETHENE	20 ppb	37 ppb
TETRACHLOROETHENE	25 ppb	105 ppb
TRICHLOROETHENE	8.9 ppb	28.5 ppb

NW-1 (GROUNDWATER)		
DATE:	SEPT 2017	AUG 2018
DEPTH (bgs):	11' 8.8"	15'
CIS-1,2-DICHLOROETHENE	12 ppb	7.9 ppb
TETRACHLOROETHENE	300 ppb	48.4 ppb
TRICHLOROETHENE	14 ppb	6.5 ppb

STREET LEVEL

RESULTS SHOWN EXCEED THE NYSDEC COMMERCIAL SCOS (FOR SOIL) OR THE NYSDEC AWQS (FOR GROUNDWATER)

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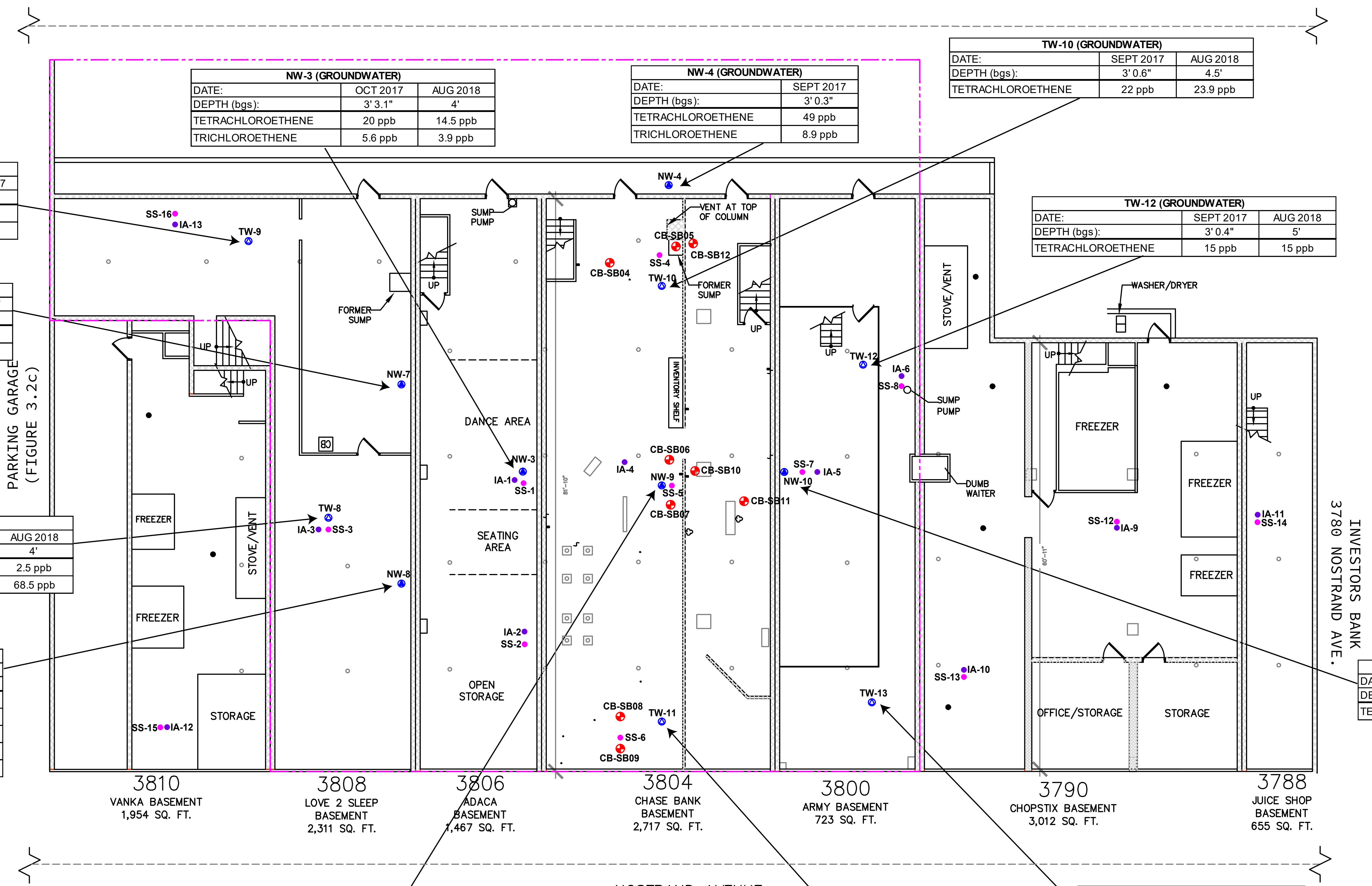
FIGURE 2.2a

STREET LEVEL
SOIL & GROUNDWATER
EXCEEDANCES

PREPARED FOR:	Acadia 3780-3858 Nostrand Avenue, LLC 411 Theodore Fremd Avenue, Suite 300, Rye, New York 10580				
SITE:	"Former" Debbie Cleaners 3800-3808 Nostrand Avenue Brooklyn, New York 11235 BCP Site # C224237				
SCALE:	1" = 16'	DATE:	09/2018	CNS JOB #:	D196
DWN BY:	JL	CHKD BY:	CP	APPRVD BY:	MH

LEGEND

- -·-·- = BCP SITE BOUNDARY
- ▲ = PERMANENT GROUNDWATER MONITORING WELL/GROUNDWATER SAMPLE LOCATION
- △ = TEMPORARY GROUNDWATER MONITORING WELL/GROUNDWATER SAMPLE LOCATION
- ⊕ = SOIL BORING/SAMPLE LOCATION
- ● = SUB-SLAB (SS) SOIL VAPOR IMPLANT/SAMPLE LOCATION



NW-3 (GROUNDWATER)

DATE:	OCT 2017	AUG 2018
DEPTH (bgs):	3' 3.1"	4'
TETRACHLOROETHENE	20 ppb	14.5 ppb
TRICHLOROETHENE	5.6 ppb	3.9 ppb

NW-4 (GROUNDWATER)

DATE:	SEPT 2017
DEPTH (bgs):	3' 0.3"
TETRACHLOROETHENE	49 ppb
TRICHLOROETHENE	8.9 ppb

TW-10 (GROUNDWATER)

DATE:	SEPT 2017	AUG 2018
DEPTH (bgs):	3' 0.6"	4.5'
TETRACHLOROETHENE	22 ppb	23.9 ppb

TW-9 (GROUNDWATER)

DATE:	SEPT 2017
DEPTH (bgs):	3' 1.7"
TETRACHLOROETHENE	280 ppb
TRICHLOROETHENE	28 ppb

TW-12 (GROUNDWATER)

DATE:	SEPT 2017	AUG 2018
DEPTH (bgs):	3' 0.4"	5'
TETRACHLOROETHENE	15 ppb	15 ppb

NW-7 (GROUNDWATER)

DATE:	SEPT 2017
DEPTH (bgs):	3' 2.7"
TETRACHLOROETHENE	80 ppb
TRICHLOROETHENE	6.9 ppb

TW-8 (GROUNDWATER)

DATE:	SEPT 2017	AUG 2018
DEPTH (bgs):	3' 1.5"	4'
CIS-1,2-DICHLOROETHENE	5.7 ppb	2.5 ppb
TETRACHLOROETHENE	34 ppb	68.5 ppb

NW-8 (GROUNDWATER)

DATE:	SEPT 2017
DEPTH (bgs):	3' 0.9"
TETRACHLOROETHENE	52 ppb
BENZ(A)ANTHRACENE	0.03 ppb
CHRYSENE	0.03 ppb
4,4'-DDT	0.26 ppb
DIELDRIN	0.011 ppb

NW-10 (GROUNDWATER)

DATE:	SEPT 2017
DEPTH (bgs):	3' 1.7"
TETRACHLOROETHENE	22 ppb

BASEMENT LEVEL

NW-9 (GROUNDWATER)

DATE:	SEPT 2017
DEPTH (bgs):	3' 1.2"
TETRACHLOROETHENE	24 ppb

TW-11 (GROUNDWATER)

DATE:	SEPT 2017
DEPTH (bgs):	3' 0.9"
TRICHLOROETHENE	5.6 ppb

TW-13 (GROUNDWATER)

DATE:	AUG 2018
DEPTH (bgs):	5'
TETRACHLOROETHENE	14 ppb

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FIGURE 2.2b
BASEMENT LEVEL
(3788-3810 Nostrand Ave.)
SOIL & GROUNDWATER EXCEEDANCES

PREPARED FOR:	Acadia 3780-3858 Nostrand Avenue, LLC 411 Theodore Fremd Avenue, Suite 300, Rye, New York 10580				
SITE:	“Former” Debbie Cleaners 3800-3808 Nostrand Avenue Brooklyn, New York 11235 BCP Site # C224237				
SCALE:	1” = 16’	DATE:	09/2018	CNS JOB #:	D196
DWN BY:	JL	CHKD BY:	CP	APPRVD BY:	MH

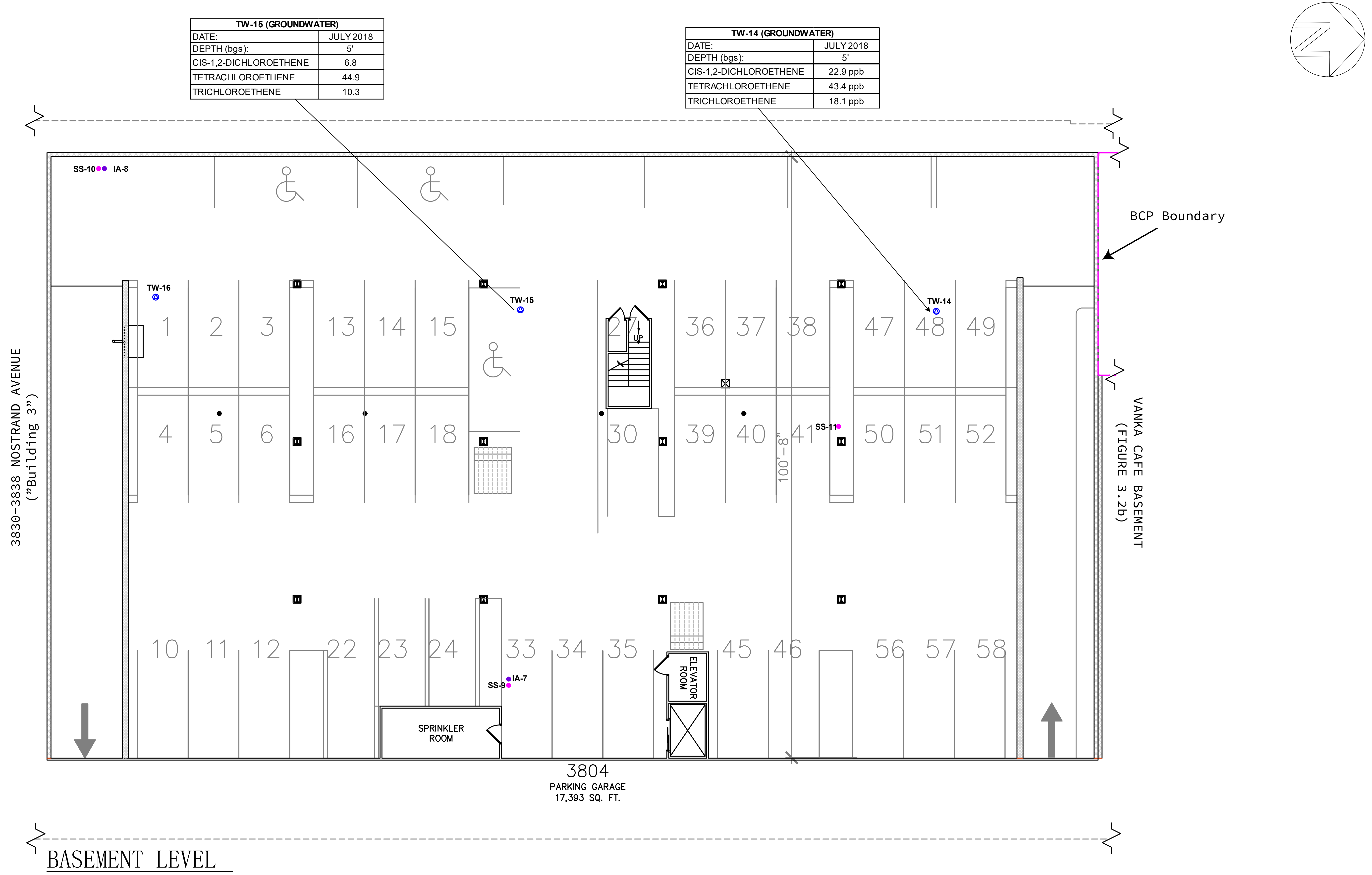
LEGEND

- - - = BCP SITE BOUNDARY
▲ = PERMANENT GROUNDWATER MONITORING WELL/GROUNDWATER SAMPLE LOCATION
△ = TEMPORARY GROUNDWATER MONITORING WELL/GROUNDWATER SAMPLE LOCATION
◐ = SOIL BORING/SAMPLE LOCATION
● = SUB-SLAB (SS) SOIL VAPOR IMPLANT/SAMPLE LOCATION
● = INDOOR AIR (IA) SAMPLE LOCATION

RESULTS SHOWN EXCEED THE NYSDEC AWQS (FOR GROUNDWATER)

TW-15 (GROUNDWATER)	
DATE:	JULY 2018
DEPTH (bgs):	5'
CIS-1,2-DICHLOROETHENE	6.8
TETRACHLOROETHENE	44.9
TRICHLOROETHENE	10.3

TW-14 (GROUNDWATER)	
DATE:	JULY 2018
DEPTH (bgs):	5'
CIS-1,2-DICHLOROETHENE	22.9 ppb
TETRACHLOROETHENE	43.4 ppb
TRICHLOROETHENE	18.1 ppb



BASEMENT LEVEL

CNS ENVIRONMENTAL
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208 NEWTOWN ROAD
PLAINVIEW, NY 11803

FIGURE 2.2c

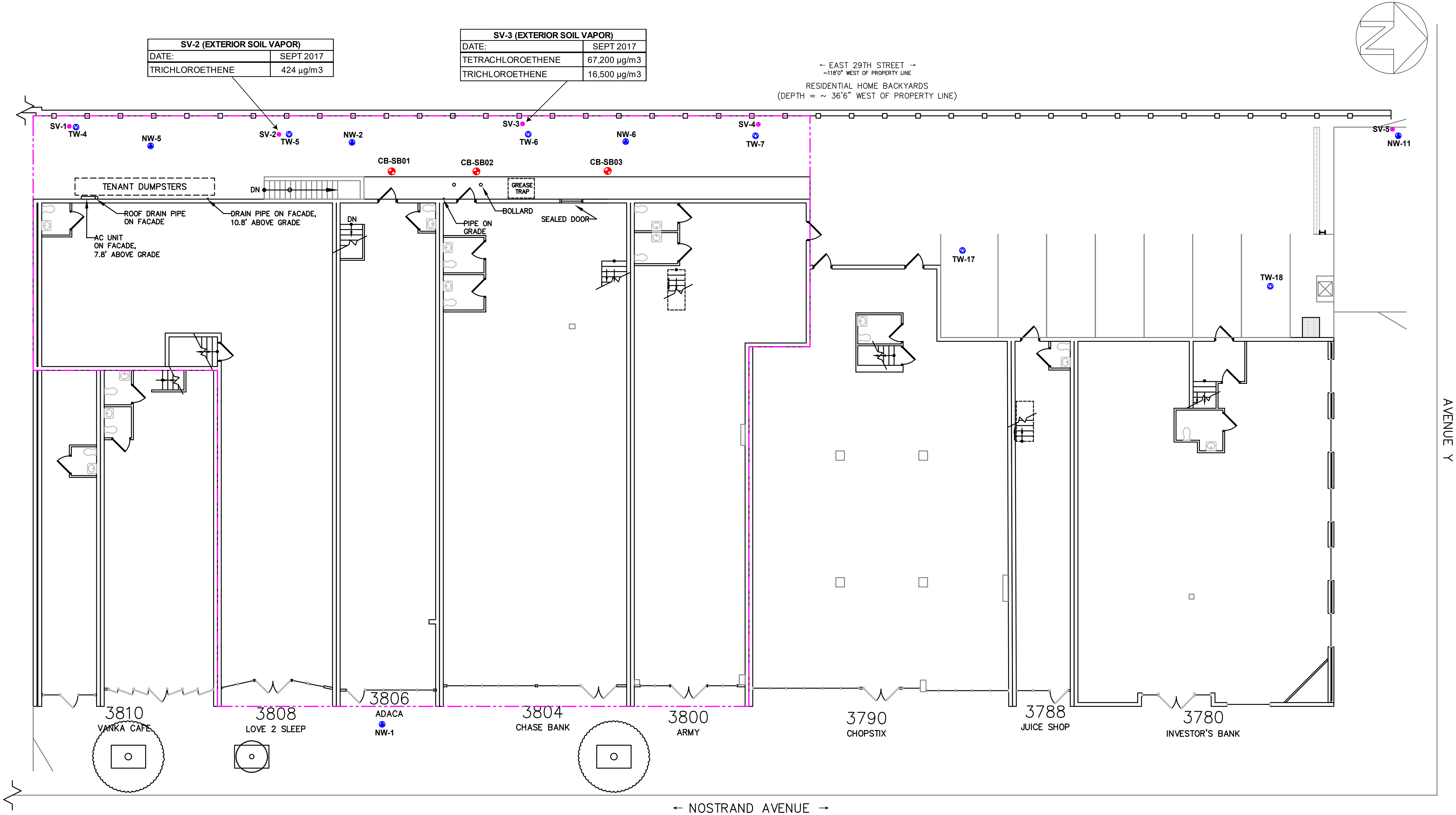
BASEMENT LEVEL
(Parking Garage)
SOIL & GROUNDWATER
EXCEEDANCES

PREPARED FOR:	Acadia 3780-3858 Nostrand Avenue, LLC 411 Theodore Fremd Avenue, Suite 300, Rye, New York 10580				
SITE:	"Former" Debbie Cleaners 3800-3808 Nostrand Avenue Brooklyn, New York 11235 BCP Site # C224237				
SCALE:	1" = 16'	DATE:	09/2018	CNS JOB #:	D196
DWN BY:	JL	CHKD BY:	CP	APPRVD BY:	MH

LEGEND

- -·-·- = BCP SITE BOUNDARY
- ▲ = PERMANENT GROUNDWATER MONITORING WELL/GROUNDWATER SAMPLE LOCATION
- △ = TEMPORARY GROUNDWATER MONITORING WELL/GROUNDWATER SAMPLE LOCATION
- ⊕ = SOIL BORING/SAMPLE LOCATION
- ● = SUB-SLAB (SS) SOIL VAPOR IMPLANT/SAMPLE LOCATION
- ● = INDOOR AIR (IA) SAMPLE LOCATION

RESULTS SHOWN EXCEED THE NYSDEC AWQS (FOR GROUNDWATER)



SV-2 (EXTERIOR SOIL VAPOR)	
DATE:	SEPT 2017
TRICHLOROETHENE	424 µg/m3

SV-3 (EXTERIOR SOIL VAPOR)	
DATE:	SEPT 2017
TETRACHLOROETHENE	67,200 µg/m3
TRICHLOROETHENE	16,500 µg/m3

STREET LEVEL

RESULTS SHOWN EXCEED THE NYSDOH MINIMUM DECISION MATRIX VALUES FOR SOIL VAPOR

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PLAINVIEW, NY 11803

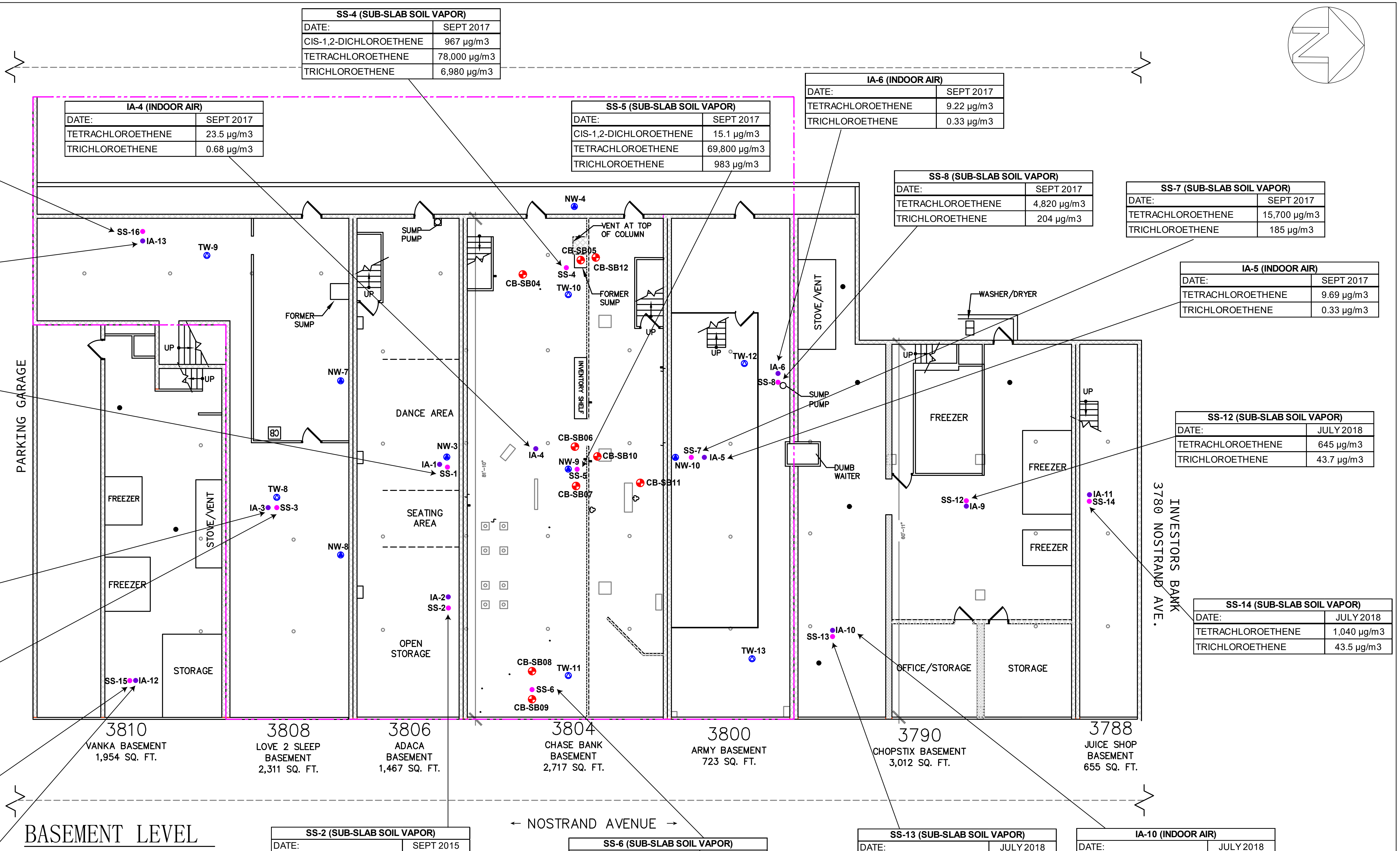
FIGURE 2.3a

STREET LEVEL
SOIL VAPOR
EXCEEDANCES

PREPARED FOR:	Acadia 3780-3858 Nostrand Avenue, LLC 411 Theodore Fremd Avenue, Suite 300, Rye, New York 10580				
SITE:	"Former" Debbie Cleaners 3800-3808 Nostrand Avenue Brooklyn, New York 11235 BCP Site # C224237				
SCALE:	1" = 16'	DATE:	09/2018	CNS JOB #:	D196
DWN BY:	JL	CHKD BY:	CP	APPRVD BY:	MH

LEGEND

- - - = BCP SITE BOUNDARY
▲ = PERMANENT GROUNDWATER MONITORING WELL/GROUNDWATER SAMPLE LOCATION
△ = TEMPORARY GROUNDWATER MONITORING WELL/GROUNDWATER SAMPLE LOCATION
⊕ = SOIL BORING/SAMPLE LOCATION
● = SUB-SLAB (SS) SOIL VAPOR IMPLANT/SAMPLE LOCATION



BASEMENT LEVEL

SS-4 (SUB-SLAB SOIL VAPOR)	
DATE:	SEPT 2017
CIS-1,2-DICHLOROETHENE	967 µg/m3
TETRACHLOROETHENE	78,000 µg/m3
TRICHLOROETHENE	6,980 µg/m3

IA-6 (INDOOR AIR)	
DATE:	SEPT 2017
TETRACHLOROETHENE	9.22 µg/m3
TRICHLOROETHENE	0.33 µg/m3

IA-4 (INDOOR AIR)	
DATE:	SEPT 2017
TETRACHLOROETHENE	23.5 µg/m3
TRICHLOROETHENE	0.68 µg/m3

SS-5 (SUB-SLAB SOIL VAPOR)	
DATE:	SEPT 2017
CIS-1,2-DICHLOROETHENE	15.1 µg/m3
TETRACHLOROETHENE	69,800 µg/m3
TRICHLOROETHENE	983 µg/m3

SS-16 (SUB-SLAB SOIL VAPOR)	
DATE:	JULY 2018
TETRACHLOROETHENE	1,220 µg/m3
TRICHLOROETHENE	57.5 µg/m3

SS-8 (SUB-SLAB SOIL VAPOR)	
DATE:	SEPT 2017
TETRACHLOROETHENE	4,820 µg/m3
TRICHLOROETHENE	204 µg/m3

SS-7 (SUB-SLAB SOIL VAPOR)	
DATE:	SEPT 2017
TETRACHLOROETHENE	15,700 µg/m3
TRICHLOROETHENE	185 µg/m3

IA-13 (INDOOR AIR)	
DATE:	JULY 2018
TETRACHLOROETHENE	12.7 µg/m3
TRICHLOROETHENE	0.34 µg/m3

IA-5 (INDOOR AIR)	
DATE:	SEPT 2017
TETRACHLOROETHENE	9.69 µg/m3
TRICHLOROETHENE	0.33 µg/m3

SS-1 (SUB-SLAB SOIL VAPOR)	
DATE:	APRIL 2013
CIS-1,2-DICHLOROETHENE	6.54 µg/m3
TETRACHLOROETHENE	120,000 µg/m3
TRICHLOROETHENE	628 µg/m3

SS-12 (SUB-SLAB SOIL VAPOR)	
DATE:	JULY 2018
TETRACHLOROETHENE	645 µg/m3
TRICHLOROETHENE	43.7 µg/m3

IA-3 (INDOOR AIR)	
DATE:	SEPT 2017
CIS-1,2-DICHLOROETHENE	0.27 µg/m3
TETRACHLOROETHENE	5.27 µg/m3

SS-14 (SUB-SLAB SOIL VAPOR)	
DATE:	JULY 2018
TETRACHLOROETHENE	1,040 µg/m3
TRICHLOROETHENE	43.5 µg/m3

SS-3 (SUB-SLAB SOIL VAPOR)	
DATE:	SEPT 2017
TETRACHLOROETHENE	48,300 µg/m3
TRICHLOROETHENE	527 µg/m3

SS-15 (SUB-SLAB SOIL VAPOR)	
DATE:	JULY 2018
TETRACHLOROETHENE	5,350 µg/m3
TRICHLOROETHENE	286 µg/m3

IA-12 (INDOOR AIR)	
DATE:	JULY 2018
TETRACHLOROETHENE	4.27 µg/m3

SS-2 (SUB-SLAB SOIL VAPOR)	
DATE:	SEPT 2015
TETRACHLOROETHENE	67,800 µg/m3
TRICHLOROETHENE	409 µg/m3

SS-6 (SUB-SLAB SOIL VAPOR)	
DATE:	SEPT 2017
CIS-1,2-DICHLOROETHENE	8.28 µg/m3
TETRACHLOROETHENE	11,100 µg/m3
TRICHLOROETHENE	393 µg/m3

SS-13 (SUB-SLAB SOIL VAPOR)	
DATE:	JULY 2018
TETRACHLOROETHENE	2,030 µg/m3
TRICHLOROETHENE	58.5 µg/m3

IA-10 (INDOOR AIR)	
DATE:	JULY 2018
TETRACHLOROETHENE	6.91 µg/m3
TRICHLOROETHENE	0.33 µg/m3

CNS ENVIRONMENTAL
A REAL ESTATE SERVICES COMPANY
208 NEWTOWN ROAD
PLAINVIEW, NY 11803

FIGURE 2.3b
BASEMENT LEVEL
(3788-3810 Nostrand Ave.)
SOIL VAPOR & INDOOR AIR
EXCEEDANCES

PREPARED FOR:	Acadia 3780-3858 Nostrand Avenue, LLC 411 Theodore Fremd Avenue, Suite 300, Rye, New York 10580				
SITE:	"Former" Debbie Cleaners 3800-3808 Nostrand Avenue Brooklyn, New York 11235 BCP Site # C224237				
SCALE:	1" = 16'	DATE:	09/2018	CNS JOB #:	D196
DWN BY:	JL	CHKD BY:	CP	APPRVD BY:	MH

LEGEND

- = BCP SITE BOUNDARY
- ▲ = PERMANENT GROUNDWATER MONITORING WELL/GROUNDWATER SAMPLE LOCATION
- △ = TEMPORARY GROUNDWATER MONITORING WELL/GROUNDWATER SAMPLE LOCATION
- ◐ = SOIL BORING/SAMPLE LOCATION
- ● = SUB-SLAB (SS) SOIL VAPOR IMPLANT/SAMPLE LOCATION
- ● = INDOOR AIR (IA) SAMPLE LOCATION

RESULTS SHOWN EXCEED THE NYSDOH MINIMUM DECISION MATRIX VALUES FOR SOIL VAPOR OR INDOOR AIR

FIGURE 3

Remedial Design Legend and Notes

GENERAL

◎	= TREE/PLANTER
⊡	= SUMP PUMP
◎	= FLOOR DRAIN
□ ○ ⊡ ⊡ ▯	= COLUMNS
☁	= STAIN
∫	= FLOOR/WALL CRACK
•	= FLOOR PENTRATION (CHASE BANK)
▯	= RODENTCIDE (CHASE BANK)

REMEDIAL DESIGN

— - - —	= BCP SITE BOUNDARY
⬚	= PROPOSED SOIL EXCAVATION AREA
●	= IN-SITU PRE-EXCAVATION WASTE CHARACTERIZATION SOIL BORING (AUGUST 2020)
▨	= PROPOSED AS/SVE SYSTEM LOCATION
⊕	= PROPOSED SOIL VAPOR EXTRACTION (SVE) WELL
◌	= SOIL VAPOR EXTRACTION (SVE) RADIUS OF INFLUENCE (ROI)
⊕ *or* ▲	= PROPOSED AIR SPARGING (AS) INJECTION WELL
▲	= EXISTING PERMANENT GROUNDWATER OBSERVATION WELL to be SAMPLED on ***SEMI-ANNUAL BASIS***
●	= EXISTING PERMANENT VAPOR MONITORING POINT to be SAMPLED on ***SEMI-ANNUAL BASIS***
▲	= EXISTING PERMANENT GROUNDWATER OBSERVATION WELL to be SAMPLED on ***BI-ANNUAL BASIS***
●	= EXISTING PERMANENT VAPOR MONITORING POINT to be SAMPLED on ***BI-ANNUAL BASIS***
▲	= EXISTING GROUNDWATER MONITORING WELL to be ***ABANDONED***
⋈	= SVE GATE VALVE
Ⓥ	= SVE VACUUM GAUGE

DATE	REVISION	BY	APVD
4/1/21	ADDED DESCRIPTIONS	JL	CP

DWN BY: **JL**
CHKD BY: **MH**
APVD BY: **CP**

SITE NO. **BCP C224237**

"FORMER" DEBBIE CLEANERS
3800-3808 NOSTRAND AVENUE
BROOKLYN, NY 11235

FIGURE 3

COMBINED AS/SVE SYSTEM
REMEDIAL DESIGN LEGEND & NOTES

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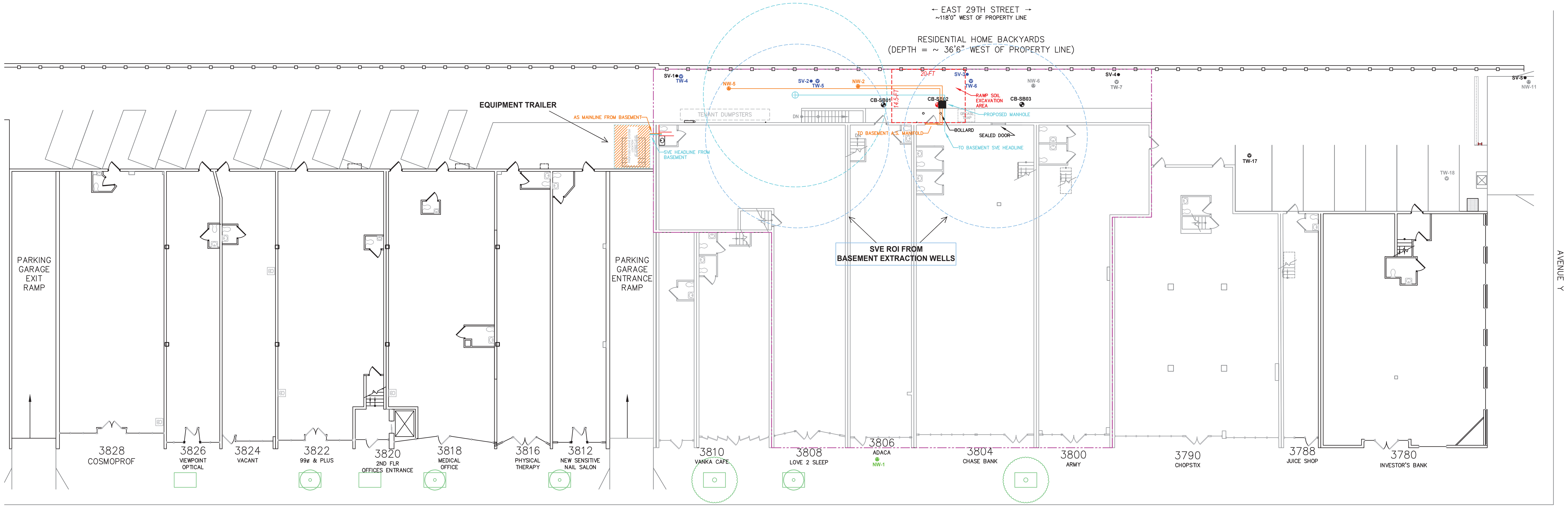
208 NEWTOWN RD
PLAINVIEW, NY 11803
www.cnsenviro.com

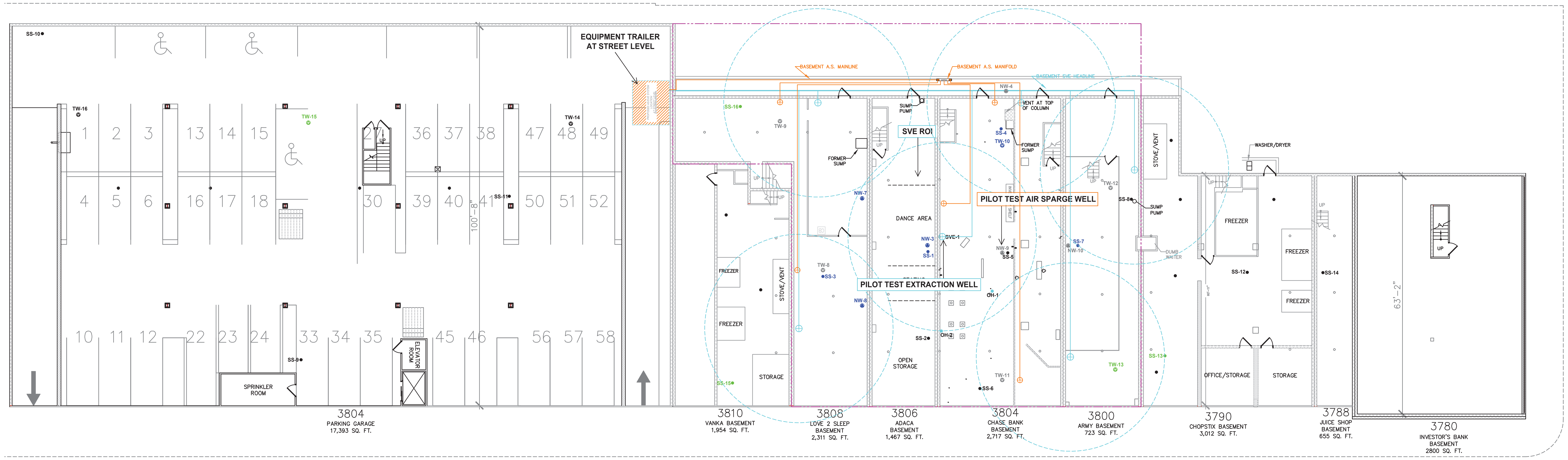
DATE **02/26/2021**
CNS JOB # **D196**
SCALE
AS NOTED

FIGURE 4

Overall Remedial Design Site Plan



STREET LEVEL



BASEMENT LEVEL

DATE	REVISION	BY	APVD
4/1/21	ADDED DIMENTIONS OF EXCAVATION AREA	JL	CP

DWN BY: JL
CHKD BY: MH
APVD BY: CP

SITE NO.
BCP C224237

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FIGURE 4
OVERALL REMEDIAL DESIGN SITE PLAN

CNS ENVIRONMENTAL
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208 NEWTOWN RD
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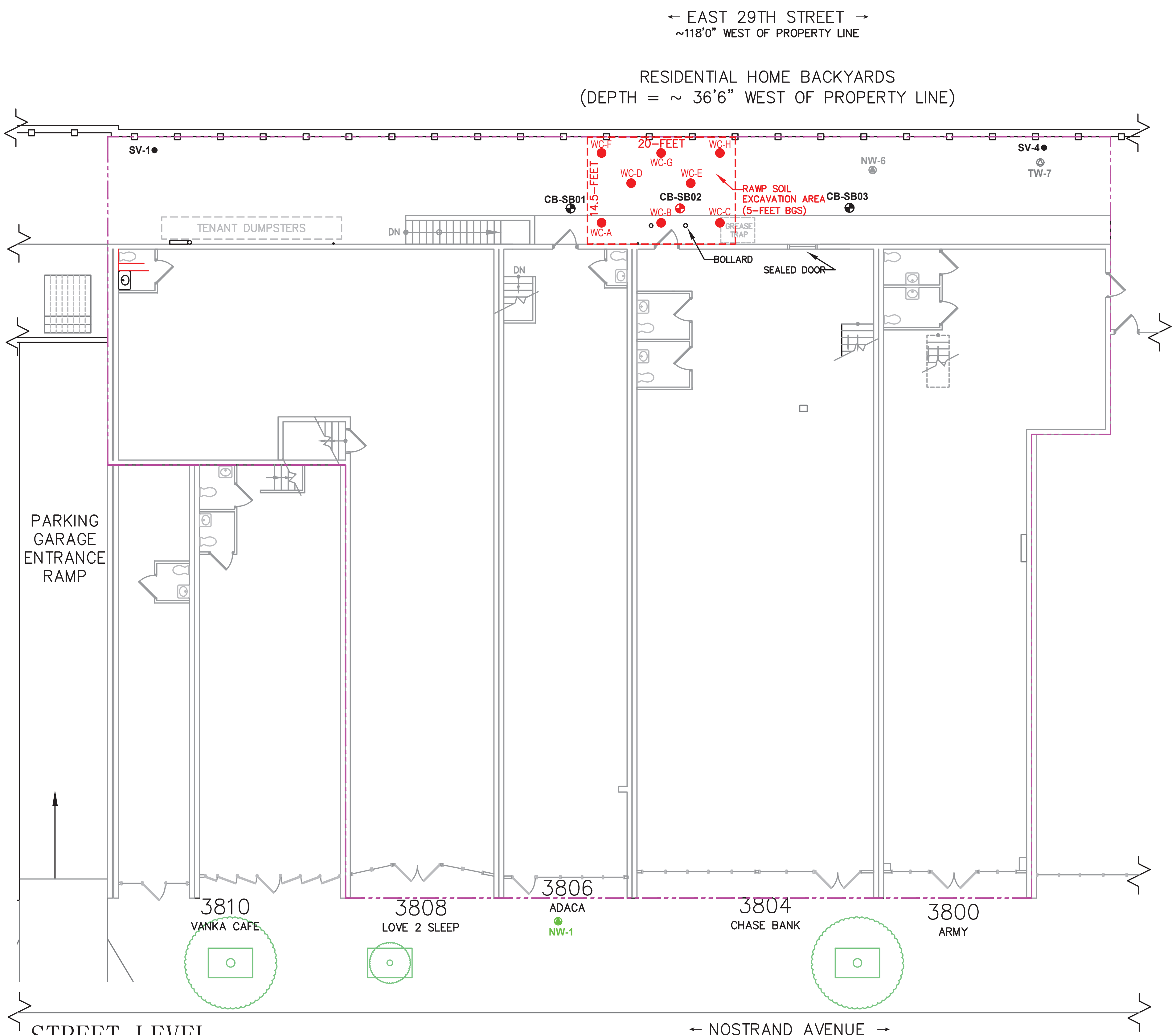
www.cnsenviro.com

DATE 02/26/2021
CNS JOB # D196
SCALE 1/16" = 1'0"

FIGURE 5

Street Level Remedial Design - Soil Excavation



STREET LEVEL

GENERAL

◌ = TREE/PLANTER
▢ = SUMP PUMP
⊛ = FLOOR DRAIN
□ ○ ▫ ▣ ▯ = COLUMNS
☁ = STAIN
∫ = FLOOR/WALL CRACK
• = FLOOR PENTRATION (CHASE BANK)
▯ = RODENTCIDE (CHASE BANK)

REMEDIAL DESIGN

— - - — = BCP SITE BOUNDARY
▭ = PROPOSED SOIL EXCAVATION AREA
● = IN-SITU PRE-EXCAVATION WASTE CHARACTERIZATION SOIL BORING (AUGUST 2020)
▨ = PROPOSED AS/SVE SYSTEM LOCATION
⊕ = PROPOSED SOIL VAPOR EXTRACTION (SVE) WELL
◌ = SOIL VAPOR EXTRACTION (SVE) RADIUS OF INFLUENCE (ROI)
⊕ *or* ▲ = PROPOSED AIR SPARGING (AS) INJECTION WELL
▲ = EXISTING PERMANENT GROUNDWATER OBSERVATION WELL to be SAMPLED on ***SEMI-ANNUAL BASIS***
● = EXISTING PERMANENT VAPOR MONITORING POINT to be SAMPLED on ***SEMI-ANNUAL BASIS***
▲ = EXISTING PERMANENT GROUNDWATER OBSERVATION WELL to be SAMPLED on ***BI-ANNUAL BASIS***
● = EXISTING PERMANENT VAPOR MONITORING POINT to be SAMPLED on ***BI-ANNUAL BASIS***
▲ = EXISTING GROUNDWATER MONITORING WELL to be ***ABANDONED***
⋈ = SVE GATE VALVE
Ⓥ = SVE VACUUM GAUGE

DATE	REVISION	BY	APVD

DWN BY: **JL**
CHKD BY: **MH**
APVD BY: **CP**

SITE NO. **BCP C224237**

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FIGURE 5

STREET LEVEL
REMEDIAL DESIGN - SOIL EXCAVATION

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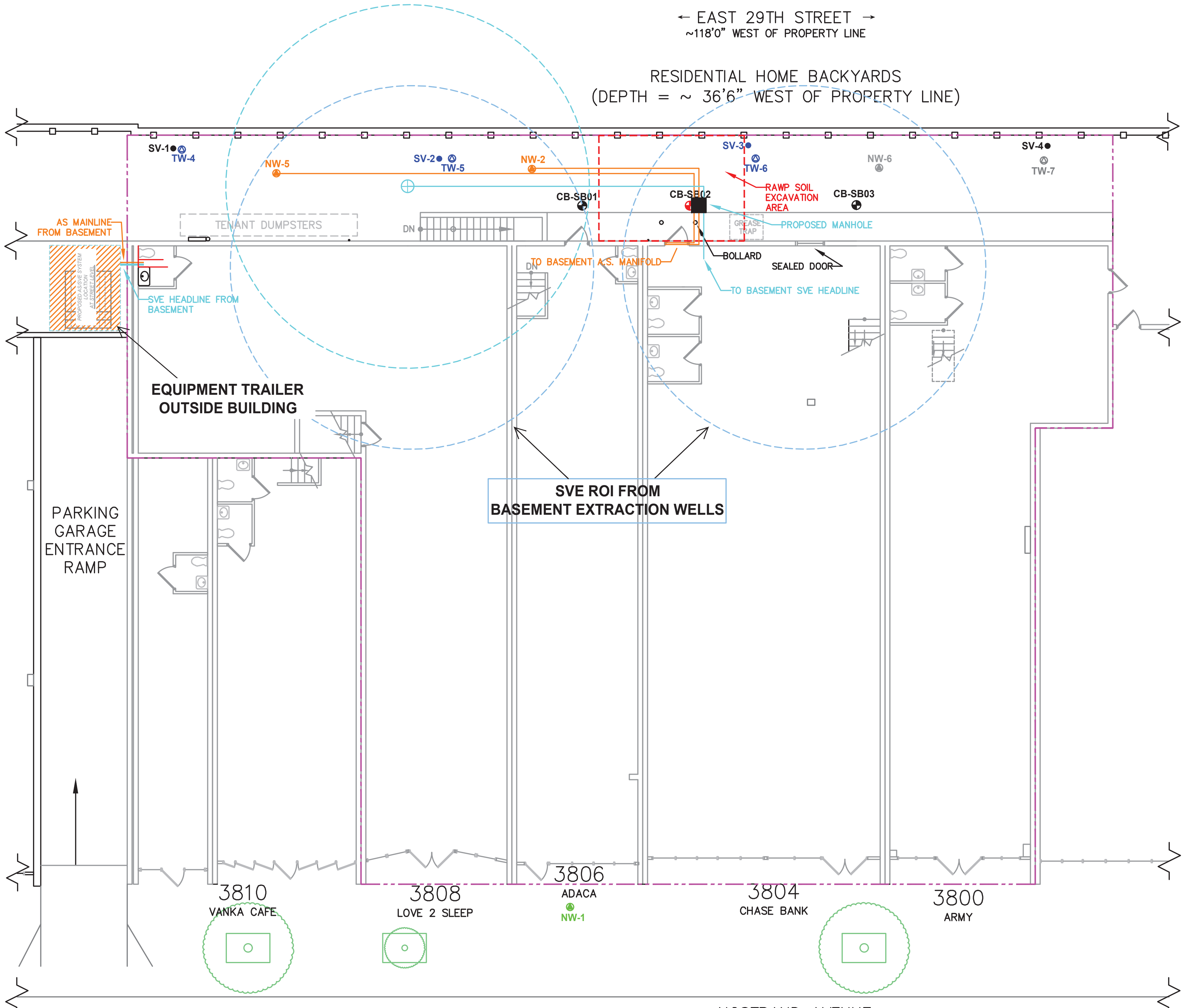
PLAINVIEW, NY 11803
www.cnsenviro.com

DATE **04/01/2021**
CNS JOB # **D196**
SCALE **1/16" = 1' 0"**

FIGURE 6

Street Level Remedial Design – AS/SVE System



STREET LEVEL

GENERAL	
◎	= TREE/PLANTER
◻	= SUMP PUMP
◍	= FLOOR DRAIN
□ ○ ▫ ▣ ▯	= COLUMNS
✿	= STAIN
∫	= FLOOR/WALL CRACK
•	= FLOOR PENTRATION (CHASE BANK)
▯	= RODENTCIDE (CHASE BANK)

REMEDIAL DESIGN	
—·-·—	= BCP SITE BOUNDARY
⬚	= PROPOSED SOIL EXCAVATION AREA
●	= IN-SITU PRE-EXCAVATION WASTE CHARACTERIZATION SOIL BORING (AUGUST 2020)
▨	= PROPOSED AS/SVE SYSTEM LOCATION
⊕	= PROPOSED SOIL VAPOR EXTRACTION (SVE) WELL
◌	= SOIL VAPOR EXTRACTION (SVE) RADIUS OF INFLUENCE (ROI)
⊕ *or* ▲	= PROPOSED AIR SPARGING (AS) INJECTION WELL
▲	= EXISTING PERMANENT GROUNDWATER OBSERVATION WELL to be SAMPLED on ***SEMI-ANNUAL BASIS***
●	= EXISTING PERMANENT VAPOR MONITORING POINT to be SAMPLED on ***SEMI-ANNUAL BASIS***
▲	= EXISTING PERMANENT GROUNDWATER OBSERVATION WELL to be SAMPLED on ***BI-ANNUAL BASIS***
●	= EXISTING PERMANENT VAPOR MONITORING POINT to be SAMPLED on ***BI-ANNUAL BASIS***
▲	= EXISTING GROUNDWATER MONITORING WELL to be ***ABANDONED***
⋈	= SVE GATE VALVE
Ⓥ	= SVE VACUUM GAUGE

DATE	REVISION	BY	APVD
4/1/21	ADDED LEGEND	JL	CP

DWN BY: JL
CHKD BY: MH
APVD BY: CP

SITE NO. BCP C224237

"FORMER" DEBBIE CLEANERS
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BROOKLYN, NY 11235

FIGURE 6

STREET LEVEL
REMEDIAL DESIGN - AS/SVE SYSTEM

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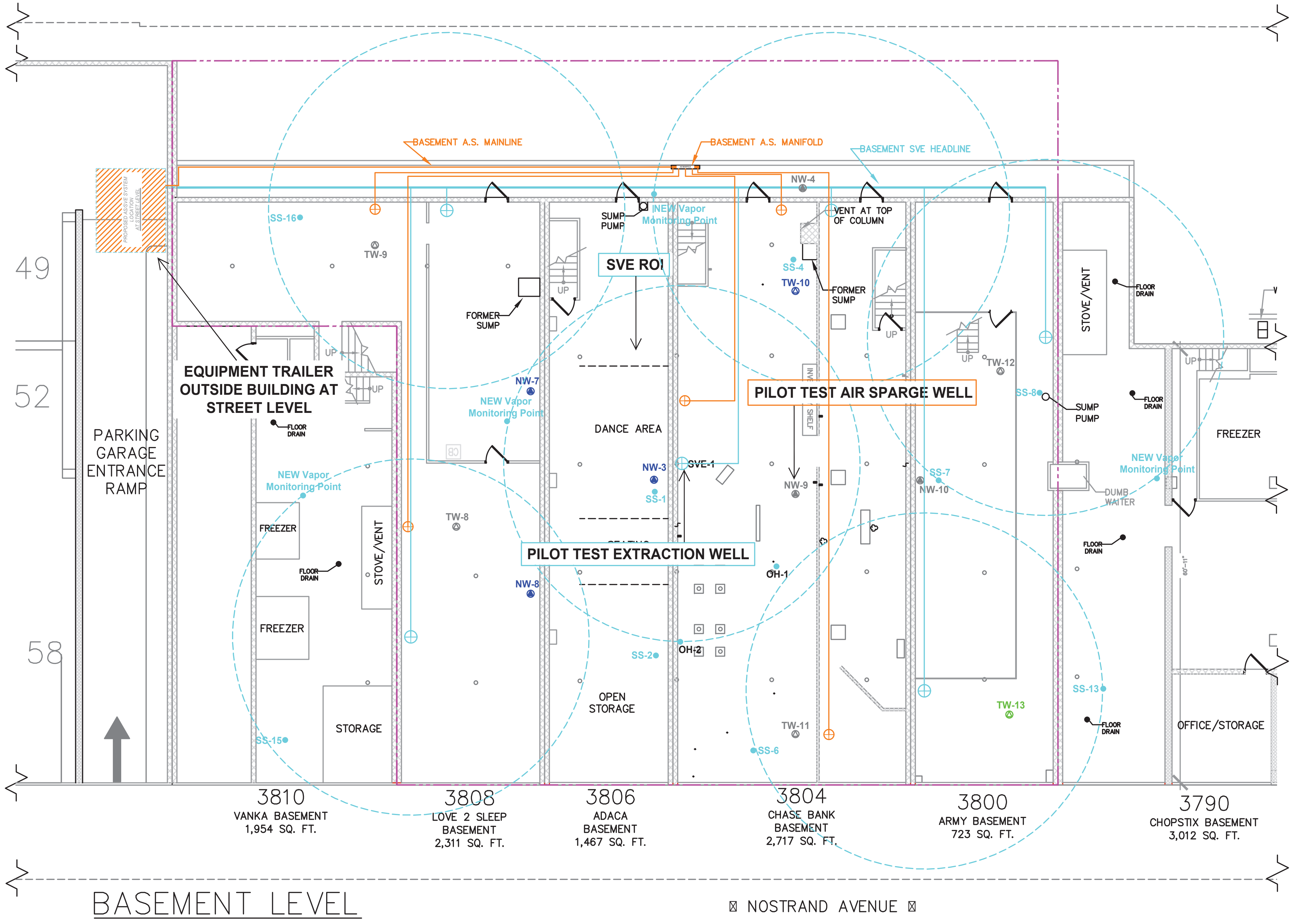
DATE 02/26/2021
CNS JOB # D196
SCALE
1/16" = 1' 0"

FIGURE 7

Basement Level Remediation Design - AS/SVE System



BASEMENT LEVEL

GENERAL

○	= TREE/PLANTER
◻	= SUMP PUMP
◎	= FLOOR DRAIN
◻ ○ ▫ ▣ ▯	= COLUMNS
✿	= STAIN
ʃ	= FLOOR/WALL CRACK
•	= FLOOR PENTRATION (CHASE BANK)
▯	= RODENTCIDE (CHASE BANK)

REMEDIAL DESIGN

— - —	= BCP SITE BOUNDARY
⬚	= PROPOSED SOIL EXCAVATION AREA
●	= IN-SITU PRE-EXCAVATION WASTE CHARACTERIZATION SOIL BORING (AUGUST 2020)
▨	= PROPOSED AS/SVE SYSTEM LOCATION
⊕	= PROPOSED SOIL VAPOR EXTRACTION (SVE) WELL
◌	= SOIL VAPOR EXTRACTION (SVE) RADIUS OF INFLUENCE (ROI)
⊕ *or* ▲	= PROPOSED AIR SPARGING (AS) INJECTION WELL
●	= PERMANENT VAPOR MONITORING POINT
⋈	= SVE GATE VALVE
Ⓥ	= SVE VACUUM GAUGE
▲	= EXISTING PERMANENT GROUNDWATER OBSERVATION WELL to be SAMPLED on ***SEMI-ANNUAL BASIS***
▲	= EXISTING PERMANENT GROUNDWATER OBSERVATION WELL to be SAMPLED on ***BI-ANNUAL BASIS***
▲	= EXISTING GROUNDWATER MONITORING WELL to be ***ABANDONED***

DATE	REVISION	BY	APVD
4/1/21	ADDED LEGEND	JL	CP
7/19/21	ADDED VMPs, CHANGED VMP COLOR	JL	CP

DWN BY: **JL**
CHKD BY: **MH**
APVD BY: **CP**

SITE NO. **BCP C224237**

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FIGURE 7

BASEMENT LEVEL
REMEDIATION DESIGN - AS/SVE SYSTEM

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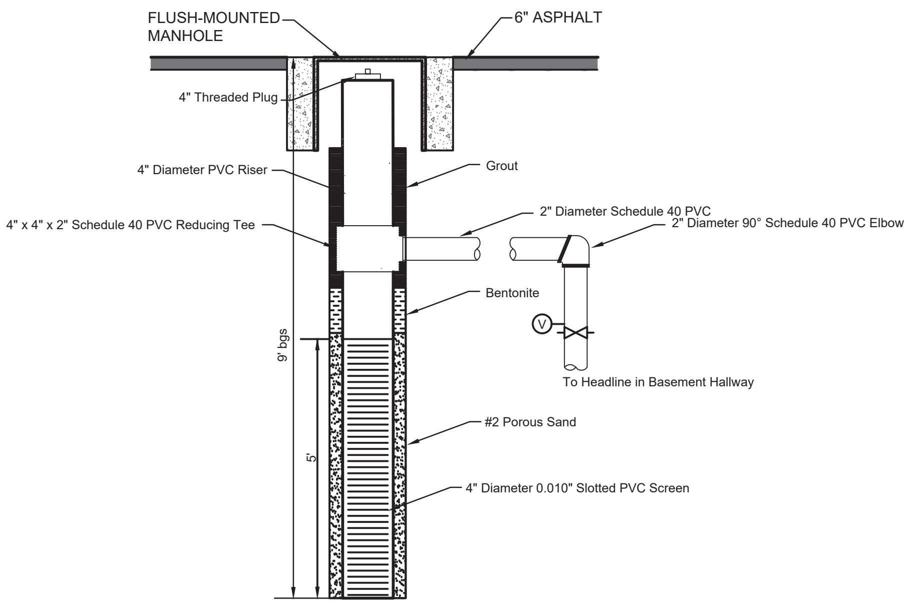
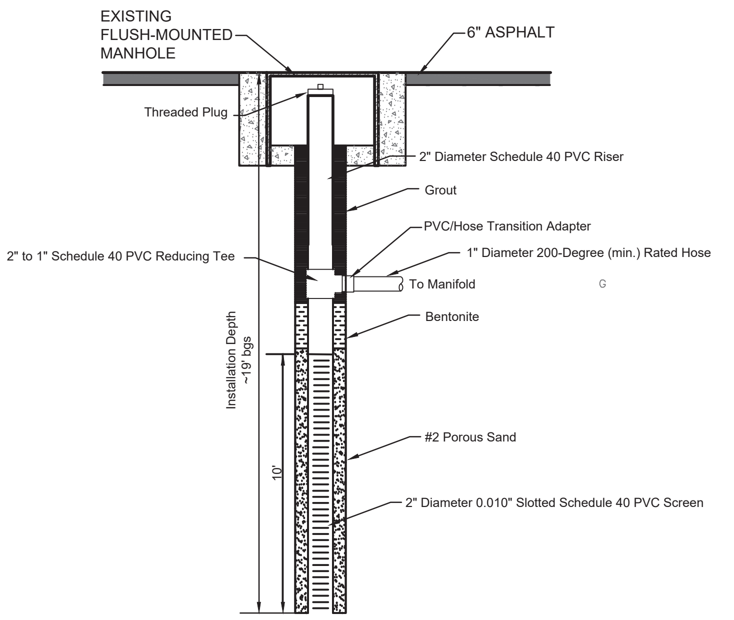
DATE **02/26/2021**
CNS JOB # **D196**
SCALE **1/16" = 1'0"**

FIGURE 8

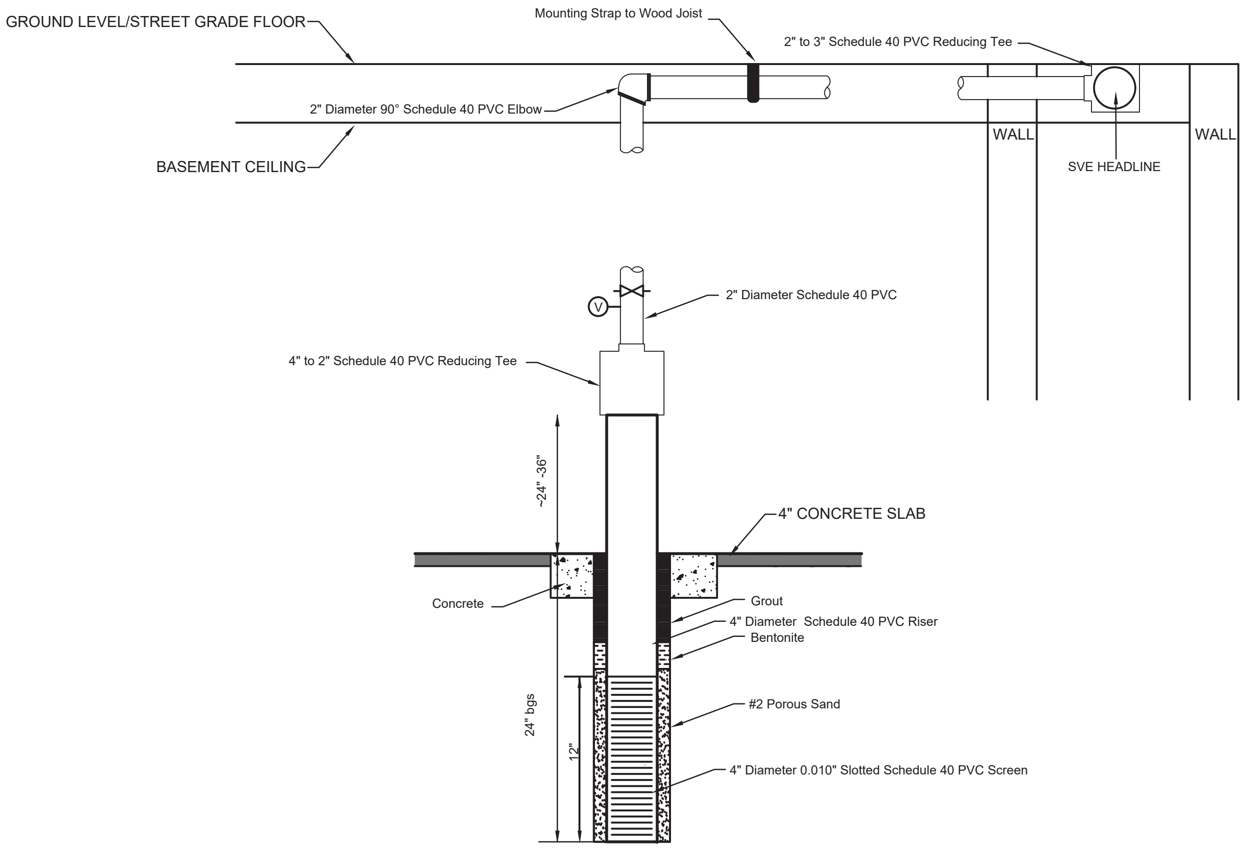
Air Sparging and Soil Vapor Extraction Well Construction Details



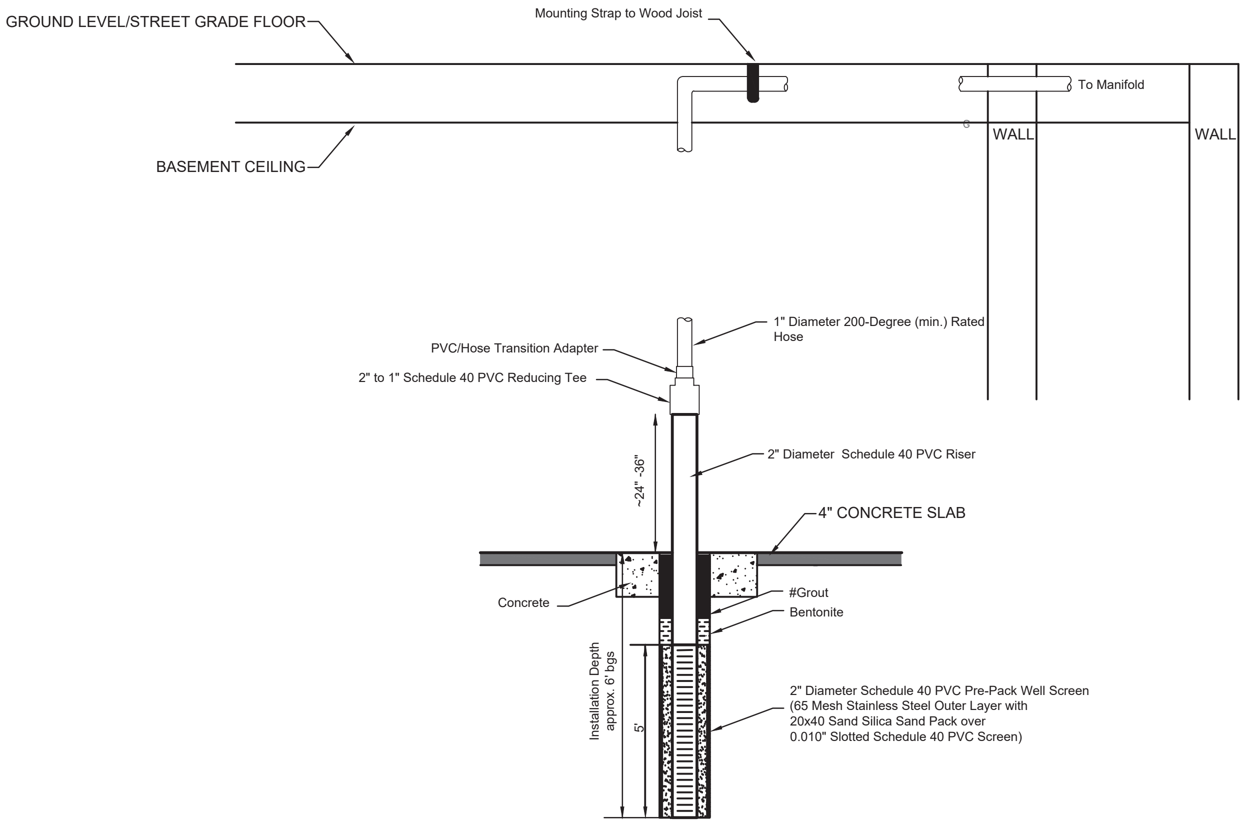
CONSTRUCTION DETAIL (TYP.)
Street Grade Soil Vapor Extraction Well
to be installed
(not to scale)



CONSTRUCTION DETAIL (TYP.)
Street Grade Air Sparging Well
to be installed at location of existing Groundwater Monitoring Well
(not to scale)



CONSTRUCTION DETAIL (TYP.)
Basement Soil Vapor Extraction Well
to be installed
(not to scale)



CONSTRUCTION DETAIL (TYP.)
Basement Air Sparging Well
to be installed at location of existing Groundwater Monitoring Well
(not to scale)

DATE	REVISION	BY	APVD

DWN BY: **JL** CHKD BY: **MH** APVD BY: **CP**

SITE NO. **BCP C224237**

"FORMER" DEBBIE CLEANERS
3800-3808 NOSTRAND AVENUE
BROOKLYN, NY 11235

FIGURE 8

SOIL VAPOR EXTRACTION WELL AND
AIR SPARGING WELL
CONSTRUCTION DETAILS
COMBINED AS/SVE SYSTEM

CNS ENVIRONMENTAL
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208 NEWTOWN RD
PLAINVIEW, NY 11803
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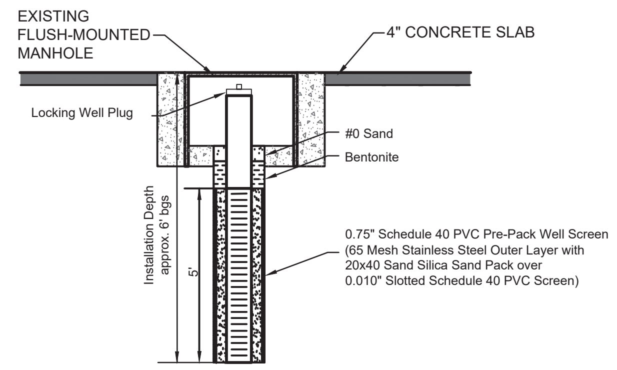
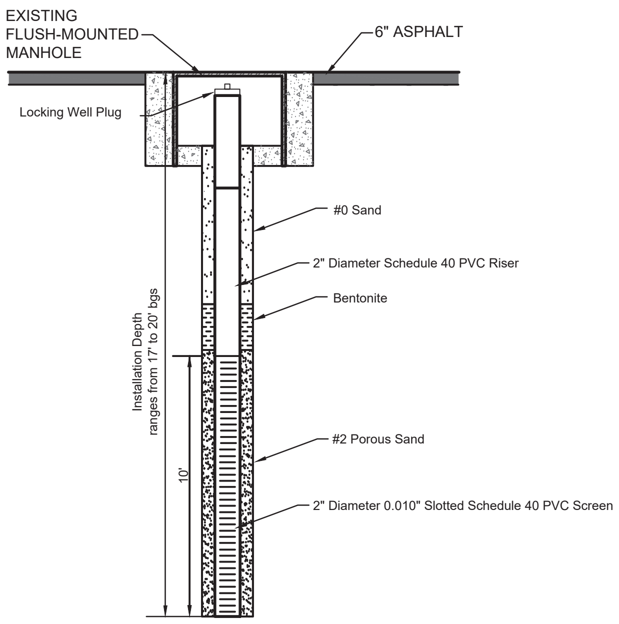
DATE **02/26/2021**
CNS JOB # **D196**
SCALE
AS NOTED

FIGURE 9

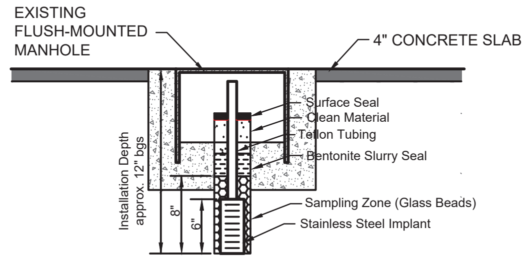
Groundwater Monitoring Well and Soil Vapor Monitoring Well Construction Details



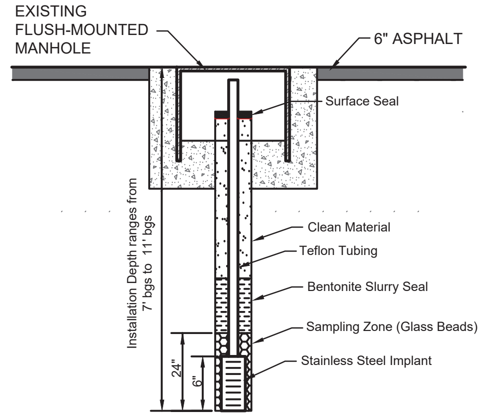
TYPICAL CONSTRUCTION DETAIL
Existing Basement Groundwater Monitoring Well
to be used as Groundwater Observation Well
(not to scale)



TYPICAL CONSTRUCTION DETAIL
Existing Street-Grade Groundwater Monitoring Well
to be used as Groundwater Observation Well
(not to scale)



TYPICAL CONSTRUCTION DETAIL
Existing Basement Soil Vapor Implant Location
to be used as Vapor Monitoring Point
(not to scale)



TYPICAL CONSTRUCTION DETAIL
Existing Street-Grade Soil Vapor Implant Location
to be used as Vapor Monitoring Point
(not to scale)

DATE	REVISION	BY	APVD

DWN BY: **JL** CHKD BY: **MH** APVD BY: **CP**

SITE NO. **BCP C224237**

"FORMER" DEBBIE CLEANERS
3800-3808 NOSTRAND AVENUE
BROOKLYN, NY 11235

FIGURE 9

GROUNDWATER MONITORING WELL
SOIL VAPOR MONITORING POINT
CONSTRUCTION DETAILS
COMBINED AS/SVE SYSTEM

CNS ENVIRONMENTAL
A REAL ESTATE SERVICES COMPANY
208 NEWTOWN RD
PLAINVIEW, NY 11803
www.cnsenviro.com

DATE **02/26/2021**

CNS JOB # **D196**

SCALE
AS NOTED

TABLE 1

Proposed System Effectiveness Monitoring/Sampling Locations & Frequency

Table 1: Monitoring Sampling Locations and Frequency

Semi-Annually (Once every 6 Months)				
Sample Location ID	**Sample Location Description**	**Sampling Method**	**Analytical Method**	**Sample Frequency**
NW-3	Center of BCP Site Basement, Center of North Wall of ADACA (3806 Nostrand Ave.)	Obtain Water Level and Quality Measurements; Low Flow Method	Tetrachloroethene (PCE), Trichloroethene (TCE) and cis-1,2-Dichloroethene (DCE) via EPA Method 8260 and Target PFAS Analytes via EPA Method 537 or ISO Method 25101	Semi-annually
TW-4	West Side of BCP Site Rear Driveway, Southwest of Love 2 Sleep (3808 Nostrand Ave)			
TW-5	West Side of BCP Site Rear Driveway, West of Love 2 Sleep (3808 Nostrand Ave)			
TW-6	West Side of BCP Site Rear Driveway, West of Chase Bank (3804 Nostrand Ave.)			
NW-7	Southwest Section of BCP Site Basement, Northwest Portion of Love 2 Sleep (3808 Nostrand Ave.)			
NW-8	Southeast Section of BCP Site Basement, Northeast Portion of Love 2 Sleep (3808 Nostrand Ave.)			
TW-10	West Side of BCP Site Basement, West Side of Chase Bank (3804 Nostrand Ave.)			
Indoor Air	Center of BCP Site Basement, Center of North Wall of ADACA (3806 Nostrand Ave.)	SUMMA Canister Collection	Tetrachloroethene (PCE), Trichloroethene (TCE) and cis-1,2-Dichloroethene (DCE) via EPA Method TO-15	
Indoor Air	South Side of BCP Site Basement, Center of Love 2 Sleep (3808 Nostrand Ave.)			
Indoor Air	West Side of BCP Site Basement, West Side of Chase Bank (3804 Nostrand Ave.)			
Indoor Air	North Side of BCP Site Basement, Center of South Wall of US Army Career Center (3800 Nostrand Ave.)			

Table 1: Monitoring Sampling Locations and Frequency

Bi-Annually (Once every 2 years)				
Sample Location ID	**Sample Location Description**	**Sampling Method**	**Analytical Method**	**Sample Frequency**
NW-1	East Side of BCP Site Street Grade Sidewalk, in front of ADACA (3806 Nostrand Ave.)	Obtain Water Level and Quality Measurements; Low Flow Method	Tetrachloroethene (PCE), Trichloroethene (TCE) and cis-1,2-Dichloroethene (DCE) via EPA Method 8260 and Target PFAS Analytes via EPA Method 537 or ISO Method 25101	Bi-annually
TW-13	North Side of BCP Site Basement, East Side of Building Utilities (3800 Nostrand Ave.)			
TW-15	South of BCP Site Boundary Basement, Center of Parking Garage			
Indoor Air	North of BCP Site Boundary Basement, Southeast Portion of Chopstix (3794 Nostrand Ave.)	SUMMA Canister Collection	Tetrachloroethene (PCE), Trichloroethene (TCE) and cis-1,2-Dichloroethene (DCE) via EPA Method TO-15	
Indoor Air	South of BCP Site Boundary, Basement, Southeast Portion of Vanka Café (3810 Nostrand Ave.)			
Indoor Air	Southwest Section of BCP Site Basement, Southwest Portion of Love 2 Sleep (3808 Nostrand Ave.)			

APPENDIX A

Soil Vapor Extraction System Specifications

GO TO GEOTECH

Vapor Phase Carbon Media

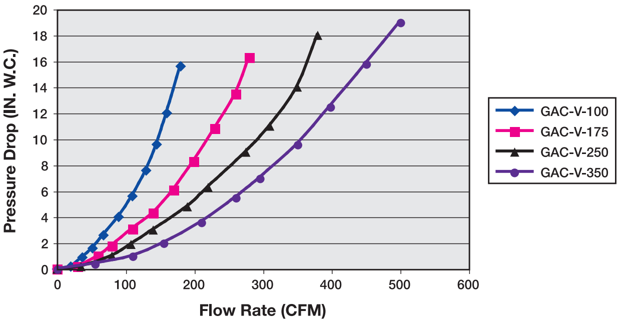
GAC-V Filter – 100-350 lb. (45.4-159 kg) Vessels

The GAC-V Filter is a media filter vessel designed to treat vapor streams. While the typical design application is activated carbon adsorbent unit, the filter vessel can easily accommodate a variety of media.

APPLICATIONS

- **Vapor phase organics removal (activated carbon)**
- **SVE off gas treatment**
- **Air stripper off gas treatment**
- **Odor off gas treatment**
- **Storage tank purge vapor treatment**
- **Pilot study**
- **Industrial process treatment**
- **Call Geotech for larger systems**

PRESSURE DROP VS. FLOW RATE



SPECIFICATIONS

Model	GAC-V-100	GAC-V-175	GAC-V-250	GAC-V-350
Overall Height	2'6" (.76m)	2'10" (.86m)	3'3" (1m)	3'7" (1.1m)
Diameter	18" (.46m)	23" (.58m)	28" (.71m)	32" (.81m)
Inlet / Outlet (FNPT)	2"	2"	2"	2"
Drain / Vent (FNPT)	OPT	OPT	OPT	OPT
GAC Fill (lbs.)	100 (45.4 kg)	175 (79.4 kg)	250 (113.4 kg)	350 (158.8 kg)
Shipping / Operational Weight	135 / 160 lbs. (61.2 / 72.6 kg)	225 / 300 lbs. (102 / 136 kg)	325 / 455 lbs.(147.4 / 206.4 kg)	450 / 600 lbs. (204.1 / 272.1 kg)
Vessel / Internal Piping	CS / CS (False Floor)	CS / CS (False Floor)	CS / CS (False Floor)	CS / CS (False Floor)
Internal Coating	Polyamide Epoxy Resin	Polyamide Epoxy Resin	Polyamide Epoxy Resin	Polyamide Epoxy Resin
External Coating	Urethane Enamel	Urethane Enamel	Urethane Enamel	Urethane Enamel
Maximum Pressure / Temperature	4 psig / 250°F (.3 bar / 121°C)	4 psig / 250°F (.3 bar / 121°C)	4 psig / 250°F (.3 bar / 121°C)	4 psig / 250°F (.3 bar / 121°C)
Cross Sectional Bed Area	2.8 ft.^{2} (.26m^2)	2.8 ft.^{2} (.26m^2)	3.7 ft.^{2} (.34m^2)	4.9 ft.^{2} (.45m^2)
Bed Depth / Volume	2.2 ft. / 6.3 ft.^{3} (.7m / .18m^3)	2.2 ft. / 6.3 ft.^{3} (.7m / .18m^3)	2.4 ft. / 8.9 ft.^{3} (.73m / .25m^3)	2.6 ft. / 12.5 ft.^{3} (.8m / .35m^3)

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GO TO GEOTECH

Soil Vapor Extraction Systems

Geotech SVE

The Geotech Soil Vapor Extraction system is designed to remove hazardous vapors from the subsurface by drawing air through contaminated soil, and volatilizing adsorbed phase pollutants. Geotech SVE systems are ideal for well point or trench type vapor barriers.

FEATURES

- **Compact, durable design**
- **Skid Mounted with moisture separator drum/mist eliminator**
  - 37 gallon (140 liters) liquid holding capacity
  - Hi Water level switch
  - Hi Vacuum switch
- **Continuous reliable operation**
- **Many blower types are available to meet your requirements:**
  - Regenerative
  - Rotary Claw
  - Positive Displacement (Rotary Lobe)
  - Rotary Vane
  - Centrifugal Fan
- **Thermal overload protection**
- **Influent dilution air valve**
- **Two vacuum gauges**
- **Optional NEC code available** (Class 1, Div. 1, or Div. 2)
- **Non-explosive units are available**

OPERATION

The Geotech SVE system works by pulling air through soil that has been saturated with hydrocarbons or other volatile organic compounds, causing these compounds to volatilize. The vapors are then discharged to the atmosphere, through carbon polishing or vapor oxidation.

These systems are deployed with a moisture separator and mist eliminator filter to protect blower and end treatment from corrosion particulates and debris.

Every Geotech SVE system is factory assembled and fully tested for function, performance, and safety to meet the design conditions of each site application.

Regenerative Blower SVE inside optional hazmat enclosure

Regenerative Blower SVE

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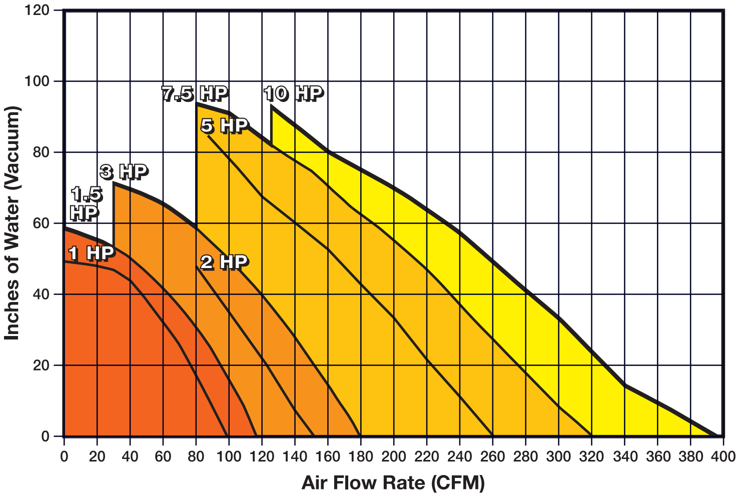
geotech

Soil Vapor Extraction Systems

Geotech SVE



Regenerative Type Blower
Soil Vapor Extraction System
Selection Curve 1 through 10 HP

Note: Higher flow and vacuum versions are available.

Regenerative Blower SVE
with optional Geotech Environmental Control Module

SPECIFICATIONS

Applications:	Well point or trench type vapor barriers
Product Recovery:	Volatile Organic Compounds (VOCs)
Dimensions:	40" L x 48" W x 65" H (101.6 cm L x 121.9 cm W x 165.1 cm)
Options:	Geotech Environmental Control Module Telemetry package Influent or effluent silencer Effluent sample port Effluent temperature gauge Local CFM display Auto-Drain (this option features automatic water level control inside the moisture separator with an effluent transfer pump)

Power Requirements:

HP	Voltage	Phase	CFM/CMM	Inches H_2O Vacuum
1	115/230	1	0-95/0-2.7	50"
1.5	230	1	0-115/0-3.3	58"
2	230	1	80-145/2.3-4.1	55"
2	230	3	80-145/2.3-4.1	55"
3	230	1 or 3	30-185/.85-5.2	72"
5	230	3	85-280/2.4-7.9	82"
7.5	230	3	80-325/2.3-9.2	93"
10	230	3	125-380/3.5-10.8	93"

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APPENDIX B

Air Sparging System Specifications

geotech

Air Sparge Systems

Geotech Rotary Claw Compressor Packages

The Geotech Air Sparge System is designed to provide positive air pressure into the subsurface thus aiding the volatilization and biodegradation process associated with soil vapor extraction technology.

Geotech rotary claw compressor systems are custom designed to meet your air flow and air pressure requirements where rotary lobe and rotary vane systems can not economically meet the discharge flow / pressure requirements, for example over 30 cfm (.85 cmm) and pressure ranges of 15-30 psig (1-2 bar).

FEATURES

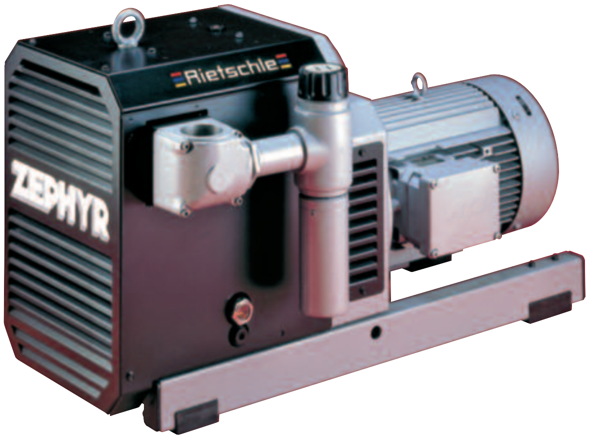
- **TEFC motor**
- **Heavy duty rotary claw compressor**
- **Compact size**
- **Low maintenance**

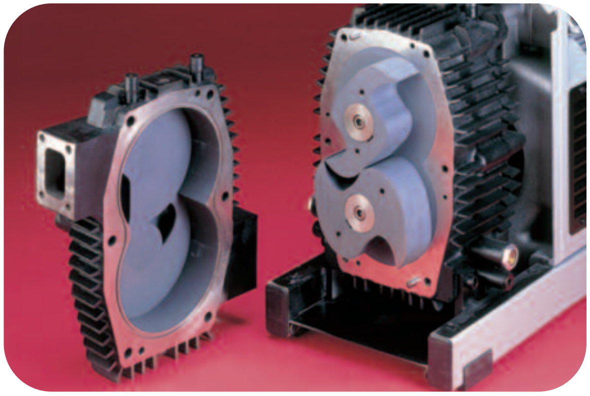
GENERAL PRINCIPLE

The Rietshle Zephyr Rotary Claw utilizes two nearly symmetrical, non-contacting claw rotors that sweep the inlet of the compressor creating internal compression without friction or lubrication, creating two discharge strokes per revolution. The dry, contactless design eliminates pollution, product contamination, and other environmental issues.

APPLICATIONS

By injecting air directly into the groundwater, the Geotech Air Sparge System remediates groundwater by volatilizing contaminants and enhancing biodegradation. Contaminants are removed from groundwater by physical contact with air and are carried up into the unsaturated zone (i.e., soil). As the contaminants move into the soil, a Geotech provided soil vapor extraction system can be used to remove vapors from the subsurface.





SPECIFICATIONS

Model	Horsepower Range	Max Flow CFM	Max Pressure PSIG
DLR 60	5	40	29.0
DLR 100	5, 7.5, 10	70.6	11.6, 23.5, 31.9
DLR 150	10, 15	100	17.0, 29.0
DLR 301	15, 20, 25	190	14.5, 26.0, 32.0
DLR 401	25, 30	272	23.0, 29.0
DLR 501	30, 40	353	20.0, 29.0

OPTIONS

- **Explosion proof motor**
- **Pressure switches**
- **Temperature gauges**
- **Temperature switches**
- **Pressure relief valves**
- **Discharge check valve**
- **CFM gauges**
- **Control panels – to integrate with soil vapor extraction systems and other equipment**

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APPENDIX C

Control Module and Equipment Trailer Specifications

GO TO GEOTECH

Remote Communications for Remediation Systems

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Geotech Environmental Control Module (GECM) with Telemetry

Stay in touch with deployed remediation systems via SMS (text message) Telemetry embedded within Geotech Environmental Control Modules. Systems with Telemetry are optimized for simple send and receive queries that make remote sites convenient to monitor.

HOW IT WORKS

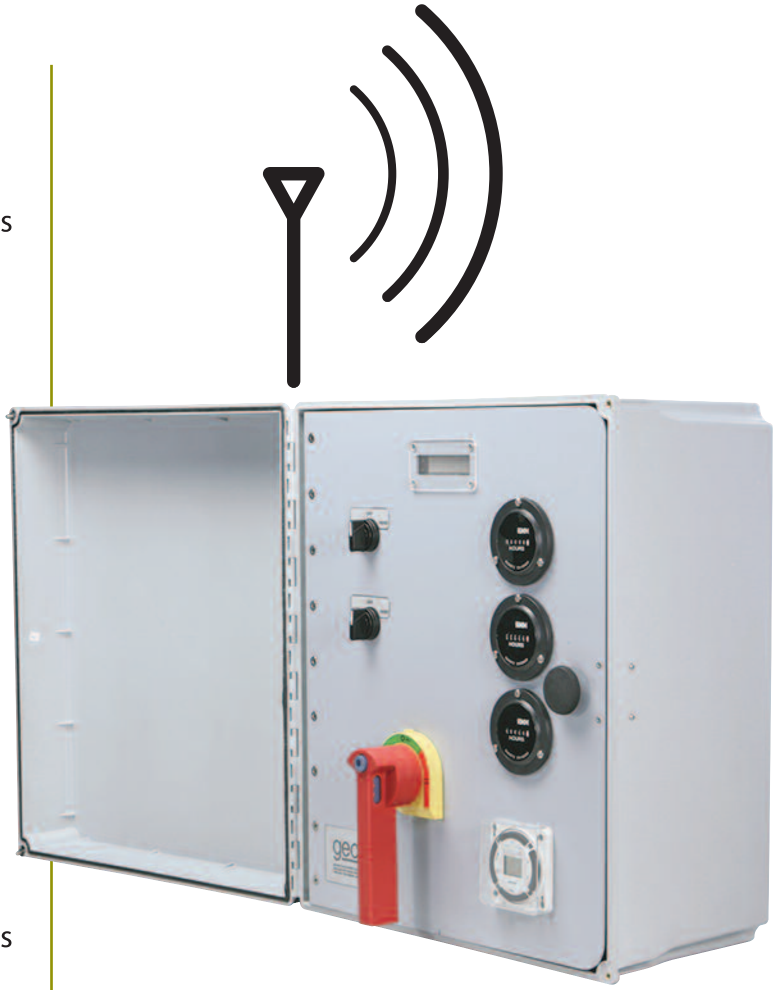
Each control panel can be programmed with several phone numbers. When the system enters into an alert condition (fault), the programmed numbers will be notified through text message.

In addition, the control panel may be queried for status updates and to respond to alert conditions via simple commands.

Examples of Telemetry Queries:

- Current operating status and check-in.
- Power status (outage and/or restart).
- Add additional phone numbers for alerts.
- Change timer settings.
- Investigate runtime, cycle counts, faults, etc.
- Enable/disable individual channels.

Systems are connected through a cellular network and accounts are managed through Geotech. Costs will depend on size of systems, frequency of alert conditions and commands, and location relative to cellular service. Antenna types will depend on location and proximity to cell towers.



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geotech_ecm_telemetry.qxp 02/25/15

Remote Communications for Remediation Systems

geotech

Geotech Environmental Control Module (GECM) with Telemetry

Text Message examples of remediation systems with embedded Telemetry

Geotech Sipper (AC or Solar*):

Text Message Alerts	System Query
`SPPR: TANKFULL`	**Prompt >** `SYSTEM STATUS?`
`SPPR: OVERRIDE`	`RUNTIME: dd:hh:mm`
`SPPR#: WATER DETECTED`	`CYCLE COUNT: nnnnnn`
`SPPR: ELEC LOW TEMP`	`TEMPERATURE: 78 F`
	`*BATTERY VOLTAGE: 12V`
*	`CHARGE STATUS:` *charged* *charging* *low power shut down*

Other Remediation Systems with GECM:

Remediation equipment which is accompanied by a Geotech Environmental Control Module (GECM) will have the option to embed Telemetry capabilities for remote monitoring. See generic examples of alerts and queries for remediation equipment.

Text Message Alerts include:	System Query
`SYS: HI TEMP`	**Prompt >** `SYSTEM STATUS?`
`TANKFULL`	`SYSTEM RUNNING`
`OVERRIDE`	`SYSTEM FAULT`
`PROBEFAULT`	`TEMPERATURE: 78 F`
`HI VACCUUM`	**System Commands**
`LO VACCUUM`	**Prompt >** `ADD PHONE`
`HI SUMP`	**Prompt >** `STOP SYS#`
`H2O IN RES`	**Prompt >** `CURRENT FAULT`
`ELEC LOW TEMP`	**Prompt >** `CHANGE TIMER`

Consult your Geotech Service Representative regarding custom Geotech Telemetry capabilities for all your remediation needs.

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NOTICE: Due to COVID-19, you need to make an appointment before visiting our store. We are taking measures to limit the amount of customers on our lot at a given time. Thank you for your understanding.

6 X 12 Carry-On Enclosed Cargo Trailer

6 X 12 Enclosed 6'Wide, 12'Long, 15" Tires, Double Door 2021 model year. Trailer: 1862

Trailer Details

Color:	WHITE
Size:	6 X 12 Enclosed Cargo
Tires:	Trailer Rated
Vin#:	4YMBC1213MM001862

Features

Tail Lights:	LED
Undercoating:	Painted

Dimensions

Overall Length:	16' 0"
Overall Width:	7' 7"
Overall Height:	8' 1"
Interior Length:	11' 8"
Interior Width:	5' 9"
Interior Height:	6' 2"
Rear Door Height:	0"
Rear Door Width:	0"

Axles/Tires

GVWR:	2990 lbs.
Empty Weight:	1207 lbs.
Suspensions:	Spring

Axles/Tires

Brakes: No

Construction

Frame: Tube

Frame Centers: 24"

Wall Centers: 16"

Flooring: 3/4" Plywood

Walls: 3/8" Plywood

Warranty

Overall: (1) Year Limited. Includes free Certified Trailer Inspections at 12 and 24 months

Roof: (1) Year Limited

Axles: (1) Year Limited

APPENDIX D

Quality Assurance Project Plan

CNS
ENVIRONMENTAL
A REAL ESTATE SERVICES COMPANY

RAWP Quality Assurance Project Plan

Site:

"Former" Debbie Cleaners
3800-3808 Nostrand Avenue
Brooklyn, New York 11235
BCP Site # C224237

Prepared For:

New York State Department of Environmental Conservation
625 Broadway
Albany, New York 12233-7016
Attn: Mr. Michael MacCabe, P.E. - Senior Environmental Engineer

On Behalf of:

Acadia 3780-3858 Nostrand Avenue, LLC
411 Theodore Fremd Avenue, Suite 300
Rye, New York 10580

Prepared By:

CNS Environmental Corporation
208 Newtown Road
Plainview, NY 11803
CNS Job #: D196

JANUARY 2019

Table of Contents

1.0 OBJECTIVE AND PURPOSE

The Remedial Action Work Plan (RAWP) Quality Assurance Project Plan (QAPP) outlines the technical and analytical approach that CNS Environmental Corp (CNS) will employ during the soil, groundwater and/or soil vapor sampling at the "Former" Debbie Cleaners site located at 3800-3808 Nostrand Avenue in Brooklyn, New York ("Site"). The RAWP provides a site summary, site history and proposed remedial actions. As an attachment to the RAWP, this QAPP provides a description of project objectives, sampling methods, analytical procedures, and quality assurance requirements that will be used to obtain valid, representative field samples and measurements. Standards contained in the QAPP will be used to ensure the validity of data generated for this project.

This QAPP was prepared for the remedial soil, groundwater, and/or soil vapor sampling to set guidelines for the generation of reliable data measurement activities such that data generated are scientifically valid, defensible, and comparable and of known precision and accuracy.

This QAPP is an extension of the RAWP and contains a discussion of the quality assurance protocols to be used by CNS and laboratory personnel.

1.1. Definitions

The parameters that will be used to specify data quality objectives, and to evaluate the analytical system performance for all analytical samples are precision, accuracy, representativeness, completeness and comparability (PARCC). Definitions of these and other key terms used in this QAPP are provided below.

Accuracy - the degree of agreement of a measurement with an accepted reference value. Accuracy is generally reported as a percent recovery, and calculated as: Measured Value x 100 Accepted Value

Analyte - the chemical or property for which a sample is analyzed.

Comparability - the expression of information in units and terms consistent with reporting conventions; the collection of data by equivalent means; or the generation of data by the same analytical method. Aqueous samples will be reported as parts per billion (ppb), solid samples will be reported in units of parts per million (ppm), dry weight and vapor/air samples will be reported in units of micrograms per cubic meter ($\mu g/m^3$).

Completeness - the percentage of valid data obtained relative to that which would be expected under normal conditions. Data are judged valid if they meet the stated precision and accuracy goals.

Duplicate - two separate samples taken from the same source by the same person at essentially the same time and under the same conditions that are placed into separate containers for independent analysis. Duplicate samples are intended to assess the effectiveness of equipment decontamination, the precision of sampling efforts, the impacts of ambient environmental conditions on sensitive analyses (e.g., volatile organics analysis (VOA), and the potential for contaminants attributable to reagents or decontamination fluids. Identifying such potential sources of error is essential to the success of the sampling program and the validity of the environmental data. Each QC sample is described below. As a minimum, each set of ten or fewer field samples will include a trip blank, a duplicate and one sample collected in a sufficient volume to allow the laboratory to perform a matrix spike.

Episode - a continuous period of time during which sampling activities are undertaken. Cessation of activities for more than 48 hours terminates the episode.

Field Blanks - field blanks (sometimes referred to as "equipment blanks" or "sampler blanks") are the final analyte-free water rinse from equipment decontamination in the field and are collected at least one during a sampling episode. If analytes pertinent to the project are found in the field blank, the results from the blanks will be used to qualify the levels of analytes in the samples. This qualification is made during data validation. The field blank is analyzed for the same analytes as the sample that has been collected with that equipment.

Precision - a measure of the agreement among individual measurements of the sample property under prescribed similar conditions. Precision is generally reported as Relative Standard Deviation (RSD) or Relative Percent Difference (RPD). Relative standard deviation is used when three or more measurements are available and is calculated as:

Quality Assurance (QA) - all means taken in the field and inside the laboratory to make certain that all procedures and protocols use the same calibration and standardization procedures for reporting results; also, a program which integrates the quality planning, quality assessment, and quality improvements activities within an organization.

Quality Control (QC) - all the means taken by an analyst to ensure that the total measurement system is calibrated correctly. It is achieved by using reference standards, duplicates, replicates, and sample spikes. Also, the routine application of procedures designed to ensure that the data produced achieve known limits of precision and accuracy.

Representativeness - degree to which data represents a characteristic of a set of samples. The representativeness of the data is a function of the procedures and caution utilized in collecting and analyzing the samples. The representativeness can be documented by the relative percent difference between separately collected but otherwise identical samples.

Replicate - two aliquots taken from the same sample container and analyzed separately. Where replicates are impossible, as with volatile organics, duplicates must be taken.

Trip Blanks - trip blanks are samples that originate from analyte-free water taken from the laboratory to the sampling site and returned to the laboratory with the volatile organic samples. One trip blank should accompany each cooler containing volatile organics; it will be stored at the laboratory with the samples, and analyzed with the sample set. Trip blanks are only analyzed for VOCs.

2.0 PROJECT MANAGEMENT

The Professional Engineer for CNS is Mr. Michael Hauptmann, and the Project Manager for CNS is Mr. Charles Powers. Dependent on the task completed, either Mr. Hauptmann or Mr. Powers will also serve as the Field Team Leader and as such, will collect samples with assistance from CNS field staff. All contractors used during the execution of the remedial action will have the proper equipment to work both inside and outside of the site and will work under his direction.

Soil, groundwater and/or soil vapor samples will be analyzed by either Phoenix Environmental Laboratories, Inc (NY ELAP #11301) located at 578 East Middle Turnpike in Manchester, CT; SGS North America, Inc (NY ELAP #10983) located at 2235 Route 130 in Dayton, NJ, and/or SGS North America, Inc (NY ELAP #12022) located at 4405 Vineland Road in Orlando, FL. The Project Manager will be responsible not only for field sampling activities but also will coordinate efforts with the Client, the laboratory, the contractor(s), the NYSDEC, and the NYSDOH, as applicable. The Project Manager and Professional Engineer will also be responsible for checking all data, coordinating with the laboratory, and preparation of reports.

3.0 DATA ACQUISITION

The RAWP describes the scope of work in detail. A brief summary of sample collection activities is provided below.

3.1. Sampling Process Design

As indicated within the RAWP, post-excavation confirmatory sampling shall be performed following the Soil Excavation and Off-Site Disposal in the area of soil boring CB-SB02, as well as the characterization of excavated material. If other than stone based backfill is used, then the source of soil backfill to be imported to the Site will be sampled.

Groundwater and soil vapor monitoring will also be performed to determine the influence of the soil source removal and the operation of the Combined AS/SVE system on the COC groundwater and soil vapor concentrations.

3.2. Logistics

Unencumbered access to the site with the sampling equipment is expected to be available.

3.3. Soil Screening

All excavated material, post-excavation in-place soil and imported backfill will be screened using a PID (11.7 eV lamp) and logged by qualified personnel for geologic characteristics.

All field equipment will be calibrated prior to use according to the manufacturer's instructions. The results of calibrations and any records of repair will be maintained in the field book. Equipment that fails calibration or fails to operate properly will be removed from service and segregated from the operational equipment. Such equipment will be repaired and re-calibrated if possible or replaced. Preventive maintenance of field equipment is performed according to the procedures indicated in the manufacturer's manuals.

3.4. Sampling Methods Requirements

The CNS Project Manager will be responsible for ensuring that appropriate sample collection procedures are followed and will take appropriate actions to correct any identified deficiencies. All samples collected will be maintained under chain-of-custody and stored and shipped in laboratory-supplied coolers.

3.4.1. Soil

As indicated in the RAWP, the first element of the proposed remedy is Soil Excavation and Off-Site Disposal in the area of soil boring CB-SB02, where the volume of estimated soil requiring excavation and off-site disposal is approximately 55 cubic yards.

Excavated soil from the soil excavation area will be stockpiled separately and will be segregated from clean soil and construction materials while awaiting proper characterization for off-site disposal. The excavated soil that is planned to be transported off-Site for disposal will be sampled for waste characterization protocols in accordance with typical disposal facility requirements, applicable permits, and in compliance with applicable laws and regulations. Waste characterization sampling and analytical methods, sampling frequency, analytical results and QA/QC will be reported in the FER.

In accordance with DER-10, waste characterization soil samples will be analyzed for the following parameters (at a minimum):

- Volatile Organic Compounds (VOCs) via EPA Method 8260
- Semi-Volatile Organic Compounds (SVOCs) via EPA Method 8270
- Polychlorinated Biphenyls (PCBs) via EPA Method 8082
- Pesticides via EPA Method 8081
- Target Analyte List (TAL) Metals + Hexavalent Chromium & Cyanide via EPA Method 6010

Removal actions under this remedy will be performed in conjunction with post-excavation confirmatory end-point sampling. After the initial excavation, confirmatory grab soil samples will be collected and submitted for laboratory analysis to verify that the Track 2 Commercial Use SCOs have been met. Additional soil will be removed if any post-excavation confirmatory sample analytical results exceed the Commercial SCOs.

Post-excavation confirmatory end-point samples will be collected from the bottom of each sidewall of the excavation area and analyzed for the cVOC COCs via EPA Method 8260.

All imported clean fill material used below and within the cover layer to meet the pre-excavation elevations and grades, will meet DER-10 sampling frequency, backfill and cover soil quality objectives for the site. The imported uncontaminated, clean soil material will be segregated at an approved source/facility and will be evaluated by the Professional Engineer to ensure.

These samples will be collected from the segregated stockpile at the source, and analyzed for the following parameters:

- Volatile Organic Compounds (VOCs) via EPA Method 8260
- Semi-Volatile Organic Compounds (SVOCs) via EPA Method 8270
- Polychlorinated Biphenyls (PCBs) via EPA Method 8082
- Pesticides via EPA Method 8081
- Target Analyte List (TAL) Metals + Hexavalent Chromium & Cyanide via EPA Method 6010

3.4.2. Groundwater

As part of the remedy, groundwater monitoring will be performed to determine the influence of the soil source removal and the operation of the Combined AS/SVE system on the COC groundwater concentrations.

In the event that any existing monitoring well needs to be reinstalled following the soil excavation activities or post-installation of the Combined AS/SVE system, the monitoring well shall be installed to the specifications of the originally installed monitoring well. The top of each new well casing will be surveyed to a common datum and tied into the existing monitoring well network.

Groundwater sampling procedures are provided in Section 6.0. CNS will measure water levels and collect groundwater samples using low-flow sampling methods. Prior to sampling, each well will be purged a minimum of three casing volumes using a peristaltic pump with per-well dedicated tubing set in the middle of the well screen. This is performed to ensure representative samples from the formation surrounding the wells and to eliminate standing water in the wells. Temperature, pH, dissolved oxygen, turbidity and conductivity measurements will be collected and recorded after the removal of each casing volume. Groundwater sampling logs will be prepared.

Immediately following collection of the samples, they will be placed in a cooler with "freezer-pats" in order to maintain sample integrity, and all volatile sample bottles to be filled to capacity with no headspace for volatilization. If necessary to meet a maximum recommended holding time, the samples are to be shipped by overnight courier to the laboratory. Groundwater for VOCs analysis will be preserved by acidification to a pH of <2 using hydrochloric acid (HCl), cooled to 4°C, and maintained at this temperature until time of analysis.

Groundwater samples will be analyzed for the cVOC COCs via EPA Method 8260.

3.4.3. Soil Vapor

As part of the remedy, soil vapor monitoring will be performed to determine the influence of the soil source removal and the operation of the Combined AS/SVE system on the COC soil vapor concentrations.

In the event that any existing vapor monitoring point needs to be reinstalled following the soil excavation activities or post-installation of the Combined AS/SVE system, the vapor monitoring point shall be installed to the specifications of the originally installed soil vapor implant.

Soil vapor sampling will be conducted in general conformance with the NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York dated October 2006 (NYSDOH Guidance).

Soil vapor sampling procedures are provided in Section 7.0. The soil vapor samples will be collected in dedicated, laboratory-supplied "batch certified clean" stainless steel Summa canisters at rates no greater than 0.2 L/min, with an average target fill-time of approximately eight (8) hours per canister.

Immediately following the sample collection, the Summa canister valves will be tightened and the flow controller will be removed. Samples will be sent via laboratory or overnight courier and analyzed for the cVOC COCs via EPA Method TO-15.

3.5. Sampling Equipment Decontamination

It is anticipated that dedicated sampling equipment will be used at all locations. However, if not the case for some reason all sampling equipment will be cleaned between sampling locations to prevent cross-contamination. All reusable sampling equipment that comes in contact with soil samples will be decontaminated prior to each sample by using the following steps:

1. Detergent (Alconox) solution wash
2. Potable water rinse
3. Detergent (Alconox) solution wash
4. Potable water rinse
5. Solvent rinse (methanol)
6. Deionized water rinse

3.6. Sample Handling and Custody Requirements

This section describes sample identification and chain-of-custody procedures that will be used for field activities. The purpose of these procedures is to ensure that the quality of samples is maintained during collection, transportation, storage, and analysis.

3.6.1. Sample Containers - Soil

The sample container, preservation, and holding time requirements for each sample matrix will meet the specified standards for EPA Method 8260. The containers for soil sample analysis via EPA Method 8260 are two (2) pre-weighed VOA Vials containing a magnetic stir, 5mL of DI water and one (1) pre-weighed VOA Vial containing 10mL of Methanol, accompanied by a 2 oz., wide mouth, straight-sided flint glass jar. The holding time for VOCs in soils is 48 Hours. CNS has requested a normal turnaround from the laboratory.

All soil samples will be shipped the same day they are obtained to the analytical laboratory for VOC analysis. The samples must be stored at or near 4°C and analyzed within specified holding times. The laboratory shall meet the specifications for documentation, data reduction and reporting. The laboratory will follow all method specifications pertaining to sample holding times contained in the specific analytical method. Screening analysis will be carried out using USEPA Method OLM04.2 and the analytical laboratory will adhere to required QA/QC procedures.

3.6.2. Sample Containers - Groundwater

Groundwater samples will be analyzed via EPA Method 8260. The containers for groundwater analysis will be a minimum of two 40 ml. VOA vials per sample. The holding time for VOCs is 14 days. All groundwater samples will be shipped the same day they are obtained to the analytical laboratory for VOC analysis. The laboratory shall meet the specifications for documentation, data reduction and reporting. The laboratory will follow all method specifications pertaining to sample holding times contained in the specific analytical method. Screening analysis will be carried out using USEPA Method OLM04.2 and the analytical laboratory will adhere to required QA/QC procedures.

3.6.3. Sample Containers – Soil Vapor

EPA Method TO-15 will be used to analyze the soil vapor samples. The soil vapor samples will be collected in dedicated, laboratory-supplied "batch certified clean" stainless steel Summa canisters at rates no greater than 0.2 L/min, with an average target fill-time of approximately eight (8) hours per canister.

CNS will send the soil vapor samples to the laboratory for analysis of VOCs by EPA Method TO-15. The reporting limits will meet the specification required via EPA Method TO-15.

3.6.4. Sample Labels

A sample label will be attached to each sampling container prior to the sampling event. Information to be included on the label will include the following:

- Sample number
- Date and time of sample collection

- Initials of person collecting the sample
- Project number
- Type of preservative, if any.

Individual samples will be identified using a unique sample number that includes the prefix for a location code. Refer to the attached table for sample numbering.

3.6.5. Chain-of-Custody Record and Shipment

There will be no preservatives added in the field. All samples will be transferred to the appropriate sampling containers and placed into a chilled (4°C) transport container for shipment to the laboratory. The chilled transport containers (coolers) will be utilized for temporary storage of the samples. The laboratory will provide sampling containers and coolers.

The shipping container used will be designed to prevent breakage, spills and contamination of the samples. Tight packing material is to be provided around each sample container and any void around the "freezer-pats". The container is to be securely sealed, clearly labeled, and accompanied by a chain-of-custody (COC) record. Separate shipping containers should be used for "clean" samples and samples suspected of being heavily contaminated. During winter months, care should be taken to prevent samples from freezing. Sample bottles will not be placed directly on "freezer- pacs".

Chain-of-custody (COC) procedures will be followed from the time of sample collection to the conclusion of laboratory analysis. Field COC procedures include:

- Label containers with sample location and sample information plus the intended analytical parameter(s). Date, time and sampler information will be written on the label in the field.
- Complete chain-of-custody forms for all samples en route to laboratory. Upon transferring samples to the laboratory sample custodian, designated staff will sign, date and note the time of transfer on the chain-of-custody form.
- Ship samples in ice chests sealed with custody seals, unless relinquished directly to a laboratory representative. The laboratory sample custodian confirms the integrity of the seals at the laboratory.
- Ensure that the samples are in possession or view of field staff or in secure storage at all times.
- Transport samples to the laboratory as soon as possible, observing appropriate preservation and holding-time requirements.

Upon receipt of the samples at the laboratory, the laboratory sample custodian will inventory the samples by comparing sample labels to those on the COC document. The custodian will enter the sample number into a laboratory tracking system by project code and sample designation. The custodian will assign a unique laboratory number to each sample and will be responsible for distributing the samples to the appropriate analyst or for storing samples in an appropriate secure area.

3.6.6. Decision Points

A normal lab turnaround is required for this project. At that point the data will be provided to and reviewed by CNS and the NYSDEC. The need for additional analyses will be determined at this time as well as the need to collect additional, confirmatory samples at the site.

3.7. Documentation Procedures

Documentation of field procedures, observations, and measurements will be provided through the use of field logs, chain-of-custody, and photographs.

Overall documentation of the nature and timing of field activities will be provided daily in the sampling personnel's field notes. The sample team or individual performing a particular sampling activity will keep a weatherproof field notebook. Field notebooks are intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during projects and to refresh the memory of the field personnel. The field notebook entries should be factual, detailed, and objective. All entries are to be signed and dated.

All members of the field investigation team are to use this notebook, which will be kept as a permanent record. The field notebook will be filled out at the location of sample collection immediately after sampling. It will contain sample descriptions including: sample number, sample collection time, sample location, sample description, sampling method used, daily weather conditions, field measurements, name of sampler, and other site-specific observations. The field notebook will contain any deviations from protocol and why, visitor's names, or community contacts made during sampling, geologic and other site-specific information which may. be noteworthy.

Good field management procedures include following· proper chain of custody procedures to track a sample from collection through analysis, noting when and how samples are split (if necessary), and making regular and complete entries in the field logbook. Proper documentation the field logbook is necessary to support the consequent actions that may result from the sample analysis. This documentation will support that the samples were collected and handled properly making the resultant data complete, comparable and defensible.

3.8. Project File Specifications

The CNS Project Manager in CNS’s Plainview, New York office location will keep all project information in a central Project File maintained. The Project File will be assigned a unique project number that will be clearly displayed on all project file folders (including electronic files). Electronic files will be maintained in a similarly organized Project File located on the CNS network system that is backed up on a weekly basis. Both hard copy and electronic Project Files will contain, at a minimum copies or originals of the following key project information:

- All correspondence including letters, transmittals, telephone logs, memoranda, and emails;
- Meeting notes;
- Technical information such as analytical data; field survey results, field notes, field logbooks and field management forms;
- Project calculations;
- Subcontractor agreements/contracts, and insurance certificates;
- Project-specific health and safety information/records;
- Project document output review/approval documentation;
- Reports: Monthly Progress, Interim Technical and Draft/Final Technical.

3.9. Analytical Methods

The contaminants of concern (COCs) defined for the Site are chlorinated Volatile Organic Compounds (cVOCs). Analytical methods will follow standard USEPA procedures consisting of Methods 8260 and TO-15.

3.10. Equipment Calibration and Maintenance Procedures

All field equipment will be calibrated prior to use according to the manufacturer's instructions. The results of calibrations and any records of repair will be maintained in the field book. Equipment that fails calibration or fails to operate properly will be removed from service and segregated from the operational equipment. Such equipment will be repaired and re-calibrated if possible or replaced. Preventive maintenance of field equipment is performed according to the procedures indicated in the manufacturer's manuals.

Laboratory analytical equipment and instruments will be calibrated in accordance with the laboratory's internal quality assurance/quality control (QA/QC) program.

3.11. Quality Control Samples

Duplicate aqueous samples will be collected and analyzed to check laboratory reproducibility of analytical data. Duplicate samples will be collected at a frequency of at least 5% (one out of every 20 samples) of the total number of samples collected to evaluate the precision and reproducibility of the analytical methods. All duplicate samples will be submitted to the analytical laboratory as a "blind duplicate", having a fictitious sample identification name and time of sample collection. Each blind duplicate will be cross-referenced to document which real sample it is a duplicate of in the field notes and on the master sample log.

Because soil sampling will be conducted, QC field samples proposed for this investigation are duplicates, matrix spike, and matrix spike duplicates. Laboratory QC will include calibration standards, laboratory control samples, reagent blanks, surrogate spikes, and laboratory duplicates.

4.0 DATA VALIDATION AND USABILITY

All field data will be summarized and recorded in the project-specific field book. Descriptive data including soil types, field screening results and observations will be summarized in an appropriate format.

The analytical laboratory will conduct necessary QC calculations that will be summarized in final laboratory reports. Copies of the analytical data will be provided to the NYSDEC as Category B deliverables for review. An electronic copy is desirable, but paper copy is acceptable. All final laboratory reports will be included as an appendix or appendices to the final report. All analytical data will also be summarized in tabular form.

Analytical data will be assessed to ensure that they are of acceptable quality. This assessment will include a review of the following:

- Sampling dates
- Dates of analysis
- Requested analysis
- Chain-of-Custody documentation
- Sample preservation
- Holding times
- Method blanks
- Surrogate recoveries
- Laboratory duplicates
- Field duplicates
- Laboratory control samples
- Method reporting limits above requested levels
- Any additional comments or difficulties reported by the laboratory
- Overall laboratory assessment of data quality

Following data validation (if conducted) and reporting, all project-generated and compiled data and information will be reconciled with the project objectives to assess the overall success of sampling activities. This data assessment, including points of achievement and departure from project - specific objectives, will be discussed in the QA section of the final report.

5.0 DATA MANAGEMENT AND REPORTING PLAN

5.1. Data Use Objectives

The typical data use objectives for this project are:

- Confirm that the soil source area has been removed;
- Determine the influence of the soil source removal on the COC groundwater and soil vapor concentrations;
- Monitor the effectiveness of the Combined AS/SVE system on the COC groundwater and soil vapor concentrations.

5.2. Data Presentation Formats

Project data will be presented in consistent formats for all letters, monthly progress reports (if required), interim technical reports, and draft/final technical reports. Specific formats will be tailored to best fit the needs of the data being presented but general specifications are described below.

5.3. Data Records

The data records will generally include one or more of the following:

- Unique sample or filed measurement code;
- Sampling or field measurement location and sample or measurement type;
- Sampling or field measurement raw data
- Laboratory analysis ID number;
- Property or component measured; and
- Result of analysis (e.g., concentration)

5.4. Tabular Displays

The following data may be presented in tabular displays:

- Unsorted (raw) data;
- Results for each constituent;
- Data reduction for statistical analysis;
- Sorting of data by potential stratification factors (e.g., location, depth, topography, etc); and
- Summary data.

5.5. Graphical Displays

The following data may be presented in graphical formats (e.g., bar graphs, line graphs, area or plan maps, isopleth plots, cross-sectional plots or transects, three dimensional graphs, etc.):

- Sample location and sampling grid;
- Boundaries of sampling area;
- Constituent concentrations at each sample location;
- Geographical extent of impacts;
- Constituent concentration levels,

- Changes in concentration in relation to distance from the source, time, depth or other parameters;
- Features affecting intramedia transport; and
- Potential receptors.

6.0 GROUNDWATER MONITORING; SAMPLING, PROCEDURES, & PROTOCOLS

Groundwater samples will be analyzed via EPA Method 8260 for the COC cVOCs by a NYSDOH-certified laboratory and deliverables will conform to NYSDEC ASP Category B. As part of the reporting process, all data will be evaluated and recommendations for modifications in the frequency of sampling and number of wells to be sampled will be presented.

6.1. Groundwater Sampling Protocols

During each round of sampling, groundwater samples will be collected, using low flow well sampling techniques described herein.

Prior to a sampling round, water levels will be measured in all monitoring wells. These water level data will be collected on a single date, prior to the field sampling, and will be tabulated and used to compile groundwater contour maps.

Three to five well casing volumes will be purged using a low flow submersible pump and disposable polyethylene tubing or by bailing. Field measurements of pH, specific conductance, and temperature will be collected and documented.

Specific conductance, pH, and temperature will be measured, at a minimum, after each purged volume. Stabilization of these parameters +/- 10% from successive purged volumes indicates that the groundwater within the well is at or approaching equilibrium and the well can be subsequently sampled.

A stainless steel, Teflon, PVC, or polyethylene bailer will be used to obtain the groundwater samples within three (3) hours of purging. All samples will be sent to the laboratory for analysis within 24 hours of sampling.

The following standard protocol for groundwater sampling has been established to conform to NYSDEC rules and regulations. The standard methods for preparation, collection and transfer of groundwater samples, as well as record keeping, are detailed below. These methods must be followed to provide representative samples of chemical analysis.

After collection of an acceptable sample in accordance with this protocol, the sample will be submitted to a NYSDOH ELAP-certified laboratory. The preparation, collection, preservation, transfer and record keeping of each sample will be coordinated with the analytical laboratory to ensure reliable test results.

6.2. Sampling Periods

The wells will be monitored, and the groundwater samples will be analyzed via EPA Method 8260 for the COC cVOCs by a NYSDOH-certified laboratory and deliverables will conform to NYSDEC ASP Category B. As part of the reporting process, all data will be evaluated and recommendations for modifications in the frequency of sampling and number of wells to be sampled will be presented.

6.3. Pre-Sampling Preparation/Equipment

Health and Safety: Sample collection with conform to Level D, as outlined within the Site Health and Safety Plan.

Authorized Personnel: All individuals involved in the sampling will have read this plan, be technically qualified, and follow the protocol whenever samples are obtained.

Staging: Prior to any sampling event, personnel responsible for sampling will take the following steps:

1) Review the sampling procedures;
2) Assemble and inspect field equipment necessary for sample collection, and verify that equipment is clean ·and in proper working order;
3) Calibrate equipment to the manufacturer's specifications;
4) Examine shuttles, bottles and preservatives. Contact the laboratory immediately if any problems are found or observed;
5) Confirm sample delivery time and method of sample shipment with the laboratory;
6) Establish a well purging and sampling schedule for the activities to be performed each day; and
7) Establish a temporary staging area consisting of plastic sheeting.

6.4. Groundwater Level Measurement Procedures

1) Clean all water-level measuring equipment (e.g., steel tape or water level indicator) using appropriate decontamination procedures;

2) Remove locking well cap, note weather, time of day and date, etc. in field notebook, or on an appropriate form.

    a) Remove well casing cap.
    b) Measure the static water level in the well with a decontaminated steel tape or electronic water level indicator. The tape or water level indicator shall be rinsed with deionized water in between individual wells to prevent cross-contamination. Synoptic rounds of water level measurements shall all be completed in the same day.
    c) Measure distance from water surface to reference measuring point on well casing, and record in field notebook. (Note that the measurement is being taken from the established survey reference mark (notch) located at the top of the PVC riser pipe in each well.
    d) Measure total depth of well and record in field notebook or on log form. All water level measurements are to be recorded to the nearest 0.01-foot.
    e) Remove all down hole equipment, replace and secure well casing cap and locking protective caps.
    f) Calculate elevation of water:

$$\mathbf{EW = E\text{-}D}$$

Where:
EW = Elevation of water;
E = Elevation of point of measurement (survey reference point);
D = Depth to water

6.5. Procedures for Well Purging

Well purging is necessary to obtain a sample representative of the groundwater in the formation and not standing/stagnant water in the well.

6.5.1. Examination of the well

a) Identify the well and record the well number of the field data sheet.
b) Verify that the well is not damaged. Notify the CNS PM if well damage is obvious or suspected, so that the well can be repaired or replaced.
c) Put on new disposable gloves.
d) Carefully remove well cover to avoid entry of foreign material into well.
e) If needed, the exterior and interior of the exposed protective well box should be wiped with clean filter paper (or equivalent) wetted with distilled water.

6.5.2. Purging the Well

a) Three to five casing volumes of water will be removed from the well prior to sampling with either a submersible pump and dedicated polyethylene tubing, or with a dedicated bailer, or properly decontaminated bailer (stainless steel, Teflon or PVC). The well volume is calculated using the following formula:

$$\mathbf{V = R^2 (H)(0.49)}$$

Where:
V = standing water volume, in gallons, to be purged
R = inside radius of well in inches
H = linear feet of standing water in the casing (total depth to groundwater)
0.49 = correction factor that includes conversion from inches to feet and assumes three well volumes will be purged

OR:

purge until water temperature, conductivity and pH stabilize (i.e., remain constant within 10% of each reading). If a well purges dry or is slow to recharge, only one well volume of water needs to be purged.

b) Temperature, specific conductance, and pH will be measured during purging. At a minimum, measurements will be taken after each well volume purged.

c) All purging and sampling equipment must be stored and transported in a manner that minimizes the possibility of accidental contamination.

6.6. Procedures for Record Keeping

The sampling team will record the following information regarding the well purging procedure in the field notebook and/or on a Groundwater Sampling Record/Field Observation Log:

- Day/date/time
- Weather conditions
- Air temperature
- Condition of the well (rusty, bent casing, etc.)
- Person(s) doing the purging
- Groundwater level prior to purging
- Depth to the bottom of the well
- Minimum volume of groundwater to be purged (3 well volumes)
- Chemical properties of evacuated water: temperature specific conductance, pH
- Method of purge water disposal
- Physical properties of evacuated water: Color, odor, turbidity, presence of sheen
- Volume of groundwater purged from the well.

The following field measurement procedures that discuss specific steps in the calibration and use of field instruments should be interpreted to reflect the manufacturer's recommended procedures for the actual instruments being utilized.

6.7. Procedures for the Measurement of Groundwater pH and Temperature

6.7.1. Calibration

a) Immerse the tip of the electrode in water overnight. If this is not possible due to field conditions, immerse the electrode tip in water for at least an hour before use.
b) Rinse the electrode with demineralized water.
c) Immerse the electrode in pH 7 buffer solution.
d) Adjust the temperature compensator to the proper temperature.
e) Adjust the pH meter to read 7.0.
f) Remove the electrode from the buffer and rinse with demineralized water.

6.7.2. Measurement

a) Collect a groundwater sample using either a stainless steel, Teflon or PVC bailer and pour a small amount of this sample into an extra sample jar that will not be used to store chemically analyzed samples.
b) Immerse the electrode into the extra sample jar. Do not immerse the electrode into a sample that will be analyzed by the laboratory.
c) Read and record the pH of the solution after adjusting the temperature compensator to the sample temperature.
d) Rinse the electrodes with demineralized water.
e) Keep the electrode immersed in demineralized water when not in use.
f) Record Results in the field notebook.

6.8. Procedure for the Measurement of Groundwater Specific Conductance

a) Immerse the electrode in water overnight. If this is not possible due to field conditions, immerse the electrode for at least an hour before use.
b) Rinse the cell with one or more portions of the sample to be tested.
c) Immerse the electrode in the sample and measure the conductivity.
d) Adjust the temperature setting to the sample temperature.
e) Record the results in the field notebook.

6.9. Procedures for Groundwater Sampling

The following procedure shall be used for monitoring well groundwater sampling:

a) Prepare for purging. Decontaminate bailer and discard rope. If a submersible pump is used, discard pump discharge line. If using a disposable bailer and dedicated rope, prepare new bailer and appropriate length of rope.
b) After purging, allow static water level to recover for ten minutes.
c) Obtain sample from well with either a stainless steel, Teflon, PVC or disposable bailer suspended on either a polypropylene monofilament or a stainless steel, coated-coated wire. The maximum time between purging and sampling will be three (3) hours.
d) Lower the bailer slowly to avoid degassing.
e) Collect samples by pouring hailers directly into sample bottles from hailers.
f) Place samples in cooler and chill to 4°C. Samples will be delivered to the designated laboratory within 24 hours.
g) Re-lock well cap.
h) Fill out field notebook, well sample log sheet, labels, custody seals and chain- of-custody forms.

6.10. Field Procedures Documentation

Data reporting practices will be followed carefully, and data entries will be validated regularly to ensure that raw data are accurate. All the field data generated during field measurements, observations and field instrument calibrations, will be entered directly into a bound field notebook.

One or more bound books will be maintained for the site, and each book will be consecutively numbered. The books will remain with the main project files. Copies will be made for PM and for the person who made the entries, if requested.

All entries in the logbook will be made in ink. When a mistake is made in the log, it will be crossed out with a single ink line and will be initialed and dated. Special care will be taken in the description and documentation or sampling procedures. Sampling information to be documented in the field notebook and/or associated forms are as follows:

- Weather conditions;
- Sample number;
- Date and time of sample collection;
- Source of sample (well, trench, etc.);
- Purged well - type of equipment, purge volume, rate of purge, decontamination procedures and method of disposal;

- Location of sample - document with a site sketch and/or written description of the sampling location so that accurate re-sampling can be conducted if necessary;
- Sampling equipment (i.e. bailer);
- Analysis and QA/QC required;
- Filtering, if required;
- Field instrument calibration including date of calibration, standards used and their source, results of calibration and any corrective actions taken;
- Field data (pH, temperature, conductivity, etc.);
- Field observations - all significant observations will be documented;
- Sample condition (color, odor, turbidity, sheen, etc.);
- Site conditions;
- Sample shipping procedure, date, time, destination, and if legal seals were attached to transport container(s);
- Comments - Any observation or event that occurred that would be relevant to the site; for example, weather changes and effect in sampling.

6.11. QA/QC Sampling

Field Blanks will be collected to evaluate the cleanliness of groundwater sampling equipment, sample bottles, and the potential for cross-contamination of samples due to airborne contaminants present in the air at the site during handling of equipment and sample bottles. Field blank samples will be collected from the same equipment used to collect the groundwater samples. The frequency of field blanks taken will be one per decontamination event for each type of sampling equipment, at a minimum of one per equipment type per day.

Where required, field blanks will be obtained prior to the occurrence of any analytical field- sampling event by pouring deionized or potable water over a particular piece of sampling equipment and into a sample container. The analytical laboratory will provide field blank water and sample containers with preservatives for the collection of field blanks. The field blanks, as well as the trip blanks will accompany field personnel to the sampling location.

The field blanks will be analyzed for the same parameters as the samples and shall be shipped with the samples taken subsequently that day. Field Blanks shall be taken in accordance with the procedure described below:

a) Decontaminate sampler/sampling equipment using the procedures specified in this plan.
b) Pour distilled/deionized water over the sampling equipment and collect the rinsate water in the appropriate sample bottles.
c) The sample shall be immediately placed in a sample cooler and maintained at a temperature of 4°C (39.2°F) until received by the laboratory.
d) Fill out sample log, labels and chain-of-custody forms, and record in field notebook.

If disposable bailers are utilized, the first step in the procedure will be deleted and replaced as follows:

- Remove wrappings from a brand new, unused disposable bailer.

A laboratory supplied trip blank consisting of an aliquot of distilled, deionized water, which will be sealed in a sample bottle(s) prior to initiation of sampling. The trip blank will be used to determine if any cross contamination occurs between aqueous samples and/or the environment during shipping. Trip blanks will be analyzed for aqueous VOCs only. Glass vials (40 ml) with Teflon-lined lids will be prepared by the laboratory prior to sampling. The sealed trip blanks will be placed in a cooler with the empty sample bottles and brought to the site by laboratory personnel or via overnight courier. One trip blank per shipment will be analyzed.

Duplicate samples will be collected and analyzed to check laboratory reproducibility of analytical data. At least 5% (one per every 20 samples) of the total number of samples collected samples will be duplicated to evaluate the precision of the methods used. Duplicate samples will be collected using the same method as non-duplicate samples. Bottles for the sample and duplicate sample will be filled alternately until all sample and duplicate sample bottles have been filled.

Matrix spike (MS) and matrix spike duplicates (MSD) for organic analysis are performed at a rate of at least 5% (one per every 20 samples) of the total number of samples collected. Further, reanalysis is required at times, due to determination of anomalous results during analysis. To ensure that the laboratory has sufficient volume for the MS/MSD analysis, triple sample volume must be submitted for aqueous organic extractable and volatile samples once per every 20 samples in a sample delivery group (SDG).

6.12. Corrective Action

If, during the course of sampling, it is determined that field procedures are not yielding representative groundwater samples, this Plan will be modified as required and reported to the NYSDEC. Any alteration to field procedures will be included as an amendment to the Plan.

6.13. Selected Laboratory and Sample Analysis

Samples will be analyzed by Phoenix Environmental Laboratories, Inc (NY ELAP #11301) located at 578 East Middle Turnpike in Manchester, CT; SGS North America, Inc (NY ELAP #10983) located at 2235 Route 130 in Dayton, NJ; and/or SGS North America, Inc (NY ELAP #12022) located at 4405 Vineland Road in Orlando, FL

7.0 SOIL VAPOR SAMPLING PROCEDURE

Soil vapor sampling will be conducted in general conformance with the NYSDOH Guidance. Prior to sampling, local conditions shall be noted, including but not limited to, weather conditions, odors and any chemicals being utilized at the subject site. A sampling log will be kept.

The soil vapor implants will be evacuated to purge any stagnant vapors within the probe (the purge volume will approximate one borehole volume). In addition, during the purging process, helium will be released around the implant at the ground surface, and vapor samples will be collected from the installed implant and analyzed for helium to assess potential short-circuiting and ensure that the surface seal is intact.

The soil vapor samples will be collected in dedicated, laboratory-supplied “batch certified clean” stainless steel Summa canisters at rates no greater than 0.2 L/min, with an average target fill-time of approximately eight (8) hours per canister.

Immediately following the sample collection, the Summa canister valves will be tightened and the flow controller will be removed. Samples will be sent via laboratory or overnight courier for analysis via EPA Method TO-15 for the COC cVOCs.

APPENDIX E

Health and Safety Plan

Health and Safety Plan

Site:
“Former” Debbie Cleaners
3800-3808 Nostrand Avenue
Brooklyn, New York 11235
BCP Site # C224237

Prepared For:

New York State Department of Environmental Conservation
625 Broadway
Albany, New York 12233-7016
Attn: Mr. Michael MacCabe, P.E.
Senior Environmental Engineer

On Behalf of:

Acadia 3780-3858 Nostrand Avenue, LLC
411 Theodore Fremd Avenue, Suite 300
Rye, New York 10580

Prepared By:

CNS Environmental Corporation
208 Newtown Road
Plainview, NY 11803
CNS Job #: D196

OCTOBER 2018

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1.0 Introduction

CNS Environmental (CNS) was retained by Acadia 3780-3858 Nostrand Avenue, LLC (the Applicant) to prepare this *Health and Safety Plan* (HASP) for Brownfields Cleanup Program (BCP) Site # C224237 known as the "Former" Debbie Cleaners site located at 3800-3808 Nostrand Avenue in Brooklyn, NY ("Site").

The BCP Site is approximately 11,152 square foot of tenant spaces and driveway behind the tenant spaces; all of which is located within the northernmost building of the Nostrand Place shopping center property located from 3780 through 3860 Nostrand Avenue in Brooklyn, Kings County, New York. The site is abutted to the north and south by other commercial tenant spaces; to the east by Nostrand Avenue with a retail shopping center beyond; and by residential homes approximately 36.5-feet to the west.

The Site currently contains four (4) tenant spaces, a basement hallway and a rear driveway identified and occupied as follows:

Occupant	Address	Description
U.S. Army Career Center and Building Utilities	3800 Nostrand Avenue	Northern-most tenant space
Chase Bank	3804 Nostrand Avenue	Former Debbie Cleaners space; situated to South of 3800 and North of 3806
Academy of Dance and Creative Arts	3806 Nostrand Avenue	Situated to South of 3804 and North of 3808
Love 2 Sleep	3808 Nostrand Avenue	Southern-most tenant space assumed occupancy after completion of RI
Basement Hallway	--	Runs along west side of abovementioned tenant spaces with access provided from each tenant space basement, as well as from an exterior staircase at rear driveway.
Rear Driveway	--	Situated at Street-grade to the west of the abovementioned tenant spaces

From approximately 1959 through 1985, the tenant space currently occupied by Chase Bank was occupied by a dry cleaner (Debbie Cleaners), which appears to have led to the dry cleaning-related chlorinated Volatile Organic Compound (cVOC) contamination of soil, groundwater and soil vapor.

Based upon the findings of the Remedial Investigation and Supplemental Remedial Investigation, dry-cleaning related cVOCs are present above regulatory levels within the Site groundwater and soil vapor, and in a suspected source area in the Site soil. Based on these findings, it is CNS's opinion that a Soil Vapor Extraction (SVE) System Remedial Action and excavation of the soil hot spot are the most feasible options for the Site.

As a result, CNS has developed the following HASP procedures for all field personnel to follow during investigation, remediation and excavation activities. The CNS Site Safety Officer (SSO) will be responsible for informing all field technical personnel of the pertinent level of personal protection required and work rules to be observed. The SSO will also maintain a daily sign in sheet to document all on-site personnel and visitors. No smoking, eating, chewing of tobacco, or use of lip balm will be permitted on the subject site during any activity that disturbs the site's surficial soils. Under no circumstance will excavation activities commence prior to completion of utility mark-out activities.

The HASP requirements are based on currently available information and a preliminary analysis of associated potential hazards. This plan establishes the minimum protocols necessary for protecting all on-site field personnel. All field technical personnel will be equipped with personnel protection/safety equipment which, at a minimum, meets the requirements of this HASP.

1.1 Project Personnel

Professional Engineer/Site Safety Officer:	Mr. Michael Hauptmann	(516) 932-3228
Senior Project Manager:	Mr. Charles Powers	
Environmental Scientist/Site Safety Technician:	Mr. Mohammad Qurashi	
Facility Contact:	Mr. Brian Bacharach	(914) 288-8100

1.1.1. Senior Project Manager

The Senior Project Manager (SPM) has overall responsibility for the health and safety of the HASP activities on the site. The SPM will approve any changes to this plan due to modification of procedures or newly proposed site activities and is responsible for the development of safety protocols and procedures. The Site Safety Officer (SSO) will report to the SPM and will notify the SPM of any health and safety deficiencies or problems requiring a specific action or level of protection required.

1.1.2. Professional Engineer / Site Safety Officer

The Professional Engineer (PE) has overall responsibility for the implementation of all remedial actions on the Site; and will also act as the Site Safety Officer (SSO) who has overall responsibility for the implementation of this HASP. The SSO will maintain communications with the SPM, provide monitoring and records of activities. The SSO is responsible for the enforcement of safety protocols and procedures of this project and will be responsible for the resolution of any day-to-day health and safety issues which arise during the conduct of site work. Health and safety-related issues will be determined by the SPM and the proper action plan (i.e. level of protection required) will be conveyed to the SSO for implementation.

1.2 Applicable Health & Safety Standards

Since this site is not a hazardous waste site or treatment facility, as defined by 29 CFR 1910.120, the specific requirements of that training standard are not applicable. Personnel will be required to understand the potential hazard of the work and will be instructed in the proper methods for avoiding contamination, for mitigating any environmental damages, and on the use of necessary personnel protective equipment (PPE). Workers involved in tasks which require any soil disturbance where inhalation, skin contact, or ingestion are possible routes of exposure, must be properly trained and qualified to wear personal protective equipment noted in Sections 5.0 and 8.0, herein. Work at protection Level B and C will require the additional training and medical qualifications set forth in CFR 1910.120.

The remedial activity must conform with safety requirements of all applicable sections of OSHA regulations found in 29 CFR 1926, 29 CFR 1200 and the General Safety Standards. The Site Safety Technician (SST) will provide area monitoring to determine and to document potential exposure levels during various tasks, but it will be the responsibility of the contractor safety supervisor(s) to alert their workers of potential hazards, to maintain any necessary medical records and to immediately notify the SPM, SSO and the owner of any unusual conditions, accidents, illnesses, near misses and property damage.

Complete records of all accidents and illnesses will be required by the contractor. Serious accidents, first aid, spills, or any unusual hazards must be reported immediately upon occurrence.

2.0 Potential Chemical Exposure

Based on site-specific information provided within the Remedial Investigation and Supplemental Remedial Investigation reports completed by CNS dated March and September 2018, respectively; potential environmental soil exposures maybe encountered. Potential contaminants associated with the project may consist of Volatile Organic Compounds (VOCs), low level Semi-Volatile Organic Compounds (SVOCs) and Metal contaminants.

The most likely routes of exposure are breathing of vapors and/or particulate-laden air released during soil disturbing activities. Dermal contact is also a potential exposure pathway. The remaining sections of this HASP address procedures (including training, air monitoring, work practices, and emergency response) to reduce the potential exposure to these contaminants.

The potential adverse health effects from the broad classes of contaminants potentially present at the site are diverse and potentially severe. Although many of these contaminants are known or suspected to result in chronic illness from long duration exposures, due to the limited nature of the field activities, acute effects are both more likely to be of concern and noticeable.

- Typical symptoms of acute exposure, particularly to VOC's and SVOCs are irritated eyes, nose or upper respiratory tract, headache, nausea, drowsiness, dizziness and difficulty breathing.
- Long-term exposure to heavy metals, such as lead and mercury, can affect the central nervous system, kidneys, and immune system, particularly in young children. In adults, lead may decrease reaction time, cause weakness in fingers, wrists, or ankles, and possibly affect the memory.

This HASP addresses potential environmental hazards from the presence of potentially hazardous materials. It is not intended to address the normal hazards of construction work, which are covered by OSHA regulations and/or local and state construction codes or regulations.

2.1 General Hazard Assessment

The probability of worker exposure to an environmental hazard varies with the job task. The job tasks that involve contact with potentially contaminated soils are expected to have a greater potential for exposure than job tasks that do not come into contact with the soil. Site workers may be exposed to VOCs, SVOCs or Metals by inhalation, ingestion, and/or dermal contact. To protect potentially exposed personnel, zones may be established, dust control measures will be implemented, respirators and personal protective equipment may be worn, and initial personal air monitoring will be conducted.

2.2 Chemical Vapor Exposures

Chemical compounds have been detected in soil samples associated with this project. The main route of exposure for many compounds is inhalation, and secondary exposure may be absorbed through the skin. Exposure to airborne concentrations of various compounds will be controlled by monitoring and the use of personal protective equipment, if and when required noted in Sections 5.0 and 8.0, herein.

2.3 Category 1 Above-Grade Remedial Activities; Limited Soil Disturbance/Contact

It is anticipated that the following activities occurring above-grade that require minimal soil disturbance should not result in contact with potentially contaminated soil or require additional Health and Safety (H&S) considerations beyond good H&S practices already in place for this type of remediation project. These tasks may include Surveying, Surface Grading, Paving-Curb & Sidewalk Work.

These operations will be conducted within the remediation work zone and will be evaluated and monitored by the SSO. Access to the work zone is limited to project personnel, project support personnel, and authorized visitors. Initially, exclusion zones will not be established for these activities, but may be established if visual evidence of contamination is seen and/or instrument readings exceeding the action levels detailed in Section 5.0 are detected.

Surveying

This activity is generally conducted above grade and does not necessitate the disturbance of the soil. It is not anticipated that a potential exposure will exist. Initially, an exclusion zone will not be established for this activity.

Landscaping

This activity will involve final grading and placement of gravel. Because this activity is expected not to significantly disturb subsurface soils, an exclusion zone will not be initially established.

Surface Grading

This activity would be to level a surface as needed. Initially, an exclusion zone will not be established for this activity. Dust control may be included as required.

2.4 Category 2 Below-Grade Remedial Activities; Contact with Soil

It is anticipated that personnel working in the following activities have some reasonable potential to come into contact with potentially contaminated soil. These activities may include:

- Soil Excavation
- Soil Stockpiling
- Soil Vapor Extraction Point Installation

These activities may result in potential exposure to contaminated soil and may be conducted in an exclusion zone. This will be evaluated by the SPM and monitored by the SSO. Access to any exclusion zone will be limited to project personnel. All project personnel working in these areas must meet the training and medical requirements for working in an exclusion zone, when established, as defined in Section 4.0 of this HASP. Personnel protective clothing and equipment will be worn as defined in Section 5.0, or as determined by the SPM.

Routes of exposure may include inhalation and incidental ingestion or skin absorption. Operators of heavy equipment (i.e. bulldozers, backhoes) will have a lesser probability of being exposed to contaminated soils by dermal contact; however, there is the possibility of inhalation exposure or accidental ingestion. Exclusion zones may be established for these activities.

3.0 Medical Emergency

Medical emergencies can be described as situations which present a significant threat to the health of personnel involved in the implementation of the subsurface assessment activities. These can result from chemical exposure, heat stress, cold stress and poisonous insect bites. Medical emergencies must be dealt with immediately and proper care should be administered. This may be in the form of first aid and emergency hospitalization.

In the event of a medical emergency, assess whether or not the victim can be safely transported to medical facilities. If the victim cannot be moved without the risk of aggravating their condition, refer to Section 3.2 "Emergency Notification" and summon an ambulance and appropriate emergency response personnel.

3.1 Transporting Victims

If the victim can be safely transported without risk of additional injury, the nearest hospital is NYC Health + Hospitals/Coney Island.

The hospital is located at the northeast corner of Shore Parkway and Ocean Parkway. The most direct or emergency route from the subject site to the hospital is as follows:

1. Head south on Nostrand Ave toward Avenue Z (0.3 mi)
2. Turn right at the 2nd cross street onto Voorhies Avenue (0.8 mi)
3. Continue onto Shore Parkway (0.1 mi)
4. Slight left to stay on Shore Parkway (0.2 mi)
5. Slight left at E 11th Street (0.2 mi)
6. Slight left onto Shore Parkway (0.2 mi)
7. Turn right onto Ocean Parkway Service Road (364 ft)
8. Arrive at NYC Health + Hospitals/Coney Island, 2601 Ocean Parkway, Brooklyn, NY 11235.

Total mileage 1.8 miles; total travel time is nine (9) minutes.

See Appendix I: Mapped Hospital Directions.

3.2 Emergency Notification

The following is a list of telephone numbers for the nearest hospital and emergency response personnel:

NYC Health + Hospitals/Coney Island	1-718-616-3000
Fire Emergency	911
Ambulance/Rescue Squad	911
NYC Police Department 61st Precinct	911
NYSDEC Spill Hotline	1-800-457-7362
NYC Department of Health	1-212-442-9666
NYSDEC Region II Division of Hazardous Waste Remediation	1-718-482-4933
CNS Senior Project Manager (Charles Powers)	1-516-932-3228 (office)
	1-516-448-5004 (mobile)
CNS Site Safety Officer (Michael Hauptmann)	1-516-932-3228 (office)
	1-516-449-8924 (mobile)

4.0 Site/Zone Control

Three zones will be used to control access to remediation areas when potential contamination may be present and to prevent the accidental spread of contaminated materials. The three zones are identified as:

1) Remediation Work Zone (Cold Zone) - all activities take place without restrictions;
2) Contamination Reduction Zone (Warm Zone) – Decontamination of personnel takes place;
3) Exclusion Zone (Hot Zone) – Remediation and clean-up are performed.

In order to delineate areas of activity involving potentially contaminated soil from other site activities, the areas will be marked with orange fencing and posted with a notice regarding potential hazards, area restrictions, and access requirements. Caution tape may be used. The Exclusion Zone shall be posted or marked in such a way as to be visually distinct from the Remediation Zone fencing. The contractor shall ensure the zone fencing is maintained and completely reestablished at the end of each workday. The SPM will be responsible for establishing the Exclusion Zone.

4.1 Remediation Work Zone

The Remediation Work Zone is the entire project work area or remediation area. All non-hazardous materials project work activities will be conducted within the Remediation Work Zone. The remediation work zone is restricted to project personnel, project support personnel and visitors as defined in this document. Unauthorized personnel will be prohibited from entering the site.

Air and/or soil sampling methods may be used while any excavation takes place. Upgrading of zones and PPE will depend upon results of sampling.

All personnel (as noted above) entering the remediation work zone will be briefed by the SPM prior to their initial entry. All project personnel entering the remediation work zone must meet the training requirements as outlined in Section 5.0. The protective work clothing and equipment to be worn is defined in Section

5.0 or as required by the SPM. All project personnel and equipment exiting the construction work zone may need to be decontaminated before leaving the site, as determined by the SPM.

Activities defined as Category 1 in Section 2.3 will be performed within the remediation work zone. The SPM will monitor these activities.

4.2 Exclusion Zone

Exclusion zones will be established by the SPM, if the action levels listed in Section 5.0 are exceeded, if there are visible signs of contamination and/or if there are changes in operations or the knowledge of the site which would increase the probability of worker exposure. The Exclusion Zone is designated to prevent the accidental spread of hazardous substances from a contaminated area to a clean area. The limits and location of the Exclusion Zone may vary depending on soil disturbing activities. The SPM will determine the extent of the Exclusion Zone depending on potential hazards and site activities. Entry into the Exclusion Zone requires the use of PPE, as defined by the SPM.

4.3 Contamination Reduction Zone

This area is a buffer between the exclusion zone and the remediation work zone where personnel and equipment are decontaminated. It serves as a reduction zone between contaminated areas and clean areas. Activities to be conducted in this zone will require personnel protection as defined in Section 5.0. Decontamination will require removal of PPE, disposal or cleaning of PPE and cleaning of work equipment. Procedures for decontamination will be followed based on appropriate standards and company procedures. Equipment may be tailored to a decontamination pad for cleaning in which case the contamination reduction zone may be a remote site.

5.0 Personal Protection On-Site

Based on currently available information, Level D protection should be adequate for most of the work to be performed on-site. For the purpose of this Health and Safety Plan, Level D areas are defined as areas where gross ambient organic vapor levels (monitoring in real time) range from site background to 5 parts per million (ppm) over background or airborne substances are exceeded, personal protection will be upgraded to Level C. Background readings will be obtained each day within the work area prior to commencement of work and along the perimeter of the work site.

Work clothing meeting requirements of the Site Information, Regulations and Safety Program for Contractors will be worn by personnel conducting activities within the remediation work zone. For work involving disturbance of soils, the SPM may designate exclusion zones for these activities. He will also determine other appropriate levels of protection to either Level "C" or Level "B". Only trained and qualified workers will be permitted to work at level "C" or "B", and work in Level "B" will require a mandatory "buddy" system at all times.

For the purpose of this Health and Safety Plan, during implementation of remedial efforts, Level D personnel protection will be required. Level D is the standard work uniform to be worn at all times when excavating or working in exposed soil in trenches, excavation or dirt piles. The level of protection to be worn by field personnel will be defined and controlled by the SPM and/or SSO as follows:

ACTIVITY	LEVEL	PROTECTIVE EQUIPMENT
Encounter with unknown chemical hazard condition, some excavation/trench work, chemical spill control, emergency rescue operations, any high hazard conditions not involving fire or other unknown safety hazard.	B	-Full face piece supplied air respirator (SAR) or self-contained breathing apparatus (SCBA) -Chemical-resistant clothing -Inner Coverall clothing -Inner and outer chemical resistant gloves -Chemical resistant safety over boots-disposable -Hard hat -Hearing protection as needed
Soil excavation, UST related work, trench related work, and activities resulting in direct contact with contaminated soils as determined by the SPM or designee	C	-Full or half face piece air purifying respirator -Chemical-resistant clothing -Inner and outer chemical-resistant gloves -Chemical resistant safety overboots (disposable) -Hard hat -Hearing protection as needed -Safety glasses or goggles if half face piece respirator is used
Soil excavation and handling, trenching operations, pile driving sub-grading constructions, (underground) piping or wiring. For all work activities in the remediation zone, when there is no exceedance to contaminant action levels.	D	-Work Clothing or Coveralls, and/or outer polycoated Tyvek or equal chemical resistant as needed -Work Clothes, standard -Safety boots -Boot covers, chemical resistant, disposable, as needed -Chemical resistant gloves as needed (Nitral or equal w/interior disposable gloves) -Safety glasses or goggles -Hard hat -Hearing protection as needed -Dust Mask

During the course of excavation activities, all efforts will be made to minimize activities that will create dust. Dust suppression, including wetting down the work area, use of haul trucks equipped with tarps and gravel pads will likely be necessary.

5.1 Basic Equipment

Basic safety equipment will be kept on-site to monitor site conditions and respond to emergency situations. This equipment includes, but is not limited to the following:

- First Aid Kits
- Portable eyewash
- Type ABC fire extinguisher
- Photo Ionization Detector (HNU or equivalent)

5.2 Personnel Training

All personnel working on-site who have the potential for coming into contact with site soils during implementation of remedial efforts must have received the minimum Health and Safety training in accordance with OSHA 1910.120(E)(2).

Initial Training – All personnel shall have the mandated OSHA 10-Hour Construction Industry Safety and Health training. Initial hazard awareness training orientation and a site briefing will be provided on-site for all Project Personnel, Project Support Personnel, and Visitors by the SPM or designee prior to their initial entry to the site. Training may also be provided on an as needed basis at the beginning of each project task to specifically address the activities, procedures, monitoring, and equipment for the site operations. It will include site and facility layout, hazards, and emergency services at the site, and will detail all provisions contained within the HASP.

Project Personnel Training - All Project Personnel designated to work in an exclusion zone, as outlined in Section 4.0, are required to have successfully completed the initial training requirement (40 hours) and refresher training requirements pursuant to OSHA 29 CFR 1910.120(e). Copies of each employee's certificate/card will be retained on file.

Supervisor Training - For any work in the exclusion zones, the direct on-site manager of the task work force shall be required to have successfully completed the supervisor training requirement pursuant to OSHA 29 CFR 1920.120(e).

Weekly Safety Training - Weekly Safety Training meetings will be conducted by the SPM or designee with crews working Levels B or C to discuss specific tasks being performed and relevant safety issues. Weekly Safety Training meetings will be held, and documented, by each contractor with all their employees.

6.0 Field Procedures

Work areas will be defined, respectively, as Level 'C' or 'D' to correspond with the required level of personal protection. Each work area will be cordoned off while work is taking place. Access to these areas will be provided only to those persons directly involved in the field operations and only if the appropriate level of personal protection is worn as outlined in Section 5.0.

All equipment and personnel will be subjected to decontamination procedures before leaving an area of restricted access. Separate work zones and decontamination zones will be predesignated in areas requiring Level C protection as outlined in Section 4.0.

Monitoring for this project is conducted (1) to manage worker safety during the project; (2) to minimize exposure outside of the construction exclusion zones, (3) to delineate zones and (4) to assist with determination of appropriate levels of personnel protective equipment. Site specific action level criteria have been established for all the instruments which may be used in making field health and safety determinations. Other information, such as the visible presence of contamination, is also used in making field health and safety decisions. Therefore, it is possible the SPM or his designee may establish exclusion zones and/or require personnel to wear PPE, even though atmospheric air contaminant concentrations are below established site-specific HASP action levels.

6.1 Air Monitoring (Particulates and VOCs)

Throughout the duration of remedial excavation activities, air quality will be monitored at the perimeters of the work site (Appendix A: Community Air Monitoring Plan) with a Photo Ionization Detector (PID) and Real-time Particulate Monitoring (PM-10) equipment. Work will stop if levels or organic vapors and/or particulate levels exceed OSHA and/or NIOSH action levels, until particulate levels are reduced, and proper site controls are enacted in the remediation zone.

Continuous monitoring will be performed by the SST during all operations which have the potential for coming into contact with potential contaminated materials. The owner, or their designees, will provide the proper required equipment, perform sampling, and record the results of this monitoring.

Real-time monitoring will be completed in compliance with New York State Department of Health (NYSDOH) Generic CAMP, May 2010, Appendix 1A of NYSDEC DER-10. Particulate monitors will have datalogging capability and the SST will manually inspect the readings every 15-minutes and log accordingly.

6.2 Record Keeping

The on-site SSO will maintain a record of all individuals present at the work site, levels of worker protection and general conformance with this HASP. PID readings will be periodically recorded in addition to noting observed peak readings.

7.0 Decontamination

All equipment and personnel will be subjected to decontamination procedures before leaving an area of restricted access. Separate work zones and decontamination zones will be predesignated, if needed, as outlined in Section 4.0.

Field decontamination will be established at the exits from the exclusion zones to the remediation zones, by the SPM and will be under the control of the SPM or designee. Decontamination of equipment and personnel require all material in contact with a potential hazardous substance to be adequately cleaned. All disposable garments will follow procedures as outlined in the 29 CFR 1910.120 and the EPA/NIOSH Guidance Document 85-115. Decontamination will take place in the decontamination reduction zone. All equipment will be cleaned to both prevent the hazards from leaving the site and cross contaminate the non-impacted areas.

7.1 Level D Areas

Before leaving Level D work areas, loose soil will be brushed from equipment and clothing. Equipment will be rinsed with potable water. Disposable coveralls, gloves, etc. will be placed in plastic bags and disposed of as household waste in available on-site receptacles. This will be performed by all project personnel exiting the construction zones before:

1. Rest breaks and meal periods
2. Leaving at the end of shift

7.2 Level B and C Areas (Exclusion Zone)

All Project Personnel exiting a construction exclusion zone to the Contamination Reduction Zone will be required to wash boots and gloves in a one tub station, then rinse in a second tub station.

All Project Personnel exiting an exclusion zone will be required to wash outer garments at Station 1, which is a tub station with soapy water; then proceed to clean up Station 2, a tub station with water for rinsing. A pump spray container (Hudson or like model) will be used to minimize contaminated water. From these stations the employee will proceed through the following eight (8) steps in the order listed. An exclusion zone will be required for all levels (D through B) of protection.

1. Remove outer boot covers
2. Remove disposable coveralls
3. Remove outer gloves
4. Vacuum or brush any dust off clothing or shoes
5. Remove respirator
6. Remove inner gloves
7. Wash face and hands prior to eating
8. Waste water is collected and returned to the soil in the exclusion zone

8.0 UST Closure Protocol

There is currently no evidence to suggest that there are any Underground Storage Tanks (USTs) located on the subject site, as a GPR Study performed as part of Remedial Investigation activities did not identify any metallic anomalies consistent with such. In the event any UST's are identified during execution of the remedial excavation, CNS will immediately notify the NYSDEC via telephone and E-mail. In addition, in the event a release of contaminants into the environment is identified, the NYSDEC Spills Hotline will be immediately contacted. Any UST identified during implementation of remedial efforts will be decommissioned as outlined within the state regulations.

During excavation, removal and cleaning of the USTs, the SST will field screen the ambient air with a PID for the presence of petroleum contamination. If a UST is encountered the SSO will classify the area as a Category 2 work area and implement and assess an Exclusion Zone as outlined in Subsection 2.4 and 4.2, herein. Level C PPE will be required for all personnel entering the UST Exclusion Zone and decontamination will be applicable as outlined in Section 5.0 and 7.0 subsection 7.2, herein.

Appendix A: Community Air Monitoring Plan (CAMP)

Community Air-Monitoring Plan

This Community Air-Monitoring Plan (CAMP) has been prepared to prevent the release of particulates and/or organic vapors for the excavation activities to be conducted for the property known as Brownfields Cleanup Program (BCP) Site # C224237 known as the "Former" Debbie Cleaners site located at 3800-3808 Nostrand Avenue in Brooklyn, NY ("Site"). This CAMP includes monitoring for airborne particulates and organic vapors during the ground-intrusive remedial activities. This CAMP is intended to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of remedial work activities.

Particulates

Particulate concentrations will be monitored continuously upwind and downwind of the remedial activities at temporary particulate monitoring stations located on the perimeter of the subject site. 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 will be visually assessed during all work activities.

If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed (e.g., water misting, smaller work areas, slower truck speeds). Work will continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 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/m^3 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.

Organic Vapors

Organic vapor concentrations will be monitored continuously upwind and downwind of the remedial activities at temporary monitoring stations located on the perimeter of the subject site. A Photo-Ionization Detector (PID) will be utilized to perform real-time monitoring daily at 2-hour intervals.

If the ambient air concentration of SVOCs exceeds 1ppm above background (for a 5-minute sustained period) at the downwind temporary monitoring station(s), activities will be halted and monitoring continued. If the VOC level decreases below 1ppm above background, activities can resume. If the SVOC levels are greater than 1ppm over background but less than 5ppm over background at the perimeter of the exclusion zone, activities can resume provided:

- The organic vapor level 200 ft. downwind of the perimeter of the subject site or half the distance to a receptor (member of the general public), whichever is less, is below 1 ppm over background (VOCs).
- More frequent intervals of monitoring are conducted.

All air monitoring results will be documented and available on request.

Appendix B: Respiratory Protection Program

CONTRACTOR
RESPIRATORY PROTECTION PROGRAM

DATE of last revision: 8/05

SUBJECT: Respiratory Protection Program

REGULATORY STATUTE: OSHA - 29 CFR 1910.134

BASIS: About 32 million workers are potentially exposed to one or more chemical hazards on a daily basis. There are an estimated 575,000 existing chemical products, and hundreds of new ones being introduced annually. This poses a serious problem for exposed workers and their employer. The OSHA Respiratory Protection Standard establishes uniform requirements to make sure that the respiratory hazards of all U.S. workplaces are evaluated, and that engineering controls, and work practice controls are implemented, and where not feasible, a respiratory protection program instituted.

GENERAL: Contractor will ensure that respiratory hazards within our facility and on our work sites are evaluated, and that information concerning these hazards is transmitted to all employees. This standard practice instruction is intended to address comprehensively the issues of; evaluating the potential respiratory hazards, communicating information concerning these hazards, and establishing appropriate engineering, work practice, or respiratory protective measures for employees.

RESPONSIBILITY: The company Safety Officer is the Director of Health and Safety. He/she is solely responsible for all facets of this program and has full authority to make necessary decisions to ensure success of the program. The Safety Officer will develop written detailed instructions covering each of the basic elements in this program, and is the sole person authorized to amend these instructions. This company has expressly authorized the Safety Officer to halt any operation of the company where there is danger of serious personal injury. This policy includes respiratory hazards.

Contents of the Contractor Respiratory Protection Program

Contractor Respiratory Protection Program

1.0 Written Program. Contractor will review and evaluate this standard practice instruction governing the selection and use of respirators on an annual basis, or when changes occur to 29 CFR 1910.134, that prompt revision of this document, or when facility operational changes occur that require a revision of this document. Effective implementation of this program requires support from all levels of management within this company. This written program will be communicated to all personnel that are affected by it. It encompasses the total workplace, regardless of number of workers employed or the number of work shifts. It is designed to establish clear goals, and objectives.

2.0 Employer and Employee Responsibility.

2.1 Employer's Responsibility.

2.1.1 Respirators shall be provided by this employer when they are necessary to protect employee health.

2.1.2 The respirator provided shall be suitable for the intended use.

2.1.3 The employer shall be responsible for establishing and maintaining a respiratory program whenever respirators are used. A program administrator shall be appointed to oversee the program. The program administrator for Contractor is the Director of Health and Safety.

2.2 Employee's Responsibility.

2.2.1 The employee shall use the respiratory protection in accordance with instructions and training received or contracted by Contractor.

2.2.2 The employee shall guard against damage to the respirator, and immediately replace suspect respirators.

2.2.3 The employee shall report any trouble with or malfunction of the respirator to his/her supervisor.

3.0 Policy Statement.

3.1 Engineering controls. To control and or minimize the threat of occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective of this program shall be to prevent atmospheric contamination. This shall be accomplished as far as feasible by accepted engineering control measures (for example, enclosure or confinement of the operation, general and local ventilation, and substitution of less toxic materials). When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used.

3.2 Respirators. Respirators shall be provided by this employer when such equipment is necessary to protect the health of the employee. This employer shall:

3.2.1 Provide the respirators which are applicable and suitable for the purpose intended.

3.2.2 Be responsible for the establishment and maintenance of a written respiratory protective program which shall include the requirements outlined in 29 CFR 1910.134.

3.3 The employee shall use the provided respiratory protection in accordance with instructions and training received.

3.4 Respirators shall be selected on the basis of hazards to which the worker is exposed.

3.5 The user shall be instructed and trained in the proper use of respirators and their limitations.

3.6 Respirators shall be regularly cleaned and disinfected. Those used by more than one worker shall be thoroughly cleaned and disinfected after each use.

3.7 Respirators shall be stored in a convenient, clean, and sanitary location.

3.8 Respirators used routinely shall be inspected during cleaning. Worn or deteriorated parts shall be replaced. Respirators for emergency use such as self-contained devices shall be thoroughly inspected at least once a month and after each use.

3.9 Appropriate surveillance of work area conditions and degree of employee exposure or stress shall be maintained.

3.10 There shall be regular inspection and evaluation to determine the continued effectiveness of the program.

3.11 Employees will not be assigned to tasks requiring use of respirators unless it has been determined that they are physically able to perform the work and use the equipment. A physician shall determine what health and physical conditions are pertinent. The respirator user's medical status will be reviewed on an annual basis or if it is suspected that the employee is no longer physically fit to wear a respirator.

3.12 NIOSH approved or accepted respirators shall be used when they are available. The respirator furnished shall provide adequate respiratory protection against the particular hazard for which it is designed.

4.0 Respiratory Selection Policy. Selection of respirators shall be made according to the specific hazard involved 29 CFR 1910.1000 and will be selected in accordance with the manufacturer's instructions or other related requirements (OSHA or ANSI standards, NIOSH, etc.).

4.1 Air quality. Compressed air, compressed oxygen, liquid air, and liquid oxygen used for respiration shall be of high purity.

4.1.1 Oxygen shall meet the requirements of the United States Pharmacopoeia for medical or breathing oxygen.

4.1.2 Breathing air shall meet at least the requirements of the specification for Grade D breathing air as described in Compressed Gas Association Commodity Specification G-7.1-1966.

4.1.3 Compressed oxygen shall not be used in supplied-air respirators or in open circuit self-contained breathing apparatus that have previously used compressed air. Oxygen must never be used with air line respirators. Breathing air may be supplied to respirators from cylinders or air compressors.

4.1.3.1 Cylinders shall be tested and maintained as prescribed in the Shipping Container Specification Regulations of the Department of Transportation (49 CFR Part 178).

4.2 Supplied Air. Compressors purchased by this company for supplying air shall be equipped with the necessary safety and standby devices. A breathing-air type compressor shall be used. The type compressor used shall be constructed and situated so as to avoid entry of contaminated air into the system and suitable in-line air purifying sorbent beds and filters installed to further assure breathing air quality. A receiver of sufficient capacity to enable the respirator wearer to escape from a contaminated atmosphere in event of compressor failure, and alarms to indicate compressor failure and overheating shall be installed in the system. If an oil-lubricated compressor is used, it shall have a high-temperature or carbon monoxide alarm, or both. If only a high-temperature alarm is installed in the system, the air from the compressor shall be frequently tested for carbon monoxide to ensure that levels are below the exposure limit for carbon monoxide.

4.2.1 Air line couplings used shall be incompatible with outlets for other gas systems to prevent inadvertent servicing of air line respirators with non-respirable gases or oxygen.

4.2.2 Breathing gas containers shall be properly marked and stored in accordance with 29 CFR 1910.101.

5.0 Use of Respirators.

5.1 This document will specify standard procedures for respirator use. These will include all information and guidance necessary for their proper selection, use, and care. Possible emergency and routine uses of respirators will be where possible anticipated and planned for.

5.2 The correct respirator shall be specified for each job. The respirator type will be specified in the work procedures by the Project Manager who supervises the respiratory protective program in the field. The individual issuing them shall be adequately instructed to insure that the correct respirator is issued.

5.3 Dangerous atmospheres. Written procedures/checklists for specific routine tasks/jobs shall be prepared covering safe use of respirators in dangerous atmospheres that might be encountered in normal operations or in emergencies. Personnel shall be made familiar with these procedures and the available respirators.

5.3.1 In areas where the wearer, with failure of the respirator, could be overcome by a toxic or oxygen-deficient atmosphere, at least one additional person shall be present. Communications (visual, voice, or signal line) shall be maintained between both or all individuals present. Planning shall be such that one individual will be unaffected by any likely incident and have the proper rescue equipment to be able to assist the other(s) in case of emergency.

5.3.2 When a self-contained breathing apparatus or Type C full face supplied air with 5 minute escape bottles are used in atmospheres immediately dangerous to life or health (IDLH), standby personnel must be present with suitable rescue equipment.

5.3.3 Employees using air line respirators in atmospheres immediately hazardous to life or health (IDLH) shall be equipped with safety harnesses and safety lines for lifting or removing persons from hazardous atmospheres or other and equivalent provisions for the rescue of persons from hazardous atmospheres shall be used. A standby personnel with suitable self-contained breathing apparatus (SCBA) shall be at the nearest fresh air base for emergency rescue.

5.4 Respirator Training. For safe use of any respirator, it is essential that our employees be properly instructed in its selection, use, and maintenance. Both supervisors and workers shall be so instructed by a training provider who is classified as an OSHA competent person. Training shall provide employees the opportunity to handle the respirator, have it fitted properly, test its face-piece seal, wear it in normal air for a long familiarity period, and, finally, to wear it in a test atmosphere.

5.5 Fit instructions. Every respirator wearer shall receive fitting instructions including demonstrations and practice in how the respirator should be worn, how to adjust it, and how to determine if it fits properly. Respirators shall not be worn when conditions prevent a good face seal. Such conditions may be a growth of beard, sideburns, a skull cap that projects under the facepiece, or temple pieces on glasses. Also, the absence of one or both dentures can seriously affect the fit of a facepiece.

5.6 Fit Evaluation (wearer). Annual fit test evaluations will be conducted to determine the correct respirator size and model for the worker. The facepiece fit shall be checked by the wearer each time he/she puts on the respirator. This will be done by following the manufacturer's facepiece fitting instructions. This will be done in accordance with the manufacturer's facepiece fitting instructions. Qualitative fit testing can be performed for all negative pressure air purifying respirators with a protection factor of 10 or less and all positive pressure respirators.

5.7 Fit Evaluation (company). Annual fit test evaluations will be conducted on the workforce to determine the correct respirator size and model for the individual workers. Periodic checks of employees while wearing respirators will be accomplished by an OSHA competent person, CET or CIH to assure proper protection. This will be done in accordance with the manufacturer's facepiece fitting instructions. Respirator fit tests are conducted annually. Qualitative fit testing can be performed on all negative pressure air purifying respirators with a protection factor of 10 or less and all positive pressure respirators.

5.8 Hair / Apparel. If hair growth or apparel interferes with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit.

5.9 Corrective vision requirements (full-face respirators). Full-face respirators having provisions for optical inserts will be reviewed for use this company. These inserts when used will be used according to the manufacturer's specification. When employees must wear optical inserts as part of the facepiece, the facepiece and lenses shall be fitted by qualified individuals to provide good vision, comfort, and a gas-tight seal. This company will provide corrective lenses for respirators based on optometry recommendations from an optometrist.

5.9.1 Conventional eye glasses. Conventional eye glasses will not be used with full-face respirators. A proper seal cannot be established if the temple bars of eye glasses extend through the sealing edge of the full facepiece.

5.9.2 Contact lenses. Contact lenses will not be used with full-face respirators. Wearing of contact lenses in contaminated atmospheres with a respirator shall not be allowed.

5.9.3 If corrective spectacles or goggles are required, they shall be worn so as not to affect the fit of the facepiece. Proper selection of equipment will minimize or avoid this problem.

6.0 Inspection, Maintenance, and Care of Respiratory Equipment. Equipment shall be properly maintained to retain its original state of effectiveness.

6.1 Respirator inspection shall include but is not limited to the following:

6.1.1 A check of the tightness of connections.

6.1.2 Condition of the facepiece, headbands, valves, connecting tube, and canisters.

6.1.3 Inspection of the Rubber or elastomer parts for pliability and signs of deterioration. Stretching and manipulating rubber or elastomer parts with a massaging action will keep them pliable and flexible and prevent them from taking a set during storage.

6.2 Specific procedures for disassembly, cleaning and maintenance of respirators used by this company will be done according the manufacturers written instructions.

6.3 Random inspections. Respiratory protection is no better than the respirator in use, even though it may be worn conscientiously. Frequent random inspections shall be conducted to assure that respirators are properly selected, used, cleaned, and maintained. The respirator manufacturer's inspection criteria will be used as the basis for the inspections. The following personnel are qualified to perform respirator inspections.

Qualified Inspectors	Duty Title
Charles Powers	Senior Project Manager
Michael Hauptmann	Site Safety Officer
______________________	______________________
______________________	______________________
______________________	______________________

Inspection records will be maintained in the Contractor's main office.

6.4 Emergency use respirators. All respirators shall be inspected routinely before and after each use. A respirator that is not routinely used but is kept ready for emergency use shall be inspected after each use and at least monthly to assure that it is in satisfactory working condition. The respirator manufacturer's inspection criteria will be used as the basis for the inspections. A record shall be kept of inspection dates and findings for respirators maintained for emergency use. Respirators maintained for emergency use shall be cleaned and disinfected after each use.

6.5 Routine use respirators. All routine use respirators shall be inspected routinely before and after each use. The respirator manufacturer's inspection criteria will be used as the basis for the inspection. Routinely used respirators shall be collected, cleaned, and disinfected as frequently as necessary to insure that proper protection is provided for the wearer.

6.6 SCBA inspections. Self-contained breathing apparatus (SCBA) shall be inspected monthly. Air and oxygen cylinders shall be fully charged according to the manufacturer's instructions. It shall be determined that the regulator and warning devices function properly.

6.7 Replacement or repairs. Replacement or repairs shall be done only by an OSHA competent person with parts designed for the respirator. No attempt shall be made to replace components or to make adjustment or repairs beyond the manufacturer's recommendations. Reducing or admission valves or regulators shall be returned to the manufacturer or to a trained technician for adjustment or repair.

6.8 Storage requirements. After inspection, cleaning, and necessary repair, respiratory protection equipment shall be carefully stored to protect against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Respirators should be packed or stored so that the facepiece and exhalation valve will rest in a normal position and function will not be impaired by the elastomer setting in an abnormal position.

6.8.1 Emergency use respirators. Respirators placed at stations and work areas for emergency use should be quickly accessible at all times and will be stored in compartments built for the purpose. The compartments will be clearly marked. Instructions for proper storage of emergency respirators, such as gas masks and self-contained breathing apparatus, are found in "use and care" instructions usually mounted inside the carrying case lid.

6.8.2 Routine use respirators. Routinely used respirators, such as dust respirators, may be placed in plastic bags. Respirators having removable cartridges with imbedded compounds that could evaporate into a sealed bag should be removed so as not to permeate into the rubber parts of the respirator. Respirators should not be stored in such places as lockers or tool boxes unless they are in carrying cases or cartons.

6.9 Identification of chemical cartridges. The primary means of identifying a chemical cartridge is by means of labels. The secondary means is by a color code. All cartridges purchased or used by this company will be properly labeled and or colored coded in accordance with 29 CFR 1910.134 before they are placed in service. The labels and colors will be properly maintained at all times until disposal. Cartridges having labels and colors not identifiable will be properly disposed of. To determine the type cartridge:

6.9.1 Determine the following from the cartridge:

6.9.1.1 Type of canister. Canister used for "X" contaminant or Type "Y" Gas Mask Canister.

6.9.1.2 "For respiratory protection in atmospheres containing not more than "X" percent by volume of "Y" (Name of atmospheric contaminant).

6.9.1.3 Radionuclides. Canisters having a special high efficiency filter for protection against radionuclides and other highly toxic particulates will have a label with a statement of the type and degree of protection afforded by the filter. The label will be affixed to the neck end of, or to the gray stripe which is around and near the top of, the canister. The degree of protection shall be marked as the percent of penetration of the canister by a 0.3 micron-diameter dioctyl phthalate (DOP) smoke at a flow rate of 85 liters per minute.

6.9.1.4 Oxygen warning. Employees must be fully aware of the label warning that states that cartridge respirators should be used only in atmospheres containing sufficient oxygen to support life (at least 19.5 percent by volume), since cartridges are only designed to neutralize or remove contaminants from the air.

6.9.1.5 Color coding. Each cartridge is painted a distinctive color or combination of colors indicated in Table I-1. All colors used are of such a color that they are clearly identifiable by the user and clearly distinguishable from one another. The color coating offers a high degree of resistance to chipping, scaling, peeling, blistering, fading, and the effects of the ordinary atmospheres to which they may be exposed under normal conditions of storage and use.

Table I-1 from 29 CFR 1910.134

Atmospheric contaminants	**Colors assigned**
Acid gases	White.
Hydrocyanic acid gas	White with 1/2 inch green stripe completely around the canister near the bottom.
Chlorine gas	White with 1/2 inch yellow stripe completely around the canister near the bottom.
Organic vapors	Black.
Ammonia gas	Green.
Acid gases and ammonia gas	Green with 1/2 inch white stripe completely around the canister near the bottom.
Carbon monoxide	Blue.
PCBs, Acid gases and organic vapors	Yellow.
Hydrocyanic acid gas and chloropicrin vapor	Yellow with 1/2 inch blue strip completely around the canister near the bottom.
Acid gases, organic vapors, and ammonia gases	Brown.
Asbestos, Lead dust, Radioactive materials excepting tritium and noble gases	Purple (Magenta).
Particulates (dusts, fumes, mists, fogs, or smokes) in combination with any of the gases or vapors	Canister color for contaminant as designated above, with 1/2 inch gray stripe completely around the canister near the top.
All of the above atmospheric contaminants	Red with 1/2 inch gray stripe completely around the canister near the top.
Note: Gray is not assigned as the main color for a canister designed to remove acids or vapors.	
Note: Orange is used as a complete body, or stripe color to represent gases not included in this table. The user will need to refer to the canister label to determine the degree of protection the canister will afford.	

7.0 Respiratory Protection Training Program. This company shall develop a standardized training format to meet the requirement for a respiratory protection training program. Fit testing of employees is an annual requirement.

7.1 Training shall be provided to each affected employee:

7.1.1 Before the employee is first assigned duties that require respiratory protection.

7.1.2 Before there is a change in assigned duties.

7.1.3 Whenever there is a change in operations that present a hazard for which an employee has not previously been trained.

7.1.4 Whenever this employer has reason to believe that there are deviations from established respiratory procedures required by this instruction or inadequacies in the employee's knowledge or use of these procedures.

7.2 The training shall establish employee proficiency in the duties required by this instruction and shall introduce new or revised procedures, as necessary, for compliance with this instruction or when future revisions occur.

7.3 This employer shall certify that the training required by this section has been accomplished. The certification shall contain each employee's name, the signatures or initials of the trainers, and the dates of training. The certification shall be available for inspection by employees and their authorized representatives.

8.0 Respirator Decision Logic.

8.1 Where a specific OSHA standard exits. Each task/job having the potential for respiratory hazards will be evaluated to determine worker protection requirement. The specific OSHA standard will be consulted to determine delineated respiratory requirements. The standards are listed in the "Z" tables to 29 CFR 1910.1000-1101.

8.2 Where a specific OSHA standard does not exit. The NIOSH respirator decision logic table from the "NIOSH guide to Industrial Respiratory Protection", Publication No. 87-116 (or subsequent versions) will be used. After all criteria have been identified and evaluated and after the requirements and restrictions of the respiratory protection program have been met, the class of respirators that should provide adequate respiratory protection will be determined.

9.0 Respirator Fit Testing. This employer shall ensure that the respirator issued to the employee exhibits the least possible facepiece leakage and that the respirator is fitted properly. For each employee wearing negative pressure respirators, this employer shall perform (or have performed) either quantitative or qualitative face fit tests at the time of initial fitting and annually thereafter. Qualitative fit tests may be used to fit test all negative pressure air purifying respirators with a protection factor of 10 or less and all positive pressure respirators. Quantitative fit testing is required for all negative pressure respirators with a protection factor of greater than 10.

9.1 Half-mask respirators. This employer shall perform (or have performed) qualitative fit test protocols in accordance with the specific standard listed in the "Z" tables to 29 CFR 1910.1000-1101. Where a specific OSHA standard protocol does not exit. The "NIOSH guide to Industrial Respiratory Protection", Publication No. 87-116 (or subsequent versions) will be used.

9.2 Minimum fit factor. Employees shall not be permitted to wear a half mask or full facepiece mask if a minimum fit factor of 100 or 1,000, respectively, cannot be obtained.

9.3 Hair. Fit testing shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

9.4 Respiratory difficulty during tests. If an employee exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respiratory diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

9.5 Respirator use determination. The test subject shall be given the opportunity to wear the assigned respirator for one week. If the respirator does not provide a satisfactory fit during actual use, the test subject may request another fit test which shall be performed immediately.

9.6 Respirator fit factor card. A respirator fit factor card shall be issued to the test subject with the following information, as a minimum:

9.6.1 Name.

9.6.2 Date of fit test.

9.6.3 Protection factors obtained through each manufacturer, model and approval number of respirator tested.

9.6.4 Name and signature of the person that conducted the test.

9.7 Filter replacement. Filters used for qualitative or quantitative fit testing shall be replaced weekly, whenever increased breathing resistance is encountered, or when the test agent has altered the integrity of the filter media. Organic vapor cartridges/canisters shall be replaced daily or sooner if there is any indication of breakthrough by the test agent.

9.8 Quantitative fit test, Re-test requirements. Because the sealing of the respirator may be affected, quantitative fit testing shall be repeated immediately when the test subject has a:

9.8.1 Weight change of 20 pounds or more.

9.8.2 Significant facial scarring in the area of the facepiece seal.

9.8.3 Significant dental changes; i.e., multiple extractions without prosthesis, or acquiring dentures.

9.8.4 Reconstructive or cosmetic surgery.

9.8.5 Any other condition that may interfere with facepiece sealing.

9.9 Fit test Recordkeeping requirements. A summary of all test results shall be maintained for 3 years. The summary shall as minimum include:

9.9.1 Name of test subject.

9.9.2 Date of testing.

9.9.3 Name of the test conductor.

9.9.4 Fit factors obtained from every respirator tested (indicate manufacturer, model, size and approval number).

10.0 RESPIRATOR INSPECTION RECORD

1. OWNER (if individually issued): ____________________

2. TYPE: ____________________

3. NO. ____________________

4. DEFECTS FOUND:

    A. Facepiece: ____________________

    B. Inhalation Valve: ____________________

    C. Exhalation Valve Assembly: ____________________

    D. Headbands: ____________________

    E. Cartridge Holder: ____________________

    F. Cartridge/Canister: ____________________

    G. Filter: ____________________

    H. Harness Assembly: ____________________

    I. Hose Assembly: ____________________

    J. Speaking Diaphragm: ____________________

    K. Gaskets: ____________________

    L. Connection: ____________________

    M. Other Defects: ____________________

6. COMMENTS: ____________________

____

____

7. INSPECTOR'S NAME/TITLE: ____________________

8. SIGNATURE: ____________________

9. DATE: ____________________

Appendix C: Hazardous Waste Operations and Emergency Response Program (HAZWOPER)

CONTRACTOR
Hazardous Waste Operations and Emergency Response Program (HAZWOPER)

REGULATORY STATUTE: OSHA - 29 CFR 1910.120

BASIS: Hazardous Waste is a serious safety and health problem that continues to endanger human and animal life and environmental quality. Unless hazardous waste is properly treated, stored, or disposed of properly, it will continue to do great harm to our environment. There are an estimated 575,000 existing chemical products, and hundreds of new ones being introduced annually. This poses a serious problem for exposed workers and their employer. The OSHA HAZWOPER Standard covers workers employed in cleanup operations at uncontrolled hazardous waste sites and at EPA-licensed waste treatment, storage, and disposal (TSD) facilities; as well as workers responding to emergencies involving hazardous materials.

GENERAL: Contractor will ensure that the hazards of all wastes on worksite clean-ups are evaluated, and that operational procedures are developed and information concerning their hazards is transmitted to all employees. This program is intended to address comprehensively the issues of; evaluating the potential hazards of wastes, communicating information concerning these hazards, and establishing appropriate operating procedures and protective measures for employees.

RESPONSIBILITY: The Contractor Safety Officer is solely responsible for all facets of this program and has full authority to make necessary decisions to ensure success of the program. The Safety Officer will develop written detailed instructions covering each of the basic elements in this program, and is the sole person authorized to amend these instructions. The Safety Officer has authority to halt any operation where there is danger of serious personal injury. This policy includes respiratory hazards.

Contents of the Contractor HAZWOPER Program

Contractor HAZWOPER Program

1.0 Written Program. Contractor will review and evaluate this standard practice instruction on an annual basis, or when changes occur to 29 CFR 1910.120 that prompt revision of this document, or when facility or site operational changes occur that require a revision of this document. Effective implementation of this program requires support from all levels of management. This written program will be communicated to all personnel that are affected by it. It encompasses the total jobsite, regardless of number of workers employed or the number of work shifts. It is designed to establish clear goals, and objectives.

2.0 Purpose. This program will provide an operational framework for;

A. Clean-up operations required by a governmental body, whether Federal, state, local or other involving hazardous substances that are conducted at uncontrolled hazardous waste sites (including, but not limited to, the EPA's National Priority Site List (NPL), state priority site lists, sites recommended for the EPA NPL, and initial investigations of government identified sites which are conducted before the presence or absence of hazardous substances has been ascertained).

B. Corrective actions involving clean-up operations at sites covered by the Resource Conservation and Recovery Act of 1976 (RCRA) as amended (42 U.S.C. 6901 et seq.).

C. Voluntary clean-up operations at sites recognized by Federal, state, local or other governmental bodies as uncontrolled hazardous waste sites.

D. Emergency Response Operations for releases of, or substantial threats of releases of, hazardous substances without regard to the location of the hazard.

3.0 Safety and Health Program. Contractor shall develop and implement a written safety and health program for employees involved in hazardous waste operations. The program shall be designed to identify, evaluate, and control safety and health hazards, and provide for emergency response for hazardous waste operations. The written safety and health program shall incorporate as a minimum the following:

3.1 An organizational structure.

3.2 A comprehensive workplan.

3.3 A site-specific safety and health plan, which need not repeat standard practice instructions developed elsewhere.

3.4 A safety and health training program.

3.5 A medical surveillance program.

3.6 This employer's standard practice instructions for safety and health.

3.7 Any necessary interface between general program and site specific activities.

4.0 Site Excavation. Site excavations created during initial site preparation or during hazardous waste operations shall be shored or sloped as appropriate to prevent accidental collapse in accordance with Subpart P of 29 CFR Part 1926.

5.0 Contractors and sub-contractors. Should the Contractor retain contractor or sub-contractor services to aid in hazardous waste operations, Contractor shall inform those contractors, sub-contractors, or their representatives of the site emergency response procedures and any potential fire, explosion, health, safety or other hazards of the hazardous waste operation that have been identified by this employer, including those identified in this employer's information program.

6.0 Program Availability. The Contractor written safety and health program shall be made available to:

6.1 Contractor or subcontractor or their representative who will be involved with the hazardous waste operation.

6.2 All associated employees and their designated representatives.

6.3 OSHA personnel.

6.4 Authorized personnel of other Federal, state, or local agencies with regulatory authority over the site.

7.0 Organizational structure part of a site program.

7.1 The organizational structure part of the program for the jobsite clean-up shall establish the specific chain of command and specify the overall responsibilities of supervisors and employees. It shall include, at a minimum, the following elements:

7.1.1 Contractor shall supply a general supervisor will have responsibility and authority to direct all hazardous waste operations.

7.1.2 Joanne Mathews, as site safety and health supervisor will have the responsibility and authority to develop and implement the jobsite safety and health plan and verify compliance.

7.1.3 All other personnel needed for hazardous waste site operations and emergency response and their general functions and responsibilities.

7.1.4 The lines of authority, responsibility, and communication.

7.2 The organizational structure shall be reviewed and updated as necessary to reflect the current status of waste site operations.

8.0 Comprehensive workplan part of a site program. Contractor will develop a comprehensive workplan that shall address the tasks and objectives of the site operations and the logistics and resources required to reach those tasks and objectives. The workplan shall:

8.1 Address anticipated clean-up activities as well as normal operating procedures which need not repeat this employer's procedures available elsewhere.

8.2 Define work tasks and objectives and identify the methods for accomplishing those tasks and objectives.

8.3 Establish personnel requirements for implementing the plan.

8.4 The workplan shall provide for the implementation of the training required by worker involved in site activities.

8.5 The workplan shall provide for the implementation of the required informational programs required workers involved in site activities.

8.6 The workplan shall provide for the implementation of a medical surveillance program required workers involved in site activities.

9.0 Site-specific safety and health plan. Contractor will develop a site safety and health plan, which will be kept on site. The plan will address the safety and health hazards of each phase of site operation and include the requirements and procedures for employee protection. The site safety and health plan, as a minimum, shall address the following:

9.1 A safety and health risk or hazard analysis for each site task and operation found in the workplan.

9.2 Employee training assignments to assure compliance with the training section of this instruction.

9.3 Personal protective equipment to be used by employees for each of the site tasks and operations being conducted as required by the personal protective equipment program.

9.4 Medical surveillance requirements.

9.5 Frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used, including methods of maintenance and calibration of monitoring and sampling equipment to be used.

9.6 Site control measures.

9.7 Decontamination procedures.

9.8 Emergency response plan meeting the requirements for safe and effective responses to emergencies, including the necessary PPE and other equipment.

9.9 Confined space entry procedures.

9.10 Spill containment requirements.

9.11 Pre-Entry Briefing. The site specific safety and health plan will provide for pre-entry briefings to be held prior to initiating any site activity, and at such other times as necessary to ensure that employees are apprised of the site safety and health plan and that this plan is being followed. The information and data obtained from site characterization and analysis will be used to prepare and update the site safety and health plan.

9.12 Effectiveness of site safety and health plan. Inspections shall be conducted by the site safety and health supervisor or, in his/her absence, the safety officer who is knowledgeable in occupational safety and health, acting on behalf of Contractor as necessary to determine the effectiveness of the site safety and health plan. Any deficiencies in the effectiveness of the site safety and health plan shall be corrected by Contractor.

10.0 Site characterization and analysis. The site shall be evaluated in accordance with this standard practice instruction to identify specific site hazards and to determine the appropriate safety and health control procedures needed to protect employees from the identified hazards. The following requirements apply:

10.1 Preliminary evaluation. A preliminary evaluation of a site's characteristics shall be performed prior to site entry in order to aid in the selection of appropriate employee protection methods prior to site entry. Immediately after initial site entry, a more detailed evaluation of the site's specific characteristics shall be performed in order to further identify existing site hazards and to further aid in the selection of the appropriate engineering controls and personal protective equipment for the tasks to be performed.

10.2 Hazard identification. All suspected conditions that may pose inhalation or skin absorption hazards that are immediately dangerous to life or health (IDLH), or other conditions that may cause death or serious harm, shall be identified during the preliminary survey and evaluated during the detailed survey. Examples of such hazards include, but are not limited to:

10.2.1 Confined space entry.

10.2.2 Explosive or flammable situations

10.2.3 Visible vapor clouds.

10.2.4 Areas where biological or environmental indicators such as dead animals or vegetation are located.

10.3 Required information. The following information to the extent available shall be obtained by CNS Management Corp. for the Owner of the site prior to allowing employees to enter a worksite:

10.3.1 Location and approximate size of the site.

10.3.2 Description of the response activity and/or the job task to be performed.

10.3.3 Duration of the planned employee activity.

10.3.4 Site topography and how accessible.

10.3.5 Safety / health hazards expected at the site.

10.3.6 Pathways for hazardous substance dispersion.

10.3.7 Present status and capabilities of emergency response teams that would provide assistance to hazardous waste clean-up site employees at the time of an emergency.

10.3.8 Hazardous substances and health hazards involved or expected at the site, and their chemical and physical properties.

10.4 Personal protective equipment. Personal protective equipment (PPE) shall be provided and used during initial site entry in accordance with the following requirements:

10.4.1 Based upon the results of the preliminary site evaluation, an ensemble of PPE shall be selected and used during initial site entry which will provide protection to a level of exposure below permissible exposure limits and published exposure levels for known or suspected hazardous substances and health hazards, and which will provide protection against other known and suspected hazards identified during the preliminary site evaluation. If there is no permissible exposure limit or published exposure level, this employer may use other published studies and information as a guide to appropriate personal protective equipment.

10.4.2 If positive-pressure self-contained breathing apparatus is not used as part of the entry ensemble, and if respiratory protection is warranted by the potential hazards identified during the preliminary site evaluation, an escape self-contained breathing apparatus of at least five minute's duration shall be carried by employees during initial site entry.

10.4.3 If the preliminary site evaluation does not produce sufficient information to identify the hazards or suspected hazards of the site, an ensemble providing protection equivalent to Level B PPE shall be provided as minimum protection, and direct reading instruments shall be used as appropriate for identifying IDLH conditions.

10.4.4 Once the hazards of the site have been identified, the appropriate PPE shall be selected and used in accordance with the engineering controls, work practices, and PPE for employee protection section of this instruction.

10.5 Monitoring. The following monitoring shall be conducted during initial site entry when the site evaluation produces information that shows the potential for ionizing radiation or IDLH conditions, or when the site information is not sufficient reasonably to eliminate these possible conditions:

10.5.1 Monitoring with direct reading instruments for hazardous levels of ionizing radiation.

10.5.2 Monitoring the air with appropriate direct reading test equipment (i.e., combustible gas meters, detector tubes) for IDLH and other conditions that may cause death or serious harm (combustible or explosive atmospheres, oxygen deficiency, toxic substances).

10.5.3 Visually observing for signs of actual or potential IDLH or other dangerous conditions.

10.6 Air Monitoring Program. An ongoing air monitoring program will be implemented after site characterization has determined the site is safe for the start-up of operations.

10.7 Risk Identification. Once the presence and concentrations of specific hazardous substances and health hazards have been established, the risks associated with these substances shall be identified. Employees who will be working on the site shall be informed of any risks that have been identified. In situations covered by the Hazard Communication Standard, 29 CFR 1910.1200, training required by that standard will not be duplicated. Risks to be considered include, but are not limited to:

10.7.1 Exposures exceeding the permissible exposure limits and published exposure levels.

10.7.2 IDLH concentrations.

10.7.3 Potential skin absorption and irritation sources.

10.7.4 Potential eye irritation sources.

10.7.5 Explosion sensitivity and flammability ranges.

10.7.6 Oxygen deficiency.

10.8 Employee Notification. Any information concerning the chemical, physical, and toxicologic properties of each substance known or expected to be present on the jobsite that is available to Contractor and relevant to the duties an employee is expected to perform shall be made available to the affected employees prior to the commencement of their work activities.

10.9 Site Control. Appropriate site control procedures will be implemented to control employee exposure to hazardous substances before clean-up work begins.

10.10 Site Control Program. A site control program for protecting employees which is part of Contractor's site safety and health program will be developed during the planning stages of a hazardous waste clean-up operation and modified as necessary as new information becomes available.

10.11 Elements of the site control program. Where these requirements are covered elsewhere they will not be repeated with just cause. The site control program will, as a minimum, include:

10.11.1 A site map.

10.11.2 Site work zones.

10.11.3 The use of a "buddy system".

10.11.4 Site communications including alerting means for emergencies.

10.11.5 The standard practice instructions or safe work practices.

10.11.6 Identification of the nearest medical assistance.

11.0 Training. All employees working on site (such as but not limited to equipment operators, general laborers and others) exposed to hazardous substances, health hazards, or safety hazards and their supervisors and management responsible for the site shall receive training before they are permitted to engage in hazardous waste operations that could expose them to hazardous substances, safety, or health hazards, and they shall receive review training as specified in this paragraph. Employees shall not be permitted to participate in or supervise field activities until they have been trained to a level required by their job function and responsibility. Elements to be covered include the following:

11.1 Names of personnel and alternates responsible for site safety and health.

11.2 Safety, health and other hazards present on the site.

11.3 Use of personal protective equipment.

11.4 Work practices by which the employee can minimize risks from hazards.

11.5 Safe use of engineering controls and equipment on the site.

11.6 Medical surveillance requirements, including recognition of symptoms and signs which might indicate overexposure to hazards.

11.7 The contents of the site safety and health plan.

11.8 Initial training requirements for hazardous waste clean-up sites.

Routine site employees	40 hours initial 24 hours field 8 hours annual refresher
Routine site employees (Minimal exposure)	24 hours initial 8 hours field 8 hours annual refresher
Non-Routine site employees	24 hours initial 8 hours field 8 hours annual refresher
Supervisors/Managers of Routine site employees	40 hours initial 24 hours field 8 hours Hazwaste Management 8 hours annual refresher
Supervisors/Managers of Routine site employees (minimal exposure) and Non-Routine site employees	24 hours initial 8 hours field 8 hours Hazwaste Management 8 hours annual refresher

11.9 Initial training requirements for treatment, storage, and disposal sites.

RESERVED

11.10 Initial training requirements for emergency response staff.

Level 1 - First Responder (awareness level)	Sufficient training or proven experience in specific competencies, annual refresher
Level 2 - First Responder (operations level)	Level 1 competency and 8 hours initial or proven experience in specific competencies annual refresher
Level 3 - HAZMAT Technician	24 hours of level 2 and proven experience in specific competencies, annual refresher
Level 4 - HAZMAT Specialist	24 hours of level 3 and proven experience in specific competencies, annual refresher
Level 5 - On Scene Commander	24 hours of level 2 and additional competencies, annual refresher

Definitions

Level 1 - First Responder. Witnesses or discovers a release of hazardous materials and who are trained to notify the proper authorities.

Level 2 - First Responder. Responds to releases of hazardous substances in a defensive manner, without trying to stop the releases.

Level 3 - HAZMAT Technician. Responds aggressively to stop releases of hazardous substances.

Level 4 - HAZMAT Specialist. Responds with and in support of HAZMAT technicians, but who have specific knowledge of various hazardous substances.

Level 5 - On-Scene Commander. Assumes control of the incident scene beyond the first-responder awareness level.

11.11 Qualifications for Trainers. Trainers used by Contractor shall be qualified to instruct employees about the subject matter that is being presented in training. Such trainers shall have satisfactorily completed a training program for teaching the subjects they are expected to teach, or they shall have the academic credentials and instructional experience necessary for teaching the subjects. Instructors shall demonstrate competent instructional skills and knowledge of the applicable subject matter.

11.12 Training Certification. Employees and supervisors that have received and successfully completed the training and field experience shall be certified by their instructor or the head instructor and trained supervisor as having successfully completed the necessary training. A written certificate shall be given to each person so certified. Any person who has not been so certified or who does not meet the requirements for entering the site shall be prohibited from engaging in hazardous waste operations.

11.13 Emergency response. Employees who are engaged in responding to hazardous emergency situations at hazardous waste clean-up sites that may expose them to hazardous substances shall be trained in how to respond to such expected emergencies.

11.14 Refresher training. Employees, managers and supervisors will receive eight hours of refresher training annually (any critique of incidents that have occurred in the past year that can serve as training examples of related work, and other relevant topics).

11.15 Equivalent training. Equivalent training includes any academic training or the training that existing employees might have already received from actual hazardous waste site work experience. Employee's who can show by documentation or certification that their work experience and/or training has resulted in training equivalent to that training required for a 40 hour course will not be required attend formal training. However, certified employees or employees with equivalent training new to a site shall receive appropriate, site specific training before site entry and have appropriate supervised field experience at the new site.

12.0 Medical Surveillance. The employer when engaged in hazardous waste operations specified Section 2 of this standard practice instruction will institute a medical surveillance program in accordance with this section.

12.1 Employees covered. The medical surveillance program shall be instituted by Contractor for the following employees:

12.1.1 All employees who are or may be exposed to hazardous substances or health hazards at or above the permissible exposure limits or, if there is no permissible exposure limit, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more a year.

12.1.2 All employees who wear a respirator for 30 days or more a year or as required by 29 CFR 1910.134.

12.1.3 All employees who are injured, become ill or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operation.

12.1.4 Members of HAZMAT teams.

12.2 Frequency of medical examinations and consultations. Medical examinations and consultations shall be made available by this employer to each employee authorized on the following schedules:

12.2.1 Prior to assignment.

12.2.2 At least once every twelve months for each employee covered unless the attending physician believes a longer interval (not greater than biennially) is appropriate.

12.2.3 At termination of employment or reassignment to an area where the employee would not be covered if the employee has not had an examination within the last six months.

12.2.4 As soon as possible upon notification by an employee that the employee has developed signs or symptoms indicating possible overexposure to hazardous substances or health hazards, or that the employee has been injured or exposed above the permissible exposure limits or published exposure levels in an emergency situation.

12.2.5 At more frequent times, if the examining physician determines that an increased frequency of examination is medically necessary.

12.3 For authorized employees who may have been injured, received a health impairment, developed signs or symptoms which may have resulted from exposure to hazardous substances resulting from an emergency incident, or exposed during an emergency incident to hazardous substances at concentrations above the permissible exposure limits or the published exposure levels without the necessary personal protective equipment being used:

12.3.1 As soon as possible following the emergency incident or development of signs or symptoms.

12.3.2 At additional times, if the examining physician determines that follow-up examinations or consultations are medically necessary.

12.4 Content of medical examinations and consultations.

12.4.1 Medical examinations will include a medical and work history (or updated history if one is in the employee's file) with special emphasis on symptoms related to the handling of hazardous substances and health hazards, and to fitness for duty including the ability to wear any required PPE under conditions (i.e., temperature extremes) that may be expected at the work site.

12.4.2 The content of medical examinations or consultations made available to employees will be determined by the attending physician. (The guidelines in the Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities should be consulted).

12.5 Examination by a physician and costs. All medical examinations and procedures performed by or contracted through this employer will be performed by or under the supervision of a licensed physician, preferably one knowledgeable in occupational medicine, and shall be provided without cost to the employee, without loss of pay, and at a reasonable time and place.

12.6 Information provided to the physician. Contractor will provide one copy of 29 CFR 1910.120 any appendices to the attending physician, and in addition the following for each employee:

12.6.1 A description of the employee's duties as they relate to the employee's exposures.

12.6.2 The employee's exposure levels or anticipated exposure levels.

12.6.3 A description of any personal protective equipment used or to be used.

12.6.4 Information from previous medical examinations of the employee which is not readily available to the examining physician.

12.6.5 Information required by 29 CFR 1910.134.

12.7 Physician's written opinion. Contractor shall obtain and furnish the employee with a copy of a written opinion from the attending physician containing the following:

12.7.1 The physician's opinion as to whether the employee has any detected medical conditions which would place the employee at increased risk of material impairment of the employee's health from work in hazardous waste operations or emergency response, or from respirator use.

12.7.2 The physician's recommended limitations upon the employee's assigned work.

12.7.3 The results of the medical examination and tests if requested by the employee.

12.7.4 A statement that the employee has been informed by the physician of the results of the medical examination and any medical conditions which require further examination or treatment.

12.7.5 The written opinion obtained by this employer shall not reveal specific findings or diagnoses unrelated to occupational exposures.

12.8 Recordkeeping. An accurate record of the medical surveillance shall be retained. This record shall be retained for the period specified and meet the criteria of 29 CFR 1910.20.
The record will include at least the following information:

12.8.1 The name and social security number of the employee.

12.8.2 Physician's written opinions, recommended limitations, and results of examinations and tests.

12.8.3 Any employee medical complaints related to exposure to hazardous substances.

12.8.4 A copy of the information provided to the examining physician by Contractor, with the exception of 29 CFR 1910.120 and any appendices.

13.0 Engineering controls, work practices, and personal protective equipment for employee protection. Contractor will ensure that engineering controls, work practices, personal protective equipment, or a combination of these will be implemented in accordance with 29 CFR 1910, Subparts G and Z. Engineering controls and work practices will be instituted to reduce and maintain employee exposure to or below the permissible exposure limits, except to the extent that such controls and practices are not feasible.

14.0 PCB Spill Response Procedures.

Personal protective equipment include Level C respiratory protection, poly coated tyvek suit, PVC gloves and boots, full face respirator or half face respirator and goggles, OVAG/HEPA respirator cartridges (acid gas/HEPA), and hardhat (if necessary).

Tests for PCBs utilized at the site will be Clor-n-Oil and or Clor-n-Soil field tests as approved by the client. These tests will be used to screen for PCBs in parts per million concentrations. The Clor-n-Oil screening kit can measure PCB contamination in oil and complies with EPA SW-846 Method 9079 for testing. The Clor-n-Soil screening kit can determine concentrations either above 50 ppm or below 50 ppm.

Rinse poly coated tyvek suits prior to disposal of suits as waste. This will prevent personnel from contaminating themselves with PCBs during removal of suits during decontamination procedures. All personal protective equipment is triple rinsed prior to disposal.

All PCB waste is drummed in DOT approved drums for transportation to an approved TSDF facility. Drums will be labeled as containing PCBs (Polychlorinated Biphenyls).

These PCB procedures will be included with the standard HAZWOPER procedures for spill responses that have the potential to contain PCBs.

Requirements for cleanup of spills of less than 500 ppm concentration are as follows. Solid surfaces must be double washed/rinsed except that all indoor, residential surfaces other than vault areas must be cleaned to 10 micrograms per 100 square centimeters (10 mg / 100 cm2) by standard commercial wipe tests. All soil within the spill area (visible traces of soil and a buffer of one lateral foot around visible traces) must be excavated, and the ground be restored to its original configuration by backfilling with clean soil (containing less than 1 ppm PCBs).

Requirements for cleanup of spills of greater than 500 ppm concentration are as follows. The contaminated area shall be cordoned off or otherwise delineated and restricted where visible traces plus a three foot buffer with caution signs to prevent exposure. Initiate cleanup of all visible traces of fluid on hard surfaces and initiate removal of all visible traces of the spill on soil, gravel, sand, etc. as per above.

Requirements for decontaminating spills in outdoor electrical substations are as follows. Contaminated solid surfaces both impervious and non-impervious shall be cleaned to a PCB concentration of 100 micrograms per 100 centimeters squared as measured by standard wipe tests. Soil contaminated by the spill will be cleaned either to 25 ppm PCBs by weight, or to 50 ppm PCBs by weight provided that a label or notice is visibly posted in the area warning future personnel accessing the area.

Requirements for decontaminating spills in other restricted access areas are as follows. High contact solid surfaces shall be cleaned to 10 mg per 100 cm2 as measured by standard wipe tests. Low contact, indoor, impervious solid surfaces will be decontaminated to 10 mg per 100 cm2. As an option, low contact, indoor, non-impervious surfaces will either be cleaned to 10 mg per 100 cm2, or to 100 mg per 100 cm2 and then encapsulated. Low contact, outdoor surfaces both impervious and non-impervious shall be cleaned to 100 ug per 100 cm2. Soil contaminated by the spill will be cleaned to 25 ppm PCBs by weight.

Requirements for decontaminating spills in non-restricted access areas are as follows. Easily replaceable household items shall be disposed of. Indoor solid surfaces and high contact outdoor solid surfaces shall be cleaned to 10 mg per 100 cm2. Indoor vault areas and low contact, outdoor, impervious solid surfaces shall be cleaned to 10 mg per 100 cm2. As an option, low contact, outdoor, non-impervious solid surfaces shall be either cleaned to 10 mg per 100 cm2, or cleaned to 100 mg per 100 cm2 and then encapsulated. Soil contaminated by the spill will be decontaminated to 10 ppm PCBs by weight provided that the soil is excavated to a minimum of 10 inches. The excavated soil will be replaced with clean soil, containing less than 1 ppm PCBs, and the spill site will be restored to its original configuration.

15.0 Definitions.

- **Buddy system** means a system of organizing employees into work groups in such a manner that each employee of the work group is designated to be observed by at least one other employee in the work group. The purpose of the buddy system is to provide rapid assistance to employees in the event of an emergency.

- **Clean-up operation** means an operation where hazardous substances are removed, contained, incinerated, neutralized, stabilized, cleared-up, or in any other manner processed or handled with the ultimate goal of making the site safer for people or the environment.

- **Decontamination** means the removal of hazardous substances from employees and their equipment to the extent necessary to preclude the occurrence of foreseeable adverse health affects.

- **Emergency response corresponding to emergencies** means a response effort by employees from outside the immediate release area or by other designated responders (i.e., mutual-aid groups, local fire departments, etc.) to an occurrence which results, or is likely to result, in an uncontrolled release of a hazardous substance. Responses to incidental releases of hazardous substances where the substance can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area, or by maintenance personnel are not considered to be emergency responses within the scope of this standard. Responses to releases of hazardous substances where there is no potential safety or health hazard (i.e., fire, explosion, or chemical exposure) are not considered to be emergency responses.

- **Facility** means (A) any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly owned treatment works), well, pit, pond, lagoon, impoundment, ditch, storage container, motor vehicle, rolling stock, or aircraft, or (B) any site or area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located; but does not include any consumer product in consumer use or any water-borne vessel.

- **Hazardous materials response (HAZMAT) team** means an organized group of employees, designated by this employer, who are expected to perform work to handle and control actual or potential leaks or spills of hazardous substances requiring possible close approach to the substance. The team members perform responses to releases or potential releases of hazardous substances for the purpose of control or stabilization of the incident. A HAZMAT team is not a fire brigade nor is a typical fire brigade a HAZMAT team. A HAZMAT team, however, may be a separate component of a fire brigade or fire department.

- **Hazardous substance** means any substance designated or listed under paragraphs (A) through (D) of this definition, exposure to which results or may result in adverse affects on the health or safety of employees:

a. Any substance defined under section 101(14) of CERCLA.

b. Any biological agent and other disease-causing agent which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any person, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformations in such persons or their offspring.

c. Any substance listed by the U.S. Department of Transportation as hazardous materials under 49 CFR 172.101 and appendices.

d. Hazardous waste as herein defined.

- **Hazardous waste** means--

a. Waste or combination, as defined in 40 CFR 261.3.
b. Substances defined as hazardous wastes in 49 CFR 171.8.

- **Hazardous waste operation** means any operation conducted within the scope of 29 CFR 1910.120.

- **Hazardous waste site or Site** means any facility or location within the scope of 29 CFR 1910.120 at which hazardous waste operations take place.

- **Health hazard** means a chemical, mixture of chemicals or a pathogen for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, heptaotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes. It also includes stress due to temperature extremes. Further definition of the terms used above can be found in appendix A to 29 CFR 1910.1200.

- **IDLH or Immediately dangerous to life or health** means an atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would cause irreversible or delayed adverse health effects or would interfere with an individual's ability to escape from a dangerous atmosphere.

- **Oxygen deficiency** means that concentration of oxygen by volume below which atmosphere supplying respiratory protection must be provided. It exists in atmospheres where the percentage of oxygen by volume is less than 19.5 percent oxygen.

- **Permissible exposure limit** means the exposure, inhalation or dermal permissible exposure limit specified in 29 CFR part 1910, subparts G and Z.

- **Published exposure level** means the exposure limits published in "NIOSH Recommendations for Occupational Health Standards" dated 1986 incorporated by reference, or if none is specified, the exposure limits published in the standards specified by the American Conference of Governmental Industrial Hygienists in their publication "Threshold Limit Values and Biological Exposure Indices for 1987-88" dated 1987 incorporated by reference.

- **Post emergency response** means that portion of an emergency response performed after the immediate threat of a release has been stabilized or eliminated and clean-up of the site has begun. If post emergency response is performed by an employer's own employees who were part of the initial emergency response, it is considered to be part of the initial response and not post emergency response. However, if a group of an employer's own employees, separate from the group providing initial response, performs the clean-up operation, then the separate group of employees would be considered to be performing post-emergency response.

- **Qualified person** means a person with specific training, knowledge and experience in the area for which the person has the responsibility and the authority to control.

- **Site safety and health supervisor (or officer)** means the individual located on a hazardous waste site who is responsible to this employer and has the authority and knowledge necessary to implement the site safety and health plan and verify compliance with applicable safety and health requirements.

- **Small quantity generator** means a generator of hazardous wastes who in any calendar month generates no more than 1,000 kilograms (2,205 pounds) of hazardous waste in that month.

- **Uncontrolled hazardous waste site** means an area identified as an uncontrolled hazardous waste site by a governmental body, whether Federal, state, local or other where an accumulation of hazardous substances creates a threat to the health and safety of individuals or the environment or both. Some sites are found on public lands such as those created by former municipal, county or state landfills where illegal or poorly managed waste disposal has taken place. Other sites are found on private property, often belonging to generators or former generators of hazardous substance wastes. Examples of such sites include, but are not limited to, surface impoundments, landfills, dumps, and tank or drum farms. Normal operations at TSD sites are not covered by this definition.

8/05

Appendix D: Trenching and Excavation

CONTRACTOR
TRENCHING AND EXCAVATION SAFETY PLAN

REGULATORY STANDARD: 29 CFR 1926.650 - 653

BASIS: OSHA requires all employers to maintain a written program. The primary hazard to which employees may be exposed during excavation work is a cave-in, which occurs when the soil forming the side of the excavation can no longer resist the forces applied to it. This results from a reduction in the frictional and cohesive capacities of the soil to resist forces. Changing environmental conditions, such as freezing and thawing, or the addition or removal of water from the pores of the soil can reduce the ability of a soil to resist forces. The addition of superimposed loads from soil piles, or the placement of equipment or materials near the edge of the excavation also creates forces that can exceed the ability of the soil to resist.

GENERAL: Contractor will ensure that whenever an excavation operation is being undertaken, that work practices and proper conditions are met prior to beginning, during and at the conclusion of such excavation operations. It should not be assumed that every acceptable safety precaution is contained herein or that unusual circumstances may not require further or additional procedures, equipment and practices. Employees will cease operations if there is a question regarding a hazard or if such is suspected or discovered.

RESPONSIBILITY: The Safety Officer and Environmental Manager are responsible for all facets of this program and have full authority to make necessary decisions to ensure success of the program. The Safety Officer and Environmental Manager are authorized to amend these instructions and is authorized to halt any operation of the area where there is danger of serious personal injury.

Contents of the Contractor Trenching and Excavation Safety Program

Contractor Trenching and Excavation Safety Program

1. Written Program. Contractor will review and evaluate this standard practice instruction:

- On an annual basis
- When regulatory changes occur that prompt revision of this document
- When facility operational changes occur that require a revision of this document
- When there is an accident or close-call that relates to this topic

Effective implementation of this program requires support from all levels of management within this company. This written program will be communicated to all personnel that are affected by it. It encompasses the total workplace, regardless of the number of workers employed or the number of work shifts. It is designed to establish clear goals, and objectives.

2. General Requirements. Contractor will establish procedures for "trenching and excavation" undertaken by its employees, through the use of this document. Preventing future work-place injuries in our company is the principle purpose of this document. This document will provide a basis for ensuring that all procedures implemented, revised or modified meet our requirements for safety. This document will help identify hazards in our work-place and enable us to determine the best course of action to take to reduce or eliminate known hazards.

3. Surface Encumbrances and Underground Installations Safety Guidelines. All surface encumbrances that are located so as to create a hazard to employees will be removed or supported, as necessary, to safeguard employees. The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, will be determined prior to opening an excavation. The following procedures are designed to provide employees of this company with a system for protection and safe conditions while working in a trenching or excavation environment. These guidelines are designed for use by employees at all levels within the work force.

3.1 Establish the locations of all underground and overhead utilities and services before beginning trenching or excavation operations.

3.1.1 Contact utility and service companies to include municipal owned and advise them prior to the start of all actual excavation. No exceptions.

3.1.2 The following local response times for utility companies in our area to locate and advise us on underground installations or surface encumbrances are as follows:

To be determined by the information collected by the contractor from New York City Dig Safe

3.1.3 Utility companies or owners will be contacted:

- Within established or customary local response times;
- Advised of the proposed work, and;
- Asked to establish the location of the utility underground installations prior to the start of actual excavation and provide advice concerning surface encumbrances.

3.1.4 When excavation operations approach the estimated location of underground installations, the exact location of the installations will be determined by safe and acceptable means (modern techniques and customary types of equipment) where this determination is unclear the owning utility will be contacted for assistance.

3.1.5 While any excavation is open, underground installations will be protected, supported or removed as necessary to safeguard employees.

4. Protection from Hazards Associated with Water Accumulation

4.1 Employees will not work in excavations in which there is accumulated water, or in excavations in which water is accumulating, unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation. The precautions necessary to protect employees adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline systems.

4.2 Inspect all excavations after any rainfall or other hazard producing occurrence to determine if any change to the soils capacity to resist the force has occurred. This will be done by a person that has the competence to do so.

4.2.1 Authorized to inspect (*Site Specific*):

1. Charles Powers, Senior Project Manager (Primary)

2. Michael Hauptmann, Site Safety Officer (Alternate)

4.2.2 Water should not be allowed to accumulate within the excavation. If such has occurred it will be removed utilizing proper pumping procedures and precautions.

4.3 Water will be controlled or prevented from accumulating by the use of water removal equipment, the water removal equipment and operations will be monitored by a competent person to ensure proper operation.

4.4 If excavation work interrupts the natural drainage of surface water (such as streams), diversion ditches or dikes, suitable means will be used to prevent surface water from entering the excavation and to provide adequate drainage of the area adjacent to the excavation. Excavations subject to runoff from heavy rains will be inspected by a competent person

5. Protection from Superimposed Loads

5.1 Superimposed loads (crane, backhoe and other such equipment working close to the excavation edges) require extra sheet piling, shoring or other bracing be used to assure the ability of the soil to resist. The use of mobile equipment near the excavation requires proper vehicle barricades and/or stop blocks.

6. Access and Egress from Excavations

6.1 Structural Ramps. Structural ramps that are used solely by employees as a means of access or egress from excavations will be designed by a competent person. Structural ramps used for access or egress of equipment will be designed by a competent person qualified in structural design, and will be constructed in accordance with the design.

6.2 Means of egress from trench excavations (less than 20 ft deep). A stairway, ladder, ramp or other safe means of egress will be located in trench excavations that are 4 feet (1.22 m) or more in depth so as to require no more than 25 feet (7.62 m) of lateral travel for employees.

6.3. Means of egress from trench excavations (20 ft or greater in depth). Ladders will be equipped with ladder platforms at 20-foot intervals.

7. Trench Safety

7.1 Trenches more than five feet deep require shoring or will be laid back to its angle of repose (stabilized slope).

7.2 In hazardous soil conditions (loosely compacted or rocky) trenches under five foot need protection.

7.3 There shall be at any excavation site a competently trained person, who is capable of identifying existing and predictable hazards and who shall have the authority to take prompt corrective action to eliminate them on the site. This individual shall be able to identify soil classifications and protective systems (shoring, bracing and piling) to be used in accordance with OSHA Trenching Standards found in 29 CFR 1926.652.

7.4 Trenches more than five (5) feet deep require shoring or will be laid back to a stable slope. In hazardous soil, trenches under five (5) feet will also be protected.

7.5 Portable trench boxes or sliding trench boxes used in place of shoring and sloping shall be designed, constructed and maintained to provide protection at least equal to the required sheeting and shoring. Shields shall be designed by a registered professional engineer and will meet the standards found in 29 CFR 1926.652.

7.6 Shields shall be installed so as to restrict lateral or other hazardous movement. Trench boxes and shields shall extend to the bottom of the trench and no less than eighteen (18) inches above the vertical top of the trench or excavation face. Exceptions are found in 29 CFR 1926.652. Excavation to a level not greater that 2 feet (.61 m) below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield. No employee shall be allowed within the shield, or trench box during the installation, removal or relocation. If at anytime trench boxes are stacked, means shall be provided to prevent separation.

8. Exposure to Vehicular Traffic

Employees exposed to public vehicular traffic will be provided with, and will wear, warning vests or other suitable garments marked with or made of reflectorized or high-visibility material.

9. Exposure to Falling Loads

9.1 No employee will be permitted underneath loads handled by lifting or digging equipment.

9.2 Employees will be required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spillage or falling materials.

9.3 Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped, in accordance with §1926.601, to provide adequate protection for the operator during loading and unloading operations.

10. Warning Systems for Mobile Equipment

When mobile equipment is operated adjacent to an excavation, or when such equipment is required to approach the edge of an excavation, and the operator does not have a clear and direct view of the edge of the excavation, a warning system will be utilized such as barricades, hand or mechanical signals, or stop logs. If possible, the grade should be away from the excavation.

11. Hazardous Atmospheres

11.1 Testing and controls. Confined space entry procedures will be adhered to in accordance with the Contractor Permit Required Confined Space Entry Program. To prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions, the following requirements apply:

11.1.1 Oxygen deficiency. Where oxygen deficiency (atmospheres containing less than 19.5 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation will be tested before employees enter excavations greater than 4 feet (1.22 m) in depth.

11.1.2 Flammable atmospheres. Adequate precaution will be taken such as providing ventilation, to prevent employee exposure to an atmosphere containing a concentration of a flammable gas in excess of 20 percent of the lower flammable limit of the gas.

11.1.3 Testing. When controls are used that are intended to reduce the level of atmospheric contaminants to acceptable levels, testing will be conducted as often as necessary to ensure that the atmosphere remains safe.

11.2 Emergency Rescue Equipment.

11.2.1 Availability. Emergency rescue equipment, such as breathing apparatus, a safety harness and line, or a basket stretcher, will be readily available where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation. The equipment will be attended when in use.

11.2.2 Lifelines. Employees entering bell-bottom pier holes, or other similar deep and confined footing excavations, will wear a harness with a lifeline securely attached to it. The lifeline will be separate from any line used to handle materials, and will be individually attended at all times while the employee wearing the lifeline is in the excavation.

12. Personal Protective Equipment (PPE). The following procedures are designed to provide employees of this company with a checklist system or procedure to follow for the selection of proper PPE for operations under this program.

12.1 Checklist

(1) Hard hat

(2) Long sleeve garment
(3) Trouser
(4) Safety toes work boot
(5) Proper eye and face protection
(6) Work glove, rubber or neoprene when working with or in chemicals
(7) NIOSH approved respirator where or when the job hazard may require
(8) Hearing protection
(9) Rubber or neoprene boots when exposed to waste-water products (a sanitary washing facility will be provided for cleanup)

Note: The first line supervisor or senior supervisor on the site will be responsible for compliance for proper utilization of PPE.

13. Material Handling Equipment. All material handling equipment will be operated in accordance with established CNS Management Corp. written policies, manufacturer's procedures and applicable OSHA standards.

14. Stability of Adjacent Structures

14.1 Where the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning will be provided to ensure the stability of such structures for the protection of employees.

14.2 Excavation below the level of the base or footing of any foundation or retaining wall that could be reasonably expected to pose a hazard to employees will not be permitted except when:

14.2.1 A support system, such as underpinning, is provided to ensure the safety of employees and the stability of the structure; or

14.2.2 The excavation is in stable rock; or

14.2.3 A registered professional engineer has approved the determination that the structure is sufficiently removed from the excavation so as to be unaffected by the excavation activity: or

14.2.4 A registered professional engineer has approved the determination that such excavation work will not pose a hazard to employees.

14.3 Sidewalks, pavements and appurtenant structures will not be undermined unless a support system or another method of protection is provided to protect employees from the possible collapse of such structures.

15. Protection of Employees from Loose Rock or Soil

15.1 Adequate protection will be provided to protect employees from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection will consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.

15.2 Employees will be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection will be provided by placing and keeping such materials or equipment at least 2 feet (.61 m) from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

16. Site Inspections

16.1 Daily inspections of excavations, the adjacent areas, and protective systems will be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. These inspections are only required when employee exposure can be reasonably anticipated. An inspection will be:

16.2 Conducted by the competent person prior to the start of work and as needed throughout the shift.

16.3 Inspections will also be made after every rainstorm or other hazard increasing occurrence.

16.4 Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees will be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

17. Fall Protection

17.1 Where employees or equipment are required or permitted to cross over excavations, walkways or bridges with standard guardrails will be provided.

17.2 Adequate barrier physical protection will be provided at all remotely located excavations. All wells, pits, shafts, etc., will be barricaded or covered. Upon completion of exploration and other similar operations, temporary wells, pits, shafts, etc., will be backfilled.

18. Training Requirements

18.1 Initial Training.

18.1.1 Contractor shall provide training to ensure the purpose and function of the trenching and excavation program is understood by employees and the knowledge and skills required for safe trenching and excavation operations is acquired by all affected employees. The training shall include as a minimum, the following:

18.1.2 Training in the recognition of applicable hazards associated with trenching and excavation operations.

18.1.3 Each affected employee shall be instructed in the purpose and use of this standard practice instruction.

18.1.4 All other employees whose work operations are or may be in an area where trenching and excavation operation are conducted shall be instructed to an awareness level about the procedures, and prohibitions relating to work in such areas.

18.2 Refresher Training.

18.2.1 Retraining shall be provided for all authorized and affected employees whenever there is a change in their job assignments, a change in equipment or processes that present a new hazard, or when there is a change in these procedures. **Note**: Retraining (to include a procedural review) will also be provided whenever there is a "close-call" or these procedures fail.

18.2.2 Additional retraining shall also be conducted whenever a periodic inspection reveals, or whenever Contractor has reason to believe, that there are deviations from or inadequacies in the employee's knowledge or use of these procedures.

18.2.3 The retraining shall reestablish employee proficiency and introduce new or revised operational methods and procedures, as necessary.

18.3 Certification. Contractor shall certify that employee training has been accomplished and is being kept up to date. The certification shall contain each employee's name and dates of training.

19. Protection of Employees in Excavations

19.1 Each employee in an excavation will be protected from cave-ins by an adequately designed protective system except when:

19.1.1 Excavations are made entirely in stable rock; or

19.1.2 Excavations are less than 5 feet (1.52 m) in depth and examination of the ground by a competent person provides no indication of a potential cave-in.

19.2 Protective systems will have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

20. Design of Sloping and Benching Systems

20.1 The slopes and configurations of sloping and benching systems will be properly selected and constructed as follows:

20.1.1 Option 1 - Allowable configurations and slopes. Excavations will be sloped at an angle not steeper than one and one-half horizontal to one vertical (34 degrees measured from the horizontal), unless the employer uses one of the other options listed below.

20.1.2 Option 2 - Determination of slopes and configurations is made using 29CFR §1926.652 Appendices A and B Maximum allowable slopes, and allowable configurations for sloping and benching systems.

20.1.3 Option 3 - Designs using other tabulated data. Designs of sloping or benching systems will be selected from and in accordance with tabulated data, such as approved tables and charts. The tabulated data will be in written form and will include:

- Identification of the parameters that affect the selection of a sloping or benching system drawn from such data;

- Identification of the limits of use of the data, to include the magnitude and configuration of slopes determined to be safe;

- Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

Note: At least one copy of the tabulated data which identifies the registered professional engineer who approved the data, will be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data will be made available to OSHA upon request.

20.1.4 Option 4 - Design by a registered professional engineer.

20.2 Sloping and benching systems not utilizing Option (1) or Option (2) or Option (3) will be approved by a registered professional engineer. Designs will be in written form and will include at least the following:

20.2.1 The magnitude of the slopes that were determined safe for the particular project;

20.2.2 The configurations that were determined to be safe for the particular project;

20.2.3 The identity of the registered professional engineer approving the design.

Note: At least one copy of the design will be maintained at the jobsite while the slope is being constructed. After that time the design need not be at the jobsite, but a copy will be made available to OSHA upon request.

21. Design of Support Systems, Shield Systems, and other Protective Systems

21.1 Designs of support systems, shield systems, and other protective systems will be selected and constructed in accordance with the following options:

21.1.1 Option 1 - Designs using Appendices A, C and D of 29CFR §1926.652. Designs for timber shoring in trenches will be determined in accordance with the conditions and requirements set forth in appendices A and C. Designs for aluminum hydraulic shoring will be in accordance with appendix D of 29CFR §1926.652, but if manufacturer's tabulated data cannot be utilized, designs will be in accordance with appendix D.

21.1.2 Option 2 - Designs using Manufacturer's Tabulated Data. Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data will be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

21.1.2.1 Deviation from the specifications, recommendations, and limitations issued or made by the manufacturer will only be allowed after the manufacturer issues specific written approval.

21.1.2.2 Manufacturer's specifications, recommendations, and limitations, and manufacturer's approval to deviate from the specifications, recommendations, and limitations will be in written form at the jobsite during construction of the protective system. After that time this data may be stored off the jobsite, but a copy will be made available to OSHA upon request.

21.1.3 Option 3 - Designs using other Tabulated Data. Designs of support systems, shield systems, or other protective systems will be selected from and be in accordance with tabulated data, such as tables and charts. The tabulated data will be in written form and include all of the following:

21.1.3.1 Identification of the parameters that affect the selection of a protective system drawn from such data;

21.1.3.2 Identification of the limits of use of the data;

21.1.3.3 Explanatory information as may be necessary to aid the user in making a correct selection of a protective system from the data.

Note: At least one copy of the tabulated data, which identifies the registered professional engineer who approved the data, will be maintained at the jobsite during construction of the protective system. After that time the data may be stored off the jobsite, but a copy of the data will be made available to the OSHA upon request.

21.1.4 Option 4 - Design by a Registered Professional Engineer. Support systems, shield systems, and other protective systems not utilizing Option 1, Option 2 or Option 3, above, will be approved by a registered professional engineer. Designs will be in written form and will include the following:

21.1.4.1 A plan indicating the sizes, types, and configurations of the materials to be used in the protective system; and

21.1.4.2 The identify of the registered professional engineer approving the design.

22. Materials and Equipment used for Protective Systems

22.1 Materials and equipment used for protective systems will be free from damage or defects that might impair their proper function.

22.2 Manufactured materials and equipment used for protective systems will be used and maintained in a manner that is consistent with the recommendations of the manufacturer, and in a manner that will prevent employee exposure to hazards.

22.3 When material or equipment that is used for protective systems is damaged, a competent person will examine the material or equipment and evaluate its suitability for continued use. If the competent person cannot assure the material or equipment is able to support the intended loads or is otherwise suitable for safe use, then the material or equipment will be removed from service, and will be evaluated and approved by a registered professional engineer before being returned to service.

23. Installation and Removal of Support Systems

23.1 General requirements.

23.1.1 Members of support systems will be securely connected together to prevent sliding, falling, kickouts, or other predictable failure.

23.1.2 Support systems will be installed and removed in a manner that protects employees from cave-ins, structural collapses, or from being struck by members of the support system.

23.1.3 Individual members of support systems will not be subjected to loads exceeding those which those members were designed to withstand.

23.1.4 Before temporary removal of individual members begins, additional precautions will be taken to ensure the safety of employees, such as installing other structural members to carry the loads imposed on the support system.

23.1.5 Removal will begin at, and progress from, the bottom of the excavation. Members will be released slowly so as to note any indication of possible failure of the remaining members of the structure or possible cave-in of the sides of the excavation.

23.1.6 Backfilling will progress together with the removal of support systems from excavations.

23.2 Additional requirements for support systems for trench excavations.

23.2.1 Excavation of material to a level no greater than 2 feet (.61 m) below the bottom of the members of a support system will be permitted, but only if the system is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the support system.

23.2.2 Installation of a support system will be closely coordinated with the excavation of trenches.

24. Sloping and Benching Systems

24.1 Employees will not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

25. Shield Systems

25.1 Shield systems will not be subjected to loads exceeding those which the system was designed to withstand.

25.2 Shields will be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

25.3 Employees will be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

25.4 Employees will not be allowed in shields when shields are being installed, removed, or moved vertically.

25.5 Excavations of earth material to a level not greater than 2 feet (.61 m) below the bottom of a shield will be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

26. Applicable Definitions

Accepted Engineering Practices - means those requirements which are compatible with standards of practice required by a registered professional engineer.

Aluminum Hydraulic Shoring - means a pre-engineered shoring system comprised of aluminum hydraulic cylinders (crossbraces) used in conjunction with vertical rails (uprights) or horizontal rails (wales). Such system is designed specifically to support the sidewalls of an excavation and prevent cave-ins.

Bell-Bottom Pier Hole - means a type of shaft or footing excavation, the bottom of which is made larger than the cross section above to form a bell shape.

Benching (Benching System) - means a method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal levels or steps, usually with vertical or near-vertical surfaces between levels.

Cave-In - means the separation of a mass of soil or rock material from the side of an excavation, or the loss of soil from under a trench shield or support system, and its sudden movement into the excavation, either by falling or sliding, in sufficient quantity so that it could entrap, bury, or other wise injure and immobilize a person.

Competent Person - means one who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

Cross Braces - mean the horizontal members of a shoring system installed perpendicular to the sides of the excavation, the ends of which bear against either uprights or wales.

Excavation - means any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal.

Faces or Sides - means the vertical or inclined earth surfaces formed as a result of excavation work.

Failure - means the breakage, displacement, or permanent deformation of a structural member or connection so as to reduce its structural integrity and its supportive capabilities.

Hazardous Atmosphere - means an atmosphere which by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating, oxygen deficient, toxic, or otherwise harmful, may cause death, illness, or injury.

Kickout - means the accidental release or failure of a cross brace.

Protective System - means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from the collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.

Ramp - means an inclined walking or working surface that is used to gain access to one point from another, and is constructed from earth or from structural materials such as steel or wood.

Registered Professional Engineer - means a person who is registered as a professional engineer in the state where the work is to be performed. However, a professional engineer, registered in any state is deemed to be a "registered professional engineer" within the meaning of this standard when approving designs for "manufactured protective systems" or "tabulated data" to be used in interstate commerce.

Sheeting - means the members of a shoring system that retain the earth in position and in turn are supported by other members of the shoring system.

Shield (Shield System) - means a structure that is able to withstand the forces imposed on it by a cave-in and thereby protect employees within the structure. Shields can be permanent structures or can be designed to be portable and moved along as work progresses. Additionally, shields can be either pre-manufactured or job-built in accordance with 1926.652. Shields used in trenches are usually referred to as "trench boxes" or "trench shields."

Shoring (Shoring System) - means a structure such as a metal hydraulic, mechanical or timber shoring system that supports the sides of an excavation and which is designed to prevent cave-ins.

Sides. See "Faces."

Sloping (Sloping System) - means a method of protecting employees from cave-ins by excavating to form sides of an excavation that are inclined away from the excavation so as to prevent cave-ins. The angle of incline required to prevent a cave-in varies with differences in such factors as the soil type, environmental conditions of exposure, and application of surcharge loads.

Stable Rock - means natural solid mineral material that can be excavated with vertical sides and will remain intact while exposed. Unstable rock is considered to be stable when the rock material on the side or sides of the excavation is secured against caving-in or movement by rock bolts or by another protective system that has been designed by a registered professional engineer.

Structural Ramp - means a ramp built of steel or wood, usually used for vehicle access. Ramps made of soil or rock are not considered structural ramps.

Support System - means a structure such as underpinning, bracing, or shoring, which provides support to an adjacent structure, underground installation, or the sides of an excavation.

Tabulated Data - means tables and charts approved by a registered professional engineer and used to design and construct a protective system.

Trench (Trench Excavation) - means a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 m) or less (measured at the bottom of the excavation), the excavation is also considered to be a trench.

Trench Box. See "Shield."

Trench Shield. See "Shield."

Uprights - means the vertical members of a trench shoring system placed in contact with the earth and usually positioned so that individual members do not contact each other. Uprights placed so that individual members are closely spaced, in contact with or interconnected to each other, are often called "sheeting."

Wales - means horizontal members of a shoring system placed parallel to the excavation face whose sides bear against the vertical members of the shoring system or earth.

8/05

Appendix E: Confined Space Entry

CONTRACTOR
PERMIT-REQUIRED CONFINED SPACE SAFETY PLAN

1.0 POLICY

1.1 Contractor is committed to provide a safe and healthful work environment for our entire staff. Pursuit of this endeavor, the following written program is in place to first identify any Permit-Required Confined Space (PRCS) and to eliminate or control hazards associated with PRCS operations. Contractor may encounter PRCS during Emergency Response Procedures. This program is in accordance with the Occupational Safety and Health Administration's (OSHA) Permit-Required Confined Spaces Standard, Title 29, Code of the Federal Regulations 1910.146.

1.2 Confined Space / Limited Egress enclosure: Any space or enclosure that (1) has limited openings for entry and egress; (2) may have limited ventilation; (3) may contain or produce life threatening atmospheres due to oxygen deficiency, or the presence of toxic, flammable, and/or corrosive contaminants; (4) and which is not intended for continuous employee occupancy. Examples of such enclosures may include but are not limited to: storage tanks, ship compartments, process/reaction vessels, stacks, pits, basements, silos, vats, degreasers, boilers, ventilation and exhaust ducts, manholes, sewers, tunnels, underground utility vaults, pipelines, and any open topped space several feet or more in depth that is not subject to adequate ventilation.

1.3 The configuration of the space and the proposed operation to be conducted within that space will ultimately determine if a permit-required confined space exists.

1.4 Health and Safety Officer or Director of Field Operations are to be considered synonymous and hold equal authority. The Director of Field Operations is a Contractor title who has the authority in the field on all the work sites of Contractor.

1.5 Purging: Displacing gases, vapors, or other airborne contaminants from a permit-required confined space by ventilation or inert gas.

2.0 RESPONSIBILITIES

2.1 Overall Program Responsibility: The Supervisor of Health and Safety is responsible for the overall implementation and maintenance of any written program or any certification concerning the requirements of the Permit-Required Confined Space (PRCS) Standard at our company.

2.2 Permit-Required Confined Space Evaluation: The Director of Field Operations and/or Health & Safety Officer is responsible for evaluating the workplace in the field to determine if any permit-required confined spaces are encountered at the work site. The Director of Field Operations and Health & Safety Officer is responsible for determining if a PRCS program is required, or if the permit space can be reclassified as a non-permit space, or if alternative procedures can be used.

2.3 Training: The Supervisor of Health and Safety is responsible for ensuring that affected personnel are properly trained and that refresher training is given. Personnel who may be included are any authorized entrants, attendants, entry supervisors, on-site rescue team members, and employees who may potentially enter the space.

2.4 Initial Contacting for Rescue Services: The Project Manager and/or Site Supervisor will ensure that rescue and emergency services have been informed of any permit-required confined spaces at the work site and have been given access to the spaces if they are to be used as standby during the course of the project.

2.5 Equipment: The Director of Field Operations will ensure that all equipment needed for safe entry into any permit spaces and non-permit spaces is available and in proper working order.

3.0 PERMIT SPACE IDENTIFICATION

3.1 The Director of Field Operations will evaluate the workplace and determine;

- No Permit-Required Confined Space(s) exist at the worksite.
- Permit-Required Confined Space(s) have been determined to exist.

Confined Space: is a space which, (1) is large enough and so configured that an employee can bodily enter and perform assigned work; (2) has limited or restricted means for entry or exit (example: tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry/exit); (3) is not designed for continuous human occupancy.

Permit Space: is a confined space which has one or more for the following characteristics (1) contains or has a potential to contain a hazardous atmosphere; (2) contains a material that has the potential for engulfing an entrant; (3) has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; (4) contains any other recognized serious safety or health hazard (i.e. electrical, mechanical, etc.).

See Confined Space and Permit-Required Confined Space Recognition Form.

3.2 The location(s) and hazard(s) posed by these permit spaces for the project are listed below;

LOCATION: HAZARD:

____

____

____

The Entry Supervisor must sign and approve PRCS entry permits prior to any entry personnel entering the confined space.

4.0 PREVENTION OF UNAUTHORIZED ENTRY

4.1 If permit spaces are identified at a worksite, The Director of Health and Safety and/or Director of Field Operations will inform exposed or potentially exposed employees of their existence and hazards. The method(s) that will be used will be:

Posting of danger signs at each permit space reading "DANGER - Permit-Required Confined Space - Do Not Enter."

All workers on the job site will be drilled on the work procedures to be used on the project. Contractor will have a project meeting with all employees on the job site prior to commencement of work procedures.

4.2 If it is determined by the Director of Field Operations that permit required confined spaces exist at the work site, the following precautions will be taken during the course of the work.

X Will not be entered by unauthorized employees.

The following measures will be taken to prevent unauthorized employees from entering the space(s).

The work site will be isolated with caution tape and caution fencing to prevent entrance by unauthorized employees. The Site Supervisor will also have the responsibility for the site that unauthorized personnel are excluded from the work site. The work area will be sealed to prevent access during non-working hours.

X The PRCS will be entered only by authorized trained employees of our company.

5.0 PERMIT-REQUIRED CONFINED SPACE (PRCS)

5.1 Safe entry procedures will be developed for each permit space at the work site. These procedures specify the proper methods and equipment necessary to conduct the entry operation in a safe manner. A Permit Space Entry Procedure Worksheet will be completed for the permit space by the Director of Field Operations.

See the Permit-Required Confined Space (PRCS) Program Worksheet.

5.2 Entry Permit System: Entry into a PRCS enclosure shall be by permit only. The permit serves as written approval and authorization for an entry of a specific space for a specific task. The permit certifies that existing and potential hazards have been evaluated by the on-site Entry Supervisor (and/or on-site Health and Safety Officer) and identifies the protective measures specified to ensure worker safety. The entry permit when completed will serve as a final safety briefing outline before entry and will be reviewed by the Health and Safety Officer with the entry team and standby personnel. The entry permit will identify:

- The location of the Permit-Required Confined Space (PRCS) and a description of the entry task.
- Known and potential hazards that may be encountered in the PRCS.
- Isolation checklist
- blanking and/or disconnecting of all lines
- electrical lockout and tagout (both)

- mechanical isolation and tagout (both)
- mechanical ventilation (volumes)
- Safety and protective equipment required
- level of protection
- type of protective equipment
- safety harness and/or lifelines
- extraction devices
- tools and electrical equipment approvals (including lighting and communication devices)
- Pre-entry atmospheric monitoring
- oxygen level
- combustible gas/vapor level
- toxic substances level
- Provisions for continuous atmospheric monitoring
- equipment
- evaluation criteria
- Identification of entry team
- Personnel to make entry
- Personnel on stand-by
- Emergency procedures and first-aid equipment location
- Training required
- PRCS entry
- PRCS rescue
- Respirator use

5.3 Testing and Monitoring

5.3.1 Absolutely no permit-required confined space entry without the use of appropriate supplied-air respirators and dermal protection is to be initiated until appropriate initial testing has been conducted to assure the atmosphere in the PRCS is safe. Monitoring shall be conducted for oxygen content, combustible gases/vapors, toxic contaminants and any other tests specified by the on-site Health and Safety Officer. Monitoring of the PRCS shall be done on a continuous basis while personnel are in the PRCS enclosure.

Entry into a PRCS shall not be permitted without the use of appropriate supplied-air respirators and dermal protection under the following conditions:

(1). Oxygen concentration less than 19.5% (148mm Hg*) or greater than 23.5% (178 mm Hg*).

* based on atmospheric pressure of 760mm Hg (sea level).

(2). Flammability measures greater than 10% of the lower explosive limits (LEL).

(3). Contaminant level measurements indicating an IDLH atmosphere present in the PRCS.

(4). Emergency rescue conditions with additional standby team available.

Whenever any of the *not entry* conditions occur, the volumes of mechanical ventilation supplied to the space shall be increased and maintained at the increased levels. Entry or re-entry will be permitted when: (1) oxygen levels are measured greater than 19.5% and less than 23.5%; (2) LEL measurements fall below 10%; and (3) an IDHL atmospheric condition no longer exists.

Regardless of the level of respiratory protection, no entry for *Hot Work* will be allowed when tests indicate the concentration of flammable gases exceeds 10% of the LEL.

Initial atmospheric samples shall be drawn while outside the PRCS at least at the following locations:

(1). Outside the entry point(s)

(2). Immediately inside the entry point(s)

(3). At least every four feet in depth of the PRCS to the surface of the floor or any remaining residues.

All initial monitoring results will be recorded on the entry permit.

5.4 Work Practices: As part of the entry procedure, the on-site Health and Safety Officer shall review the entry permit with all members of the entry team and standby team personnel as indicated in Section 8.1 and shall be present during the operation. The Health and Safety Officer and Entry Supervisor will maintain communications and have ready access to emergency and support services and facilities.

5.4.1 Purging and Ventilation: All PRCS enclosures shall be subject to purging and continuous ventilation after initial atmospheric testing bur prior to any actual entry. the only exception to this requirement is where entry is made solely to obtain samples of materials remaining in the PRCS *and* initial atmospheric testing indicates:

(1). No oxygen deficiency or enrichment.

(2). LEL measurements are less than 10%

(3). Contaminant levels are less than 10% of the established IDHL of the airborne contaminant present.

(4). Organic vapor measurements coincide with the appropriate level of personal protective equipment employed for confined spaces.

(5). Special conditions exist such that the above criteria do not apply and specific authorization is obtained from the Director of Health and Safety of the Company.

5.4.2 Isolation / Lockout and Tagging

Except for such PRCS as manholes, sewers, and tunnels, where complete isolation is not physically possible, all PRCS shall be completely isolated from all other systems by such means as double block and bleed, blanking or physical disconnection of all lines into the PRCS. All lines that have been subject to the isolation actions shall be tagged to identify the reason for blocking, blanking and/or disconnection. The *Tag* shall contain the following statement:

**THIS EQUIPMENT HAS BEEN
REMOVED FROM SERVICE DUE
TO CONFINED SPACE WORK
AT ____________________
DO NOT OPERATE**

The PRCS shall be electrically isolated to prevent accidental activation of moving parts in the PRCS or other electrical equipment serving the PRCS. Electrical isolation shall be accomplished by lockout of circuit breakers and/or power disconnects in the open (OFF) position by key-type padlock. The Entry Supervisor for the entry team entering the PRCS shall have placed a lock on the circuit breaker/disconnect and shall maintain possession of the only key to the lock. Any circuit breaker/disconnect that is locked out, shall also be tagged to identify the reason for the lock out.

Mechanical isolation of moving parts shall be deactivated by disconnecting linkages, or removal of chain or belt drives. Other moving mechanical parts shall be blocked in such a manner as to preclude accidental rotation. Any mechanical isolation shall be tagged to identify the reason for the isolation.

5.4.3 Cleaning

Initial cleaning of any PRCS shall be done from the outside if at all feasible. If initial atmospheric testing shows a flammable atmosphere at or above the lower explosive limit (LEL) in the PRCS enclosure, it shall be inert gas purged prior to starting ventilation.

The cleaning process itself may create an additional potential for hazard in the PRCS. Examples of such conditions include:

(1). Excessive heat stress in the PRCS if it is steam cleaned and not allowed to cool down.

(2). Build up of toxic materials if a chemical neutralization is used and ventilation is not maintained or adequate.

3). Potential for fire and explosion in the PRCS where the auto ignition temperature of the stored product in the PRCS is 120% or less of the steam pressure and/or the steam hose nozzle is not bonded to the PRCS during steam cleaning operations.

5.4.4 Equipment, Instruments and Tools

All tools and other equipment, including monitoring instruments, for use in the PRCS shall be inspected for compliance with the following requirements.

(1). Tools and equipment will be kept cleaned in good state of repair.

(2). All electrical equipment including portable tools, lighting, and power cords shall meet approvals in accordance with OSHA regulations found in 29 CFR 1910 Subpart S, including provisions for ground fault interruption protection and visual inspection of equipment for defects or damage.

(3). Lighting used in the PRCS shall be explosion proof design equipped with necessary guards and bearing Underwriters Laboratories or other appropriate approval listings.

(4). Air activated tools used where flammable liquids are present shall be bonded to the PRCS.

(5). Compressed gas cylinders, except those that are part of Self Contained Breathing Apparatus (SCBA) or resuscitation equipment, shall never be permitted inside a PRCS. Cylinders used to supply compressed gases to the PRCS shall be turned off at the valve when not in actual use, and the supply lines removed from the PRCS.

(6). Ladders, scaffolding and staging shall be adequately designed and secured and in conformance with OSHA regulations found in 29 CFR 1910 Subpart D.

(7). Any equipment or instrumentation subject to use in PRCS where flammable atmospheres may occur shall be listed as explosive proof or intrinsically safe by a recognized testing laboratory.

5.4.5 Recordkeeping: Copies of the entry permit will be maintained as an employee exposure record as required under 29 CFR 1910.20.

6.0 ALTERNATIVE PROCEDURES

6.1 The OSHA regulations allow permit spaces which have, as their only hazard, an actual or potential hazardous atmosphere to use alternative procedures for entry. These alternative procedures as discussed in Section 1 do not require the implementation of a full PRCS program.

7.0 RECLASSIFYING PERMIT SPACE TO NON-PERMIT SPACE

Reserved

8.0 PERSONNEL, DUTIES, and TRAINING for FULL PERMIT-REQUIRED CONFINED SPACE ENTRY OPERATIONS

8.1 Entry into a PRCS where a full PRCS program is mandated will require a specially trained and equipped team. Each team will consist of an:

- *authorized entrant*
- *attendant*
- *entry supervisor*
- *rescue personnel* - will be supplied by others.

8.2 Each member of the team will receive initial and annual refresher training. The training will be specific for the duties of each team member and include the procedures and practices necessary to protect them from the dangers of the permit space.

8.3 The training program will include the duties of each team member as listed below:

Authorized Entrants
- Know the hazards associated with the permit space and their effects.
- Entry and egress procedures
- Properly use the equipment required for entry.

- Maintain a continuous means of communication with the attendant.
- Alert the attendant in the event of an emergency.
- Evacuate the space if an emergency occurs.

Attendants
- Know the hazards associated with the permit space and their effects.
- Entry and egress procedures
- Maintain an accurate account of the authorized entrants.
- Remain at their assigned station until relieved by another attendant or until the permit space entry is complete.
- Monitor conditions in and around the permit space.
- Summon rescue and applicable medical services in the event of an emergency.
- Perform non-entry rescue procedures.
- Perform appropriate measures to prevent unauthorized personnel from entering the permit space.

Entry Supervisors
- Know the hazards associated with the permit space and their effects.
- Verify the safeguards required by the permit space have been implemented.
- Verify that rescue services are available and that the means for summoning them are operable.
- Cancel the written permit and terminate the permit space entry when required.
- Remove personnel who are not authorized to enter the permit space during entry operations.
- Periodically, determine that the entry operation is being performed in a manner consistent with the requirements of the permit space entry procedures and that acceptable entry conditions are maintained.

Rescue Personnel
- See Rescue and Emergency Services attachment.

8.4 Permit-Required Confined Space (PRCS) Program Training

If a full permit-required confined space program is required, training is needed on the following topics.

a. Types of confined space hazards.
b. Components of the written PRCS program.
c. Components of the entry permit system.
d. Components of the hot work permit.
e. The need for prompt guarding of the entrance opening.
f. Atmospheric testing equipment including its use, calibration, and maintenance.
g. Atmospheric testing protocol:
    * oxygen, combustibles, toxics
    * pre-entry, frequent or continuous testing
    * check all levels of the space
h. Methods for the control or elimination of any atmospheric hazards:
    * Inerting
    * Draining and rinsing
    * Purging and cleaning
    * Continuous forced air ventilation
i. Procedures the employees must follow if they detect a hazard.
j. The evaluation process to be used for re-entry if hazards are detected.
k. Train employees on the use of entry equipment (ladders, communication devices, etc.).

l. Personnel protective equipment required:
 * full body harness
 * respiratory protection
 * chemical protective clothing
 * eye and face protection

m. Personnel and their responsibilities:
 * authorized entrant
 * attendant
 * entry supervisor
 * rescue team

n. On-site or Off-site rescue
 * Rescue Plan
 * practice rescues
 * basic first-aid and cardiopulmonary resuscitation certification.
 * full body harness with retrieval line attached to mechanical retrieval device

o. Procedures for annual review of canceled permits.

p. Any other information necessary to ensure employee safety during a permit space entry operation.

q. Documentation of the training.

8.4.1 The following is a list of employees who have been equipped and trained to serve as authorized entrants.

Authorized Entrants:	**Trainer:**	**Date of Training:**

8.4.2 The following is a list of employees who have been equipped and trained to serve as attendants.

Attendant:	**Trainer:**	**Date of Training:**

8.4.3 The following is a list of employees who have been trained to serve as entry supervisors.

Entry Supervisor:	**Trainer:**	**Date of Training:**

9.0 HOST EMPLOYER'S RESPONSIBILITIES WITH CONTRACTORS

9.1 When contractors are involved in permit space entry work at the work site, they will inform Contractor of the following information and coordinate any entry operations:

- The location of the permit spaces at their facility and that entry into these spaces is only allowed through a permit space program or alternative procedures or space reclassification.
- Owner's rationale for listing the space as a permit space such as any identified hazards and their experiences with the particular space.
- Precautions that they have implemented to protect employees working in or near the space.
- Owner's Health and Safety Officer or Representative (or equivalent) will debrief Contractor personnel at the completion of the entry operation, or during if a need arises, and if any hazards were confronted or created during their work.

10.0 CONTRACTOR'S RESPONSIBILITIES WITH HOST EMPLOYERS

10.1 When Contractor is hired to perform work in a PRCS, the Director of Field Operations and/or Director of Health and Safety will obtain the following information from the Owner or Owner's Representative (the host employer) and ensure the following tasks are performed.

* Obtain any information on the hazards of the permit space and information from pervious entry operations from the host employer.
* Determine if the host employer's workers will be working in of near the space.
* If the host employer will have employees working in or near the space during our entry operation, the Director of Field Operations will coordinate entry operations with the host employer's representative.
* Will inform the host employer of the permit space program that will be utilized.
* Hold a debriefing conference at the completion of the entry operation of during the entry operation (if needed) to inform the host employer of any hazards confronted or created.

11.0 RESCUE AND EMERGENCY SERVICES

11.1 The precautions and procedures outlined in our written PRCS program are designed to ensure that our employees are safe while working in permit spaces. Under no circumstances do we expect our employees to enter a permit space where hazards have not been eliminated or effectively controlled.

Additionally, we recognize that unexpected situations might arise that prevent entrants from self-rescue. Contractor does not maintain their own emergency rescue team. In response, the following rescue and emergency action plan has been developed and will be strictly enforced:

Contractor has decided to utilize (this will be determined prior to the project commencement);

_____ On-site rescue services which include:
_____ non-entry rescue procedures
_____ entry rescue procedures
_____ Off-site entry rescue services

11.2 Contractor requires that each member of the local rescue service is appropriately trained. Refer to Rescue and Emergency Services appendix for rescue plan and training requirements.

11.3 Contractor requires that each member of the rescue service is appropriately trained in basic first-aid and cardiopulmonary resuscitation (CPR) training and hold current certification.

11.4 Emergency Rescue Teams should practice rescue techniques at least annually from the actual or similarly configured space(s). Simulated rescue operations must include dummies, mannequins, or actual persons from the actual or representative permit spaces. Actual rescues during the 12-month period may also substitute for a practice rescue.

11.5 The Director of Health and Safety will make arrangements with **FDNY** for off-site rescue and emergency services on on-going planned PRCS work sites

The Director of Health and Safety will inform **FDNY** of the hazards they may encounter if they are summoned during on-going planned PRCS work sites. The Director of Health and Safety has also provided access to the rescue service so they can evaluate the permit spaces to develop appropriate rescue plans and practice rescue operations. If rescue and emergency services are needed, the following procedures will go into effect.

Name of Rescue Service:	FDNY
Telephone Number:	911
Location:	2165 Gerritsen Ave, Brooklyn, NY 11229
Distance from Site:	1.4 miles
Approximate Response Time:	Unknown
Name of Emergency Medical Service:	NYC Health + Hospitals/Coney Island
Telephone Number:	1-718-616-3000
Location:	2601 Ocean Parkway, Brooklyn, NY 11235
Distance from Site:	1.8 miles
Approximate Response Time:	Unknown
<u>Alternate Hospital:</u>	
New York Community Hospital, 2525 Kings Hwy, Brooklyn, NY 11229 (2.1 miles/11 minutes)	

12.0 TRAINING

12.1 Training must be given to each employee who has access or potential access to a permit space. The amount and type of training needed will depend on the individual's duty assignment. For example, some employees may only be required to know the existence, location, and danger posed by a permit space. Others would need considerably more training if they are members of a PRCS team. Still others would need training as it pertains to the type of entry procedures used (i.e. alternative procedures or reclassifying to non-permit space procedures). The overall intent of this training is to give employees the understanding, knowledge, and skills necessary for the safe performance of their assigned duties in relation to the permit spaces of concern.

12.2 Four basic categories have been set up to train employees based on duties and potential exposure.

12.2.1 Awareness Training: Awareness training for employees potentially exposed to permit spaces can be satisfied by providing them with the specific information contained in sections 3 and 4 of this program.

12.2.2 Training required for using alternative procedures

Reserved

12.2.3 Training required for using the reclassifying permit space procedures.

Reserved

12.2.4 Training required for using full Permit-Required Confined Space Procedures. (See Section 8.4)

13.0 PERMIT-REQUIRED CONFINED SPACE PROGRAM REVIEW

13.1 Within one year of any entry operation, the Supervisor of Health and Safety will conduct a review of the program using the canceled entry permits to identify any deficiencies in our program. A review will be conducted sooner if there is reason to believe that the program does not adequately protect our employees. Any corrective measures will be documented by a revision of the program. Employees will be trained on any changes. Additionally, employees who note any discrepancies with this program can contact the Supervisor of Health and Safety. If no permit entry operations are conducted during the year, no review is needed.

14.0 MEDICAL SURVEILLANCE

14.1 Contractor personnel are required to have annual physicals in accordance with OSHA 29 CFR 1910.120(f). Physicals are performed by a physician of the employee's choice and payment is fully covered by Contractor. The physician reports the employee's ability to perform his/her work and wear an air purifying respirator to Contractor. All employees receive a copy of the results of their medical exam upon completion by the physician. Contractor also maintains a copy of employee medicals on file. All employee medical records are kept on file in the Contractor's main office. An employee may obtain a copy his medical file by requesting it through the company's Supervisor of Health and Safety. Contractor maintains copies of employee files for 30 years after the date of termination of employment.

14.2 All employees receive an initial medical examination prior to beginning work with the company. Employees receive an initial medical examination even if they have received a prior medical examination within one year in conjunction with a previous employer. The contents of the initial medical examination consist of;

- Medical and work history questionnaire
- Completion of the respiratory disease standardized questionnaire (Periodic)
- Complete physical examination, concentrating on respiratory, cardiovascular, and digestive systems
- Routine urinalysis
- Chest x-ray read by a Type B Reader
- Pulmonary Function Test FVC, FEV1
- Electrocardiogram
- Additional tests deemed necessary by the examining physician

14.3 All employees receive annual medical examination in order to determine if the employee can maintain his/her job tasks. The cost of annual medical examinations are covered by Contractor and their contents consist of;

- Medical and work history questionnaire
- Completion of the respiratory disease standardized questionnaire (Periodic)
- Complete physical examination, concentrating on respiratory, cardiovascular, and digestive systems
- Chest x-ray read by a Type B Reader
- Pulmonary Function Test FVC, FEV1
- Additional tests deemed necessary by the examining physician

14.4 Employees may receive medical examinations if desired from one of the participating medical physicians that Contractor uses or one of the employee's own choice.

14.5 Contractor provides its employees with semi-annual respirator fit tests as required by OSHA at no charge to the employee. A copy of Contractor Respiratory Protection Program is located in Appendix F of the Health & Safety Manual.

14.6 Contractor collects worker exposure data as per OSHA 29 CFR 1910.120 regulations. Contractor maintains copies of workers personal exposure samples on file in the Contractor's main office.

8/05

Appendix F: Miscellaneous Tasks

Miscellaneous Task Standard Operating Procedures and Safety Measures

1.0 Site Inspection

2.0 Drum Handling

3.0 Opening Drums and Overpacks

4.0 Drum Staging and Overpacking

5.0 Compatibility Testing and Composting of Samples

6.0 Working Around Heavy Equipment

7.0 Corrosive Liquid Transfer

8.0 Flammable / Combustible Liquid Transfer

9.0 Lab Packing and Lab Inventory

10.0 Soil Excavation

11.0 Drum Sampling

12.0 Use of a High Pressure Water Cleaner

13.0 Drum Excavation

14.0 Soil Sampling

15.0 High Pressure Washer During Vat Cleaning

16.0 Compressed Gas Cylinders

17.0 Empty Drum Crushing

TASK SAFETY AND HEALTH RISK ANALYSIS

This Hazard Assessment identifies the general hazards associated with specific site operations and presents an analysis of documented or potential chemical hazards that exist at the site. Every effort must be made to reduce or eliminate these hazards. Those which cannot be eliminated must be guarded against by use of engineering controls and/or personal protective equipment.

ACTIVITY SPECIFIC HAZARDS and SOPs

1.0 Hazards and SOPs Associated with Site Inspection

Hazards

1. Slip / trip / fall hazards from debris and holes, trenches in floor.
2. Injury from unstable overhead and falling building materials/debris.
3. Gas release hazards.
4. Direct skin contact and/or inhalation of contaminants.
5. Biological hazards.

SOPs

1. Be sure that all areas of entry have or are provided with adequate lighting.
2. All personnel should wear hard hats at all times when inside buildings and hot zones.
3. Be sure that all manholes/floor drains are covered and marked.
4. Be sure that stairways are structurally sound.
5. Be sure that all rooms are checked for loose or unstable overhead structures/debris.
6. Minimize slip. trip. fall hazards by keeping work areas clean and being aware or unstable or loose footing.
7. Air monitoring is to be conducted prior to inspection.
8. Be aware of and avoid potential biological hazards.

2.0 Hazards and SOPs Associated with Drum Handling

Hazards

1. Injury from slip/trip/fall due to unstable ground conditions.
2. Cuts or abrasions from sharp or jagged metal during drum handling.
3. Potential for crushed fingers and toes, strained muscles, and back injury from moving heavy objects.
4. Operation of heavy equipment (e.g. backhoe with drum grappler).
5. Direct skin contact and/or inhalation of contaminants.

SOPs

1. Personnel are to be aware of footing as well as heavy equipment operating in the area.
2. Personnel should wear leather gloves and steel-toed boots.
3. Moving and opening drums is to be in accordance with 29 CFR 1910.120(j)
4. Level B or C respiratory protection should be used with handling drums.
5. All heavy equipment to have backup alarms and ground spotters to assist operators. Eye to Eye contact with the operator is to be made before approaching moving equipment.

3.0 Hazardous and SOPs Associated with Opening Drums and Overpacks Hazards

Hazards

1. The presence of air-reactive chemicals.
2. The presence of water-reactive chemicals, particularly when it is raining.
3. Direct skin contact, ingestion, and inhalation of contaminants.
4. Opening drums of unknown waste.
5. Splashing wastes.
6. Cuts from sharp metal edges.
7. Air lines tangles among the drums.

8. Slip/trip/fall.
9. Pinch points.
10. Bulging or visually unstable drums.

SOPs

1. Open drums and overpacks in Level B respiratory protection.
2. Be alert for bulging drums and chemical reactions.
3. Avoid allowing rain to enter drums.
4. Regular, periodic air monitoring is to be performed with the rad meter, monitox units, HNU and CGI to ensure a safe environment.
5. Keep fire extinguishers in the area.
6. Keep absorbent materials immediately available.
7. If a drum is bulging or difficult to open , use remote opening techniques.
8. Level B will be used when opening unknown drums, and when handling drums that are in poor physical condition.

4.0 Hazards and SOPs Associated with Drum Staging and Overpacking

Hazards

1. Direct skin contact and inhalation, ingestion threat from hazardous materials.
2. Poor physical condition of drums. Rusty metal and holes indicate a high potential or spills and splashes during drum handling.
3. Routine heavy equipment hazards.
4. Physical hazards associated with drum handling operations - potential for crushed fingers and toes, strained muscles, and back injury from moving/lifting heavy objects.
5. Operation of heavy equipment (e.g. backhoe with drum grappler).

SOPs

1. Use of level B or Level C personal protective equipment. Chemical resistant coveralls, gloves, splash shields, hard hats, and steel-toed boots should be used when handling drums, and in the vicinity of open drums.
2. Keep absorbents and emergency spill materials immediately available in the exclusion zone.
3. Use of safe work practices to prevent physical injury.
4. Drums will be staged on a polyethylene-lined containment pad.

5.0 Hazards and SOPs Associated with Compatibility Testing And Composting of Samples

Hazards

1. Inhalation of hazardous fumes.
2, Mixing incomplete materials.
3. Splashing or spilling samples.

SOPs

1. Personnel not involved with compatibility testing procedures should not be in the area.
2. Personnel will wear safety glasses, gloves, and acid shields
3. Containers should be clearly marked.
4. Chemicals should be added slowly an in small amounts with constant observation.
5. Personnel should evacuate the area in the event of uncontrolled chemical reactions.
6. All compatibility tests will be performed by an on-site chemist.

6.0 Hazards and SOPs Associated with Working Around Heavy Equipment

Hazards

1. Equipment movements.
2. Overhead and Underground utility lines.
3. Unstable slopes and open pits.

SOPs

1. All equipment must have operational backup alarms.
2. Personnel must make eye-to-eye contact with the operator before approaching operating equipment.
3. Operators must be aware of personnel in the area and use proper hand signals when communicating.
4. Operators must use caution when handling containers of hazardous materials.
5. Operators must wear hard hats if the machine does not have an enclosed cab or cage cover.
6. Operators must wear hard hats when going to and from their machines.
7. Ground spotters are to assist heavy machine operators.

7.0 Hazards and SOPs Associated with Corrosive Liquid Transfer

Hazards

1. Direct skin contact with corrosive materials.
2. Potential for spills or leaks during transfer operations.
3. Potential for chemical reaction from mixing incompatible liquids or from contact with transfer equipment.
4. Potential splashing of corrosive liquids during transfer operations.
5. Slip/trip/fall around transfer hoses and equipment.

SOPs

1. Wear protective corrosive resistant clothing (e.g. acid suits, splash shields). Be sure gloves and boots are taped to protective clothing. Take precautions to ensure that no skin surfaces are exposed.
2. Wear appropriate level of respiratory protection.
3. Keep absorbents and spill containment materials nearby in the event of a spill or leak.
4. Monitors transfers continuously for changes in conditions (e.g. reactivity, pressure buildup, fire). Personnel monitoring the pumping and receiving vessel must have clear and continuous communication. If necessary, install a remote shutoff on the transfer pump.
5. Make sure the transfer equipment (e.g. hoses, fittings, pumps and receiving vessels) are compatible with the corrosive material and that they are clean.
6. Be aware of the locations of emergency showers and eyewashes, which should be placed nearby during operations.
7. Have an emergency escape route and contingency plan.
8. Be sure that all drums are characterized and adequately and appropriately marked to avoid mixing incompatible materials.
9. Make transfer with caution, remembering that corrosives may react violently, even explosively, with a wide variety of chemicals.
10. Provide adequate ventilation to area of transfer activities.

8.0 Hazards and SOPs Associated with Flammable / Combustible Liquid Transfer

Hazards

1. Direct skin contact, inhalation, ingestion.
2. Potential for fire or explosion during transfer.
3. Potential for spills during transfer.
4. Potential for chemical reaction during transfer.
5. Slip/trip/fall around transfer hoses and equipment.

SOPs

1. Use chemical resistant coveralls such as Saranex or butyl rubber when working with flammable / combustible liquids or when in the vicinity of open liquids.
2. Use Level B respiratory protection when opening tanks, when monitoring intake vacuum hoses when ambient organic concentrations exceed 5 ppm or while engaged in other high hazard / contact activities.
3. Level C may be sufficient for non-intrusive perimeter activities if ambient concentrations are less than 5 ppm.
4. Keep fire extinguishers in readily accessible locations.
5. Ground or bond the tank and tanker truck prior to beginning transfer operations.
6. Clear the area of all open flames or other ignition sources, and all flammable and combustible materials.
7. Use spark-proof tools and equipment.
8. Keep absorbents and spills containment equipment nearby in the event of a spill or leak.
9. Conduct air monitoring for organics, flammable/explosive vapors and oxygen as appropriate. Air monitoring equipment can be left in the work area unattended and programmed to sound an alarm if dangerous levels are encountered.
10. Have an emergency escape route planned and a contingency plan in case of an accident.
11. Be sure that all tanks are characterized and appropriately marked to avoid bulking of incompatible tanks.
12. Conduct the transfer with extreme caution, remembering that striking surfaces may cause sparks.

9.0 Hazards and SOPs Associated with Lab Packing and Lab Inventory

Hazards

1. Possible skin contact with leaking bottles.
2. Mixing of incompatible materials.
3. Presence of shock sensitive materials.
4. Sudden release of dangerous vapors.

SOPs

1. Wear appropriate personal protective equipment, Level B (e.g. splash shields, acid suits, hard hats, chemical resistant gloves).
2. Clearly mark containers.
3. Non-essential personnel must be restricted from area.
4. Have appropriate fire fighting equipment present.
5. Review information files for possible chemical data.
6. Carefully follow lab packing guidelines specifically for the acceptable disposal facility.
7. Have sorbent materials on hand to quickly clean up any spills.

10.0 Hazards and SOPs Associated with Soil Excavation

Hazards

1. Movement of heavy equipment during soil excavation.
2. Direct skin contact with contaminated soil.
3. Damaging drums while excavating which could release unknown contaminants.
4. Inhalation of contaminated dusts.
5. Loose footing and slip/trip/fall hazards.

SOPs

1. Personnel are to be aware of working locations of heavy equipment.
2. All equipment must have operational back-up alarms.
3. Personnel should make eye-to-eye contact with the operator before approaching heavy equipment.
4. Personnel should wear appropriate respiratory equipment.

11.0 Hazards and SOPs Associated with Drum Sampling

Hazards

1. Direct skin contact, ingestion and inhalation of contaminants.
2. Potential for chemical splash and mixing of incompatible materials, air or water reaction.
3. Poor physical condition of drums.
4. Slip/trip/fall hazards associated with slick surfaces or high or elevated work areas.

SOPs:

1. Use chemical resistant coveralls such as Saranex or butyl rubber during sampling.
2. Use Level B respiratory protection for opening tanks or unknown materials, for sampling solvent tanks, or when ambient organic concentrations exceed 5ppm.
3. Use Level C respiratory protection for re-sampling materials and ambient organic concentrations are less than 5ppm.
4. Keep fire extinguishers immediately available.
5. Keep absorbent materials immediately available.
6. Use of a new drum thief to sample each drum or container.
7. Frequent air monitoring will be performed to ensure the quality of the ambient air.
8. If a drum is bulging or difficult to open, use remote opening techniques.

12.0 Hazards and SOPs Associated with the use of High Pressure Water Cleaner

Hazards

1. Body parts being injured/severed due to high pressure (3,000 psi) water stream.
2. Slip / trip / fall associated with water overspray and hose.
3. Control of high pressure nozzle.
4. Exposure to contaminants.

SOPs

1. Level C will be worn along with splash suit and shield.
2. No Hands, feet arms, or legs will be within three feet of high pressure nozzle.
3. Splash shields and rain protection should be worn over minimum level of protection.
4. Skin and ear protection may be required.
5. Operators are to be aware of other personnel or equipment in the area.

6. No personnel are to hold material being cleaned.

13.0 Hazards and SOPs Associated with Drum Excavation

Hazards

1. Drums may contain unknown hazardous substances.
2. Moving of drums may disturb otherwise intact hazardous materials.
3. Containers may be pressurized and subject to violent release of contents.

SOPs

1. Containers (other than empty containers) should be moved only by remote mechanical devices.
2. Where applicable polyethylene sheeting shall be place in such a manner as to contain any spilled material.
3. Containers should not be handled by personnel until the contents and condition of the containers are recognized as safe to handle. (Level B protection applies)
4. Use PID or HNU and Radmeter for initial hazard identification of containers.

14.0 Hazards and SOPs Associated with Soil Sampling

Hazards

1. Contact with or inhalation of contaminants, potentially in high concentrations in sampling media.
2. Back strain and muscle fatigue due to lifting, shoveling and auguring techniques.
3. Contact with or inhalation of decontamination solutions.

SOPs

1. Proper awareness of chemical contaminants and review of suspected contaminates should be completed.
2. Proper lifting (pre-lift weight assessment, use of legs, multiple personnel) techniques will prevent back strain. Use slowly easy motions when shoveling, auguring, digging to decrease muscle strain.
3. Material Safety Data sheets for all decon solutions should be included with each site health and safety plan.

15.0 Hazards and SOPs Associated with use of as High Pressure Washer During Vat Cleaning

Hazards

1. Body parts being injured/severed due to high pressure water stream.
2. Slip/trip/fall associated with water overspray and hose.
3. Control of high pressure nozzle.
4. Vat handling to facilitate cleaning.
5. Exposure to contaminants.

SOPs

1. No hands, feet, arms or legs will be within three feet of high pressure nozzle.
2. Splash shields and rain protection should be worn over minimum level of protection.
3. Operators are to be constantly aware of other personnel/equipment in the area.
4. Personnel will not hold or be near vats while cleaning with high pressure washer is ongoing. If necessary, vats will be maneuvered with heavy equipment.

16.0 Hazards and SOPs Associated with Compressed Gas Cylinders

Hazards

1. Sudden release of dangerous gases from unknown cylinders.
2. Slip / trip / fall from hidden or obstructed cylinders.
3. Possible sudden explosion from ruptured valves.

SOPs

1. To the extent possible, initial activities on site will involve locating and clearly marking the location of all unknown cylinders on site.
2. Equipment operators will be assisted by ground spotters when segregating drums and debris and during soil excavation activities.
3. When a damaged or corroded cylinder is found, it should not be moved or handled and extreme caution should be excised in staying clear of the valve stem.
4. All identified cylinders will be examined and evaluated by an experienced and qualified person prior to moving any cylinders.
5. If a cylinder leaks or ruptures, all personnel will evacuate the area.

17.0 Hazards and SOPs Associated with Empty Drum Crushing

Hazards

1. General hazards associated with heavy equipment operations.
2. Slip / trip / fall hazards.
3. Physical contact from splashing of any residual material that remains in drums.
4. Physical contact from flying metal pieces.

SOPs

1. Wear hard hats, face shields, safety goggles, and steel toed work boots at all times.
2. All personnel not necessary for the operation of equipment should stay clear of drum crushing activities.
3. Equipment operators are to be constantly aware of all other personnel/equipment in the area during operation.

5/01

Appendix G: Heat / Cold Stress Protocols

CONTRACTOR
HEAT / COLD STRESS PROTOCOLS FOR WORK

1.0 Heart rate (HR) should be monitored by the radial pulse for 30 seconds as soon as possible in the resting period.

1.1 If at the beginning of the rest period a worker's radial pulse is measured and his heart rate exceeds 100 beats per beats per minute, the worker's next work period should be reduced by 33%. Therefore, if the original work period was one hour, the following work cycle should be reduced to 40 minutes.

2.0 Heat stroke is a true medical emergency. First aid should be directed toward immediate measures to cool the body quickly, as well as seeing that the victim receives medical attention as soon as possible.

2.1 Prior to medical treatment, remove as much clothing as possible and proceed to cool the victim's body, taking care not to overchill the victim once his temperature falls below 102 ^{o}F. One of the following cooling measures should be taken:

a. sponge the bare skin with cool water;
b. apply cold packs continuously;
c. wrap the victim in a sheet soaked with water; or
d. immerse the victim in a tub of cold water, while closely monitoring the victim's level of consciousness.

3.0 Prior to site activity, the field team leader may make arrangements for heat stress monitoring (i.e., monitoring heart rate, body temperature and body water loss) during actual site work if conditions warrant these measures. In addition, he would want to ensure that the team members have been acclimatized to the particular environmental conditions and that personnel are aware of the signs and symptoms of heat sickness and have been adequately trained in first aid procedures. As field team leader, one could also make sure there is sufficient personnel on-site, so as to rotate work assignments. Schedule work during hours of reduced temperatures, and ensure work during hours of reduced temperatures, and ensure personnel do not consume alcoholic or caffeinated beverages but rather drink moderate levels of an electrolyte solution and eat well prior to commencing site work.

4.0 The worker could be experiencing a condition of heat rash. Allow workers to rest and relieve the itching associated with heat rash rather than return to work too soon. Itching workers may not follow stringent decontamination procedure or scratch where it itches on-site and risk cross contamination.

5.0 The sense of thirst is not an adequate regulator of water replacement during heat exposure. Therefore, as a general rule, the amount of water administrated should replace the amount of water lost, and it should be administered at regular intervals throughout the day. For every 1/2 pound of water loss, 8 ounces of water should be ingested. Water should be replaced by drinking 2-4 ounce servings during every rest period. A recommended alternative to water is an electrolyte drink split 50/50 with water.

6.0 Although there is no specific test given during a baseline physical that would identify a person's intolerance to heat, there are physical factors and personal habits which may indicate possible intolerance to heat, such as, whether or not an individual smokes, one's dietary habit, body weight, as well as predisposed physical conditions such as high blood pressure, heavier conditions, diabetes, or one's medication, that may influence an individual's ability to tolerate excessive heat.

7.0 Heat cramps are caused by profuse perspiration with inadequate fluid intake and salt replacement. Heat cramps most often afflict people in good physical condition who overwork in conditions of high temperature and humidity. Heat cramps usually come on suddenly during vigorous activity. Untreated, heat cramps may progress directly to heat exhaustion or heat strokes. First aid treatment: remove victim to a cool place and give sips of slated water (1 teaspoon of salt to 1 quart of water), 4 ounces every 15 minutes over a period of one hour. A commercial preparation, e.g., Gatorade may be used if split 50/50 with water.

7.1 The salted water or solution should mitigate the cramps. Manual pressure should not be applied to the cramped muscles.

TABLE C-1

Required Frequency of Heat Stress Monitoring for Workers in Impermeable Clothing

Adjusted Temperature °F	Work time allowed before monitoring break (minutes)
90 or above	15
87.5-90	30
82.5-87.5	60
77.5-82.5	90
72.5-77.5	120

(1) Adapted from Eastern Research Group and National Institute for Occupational Safety and Health, Occupational Safety and Health Manual for Super Activities. September 26, 1984, pp. 8-75

(2) Calculate the adjusted air temperature (Ta adj.) by using this equation:

Ta adj. F = Ta F + (13 x % sunshine)

Measure air temperature (Ta) with a standard thermometer, with the bulb shielded from radiant heat. Then estimate percent sunshine (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows).

TABLE C-2

Heat Stress Indicator	When to Measure	If Exceeds	Action
heart rate	beginning of rest period	110 beats per minute	shorten next work period by 33%
oral temperature	beginning of rest period	99 °F (After thermometer is under tongue for 3 minutes) 110.6 °F	shorten next work period by 33% prohibit work in impermeable clothing
body weight	1. Before workday begins (a.m.) 2. After workday ends (p.m.)		increase fluid intake

8.0 SYMPTOMS OF HEAT STRESS

8.1 Heat Rash results from continuous exposure to heat or humid air.

8.2 Heat Cramps are caused by heavy sweating with inadequate fluid intake. Symptoms include:

- Muscle spasms.
- Pains in the hands, feet and abdomen.

8.3 Heat Exhaustion occurs when body organs attempt to keep the body cool. Symptoms include:

- pale, cool, moist skin.
- heavy sweating
- dizziness

8.4 Heat Stroke is the most serious form of heat stress. Immediate action must be taken to cool the body before serious injury and death occur. Symptoms include:

- red, hot, dry skin.
- lack of perspiration.
- nausea
- dizziness and confusion
- strong, rapid pulse.
- coma

(Reproduced from Occupational Safety and Health Guidance Manual for Superfund Activities, p. 8-79)

9.0 COLD STRESS (Hypothermia)

Cold stress is a function of cold, wetness and wind. A worker's susceptibility to cold stress can vary according to his / her physical fitness, degree of acclimatization to cold weather, age, and diet.

Prevention: Institute the following steps to prevent overexposure of workers to cold:

9.1 Maintain body core temperature at 96.8 °F or above by encouraging workers to drink warm liquids during breaks (preferably not coffee) and wear several layers of clothing. Wool is recommended since it can keep the body warm even when the wool is wet.

9.2 Avoid frostbite by adequately covering hands, feet, and other extremities. Clothing such as insulated gloves or mittens, earmuffs, and hat liners should be worn. To prevent contact frostbite (from touching metal and cold surfaces below 20 °F), workers should wear anti-contact gloves. Tool handles and control bars should be covered with insulating materials.

9.3 Adjust work schedules if necessary, providing adequate rest periods. When feasible, rotate personnel and perform work during the warmer hours of the day.

9.4 Provide a heated enclosure for workers close to their work area. Workers should remove their outer layer(s) of clothing while in the shelter to allow for sweat evaporation.

9.5 In the event that wind barriers are constructed around an intrusive operation (such as drilling), the enclosure must be properly vented to prevent the build-up of toxic or explosive gasses or vapors. Care must be taken to keep any heat source away from flammable substances.

9.6 Using a wind chill such as the one in Table-3, obtain the equivalent chill temperature (ECT) based on actual wind speed and temperature. Refer to the ECT when setting up work warm-up schedules, planning appropriate clothing, etc. Workers should use warming shelters at regular intervals at or below an ECT of 20 °F. For exposed skin, continuous exposure should not be permitted at or below an ECT of -25 °F.

9.7 Workers who become immersed in water or whole clothing becomes wet (from perspiration, rain, etc.) must immediately be provided a change of dry clothing whenever the air temperature is 25.6 °F or below.

9.8 Maintain an optimal level of worker fitness by encouraging regular exercise, proper diet, etc. If possible, acclimatize workers to site conditions for several days before work begins.

10.0 MONITORING

Personnel should be aware of the symptoms of cold stress. If the following symptoms of systemic hypothermia are noticed in any worker, he/she should immediately go to the warm shelter:

* Heavy, uncontrollable shivering
* Excessive fatigue or drowsiness
* Loss of coordination
* Difficulty in speaking, and
* Frostbite (see below)

Frostbite is the generic term for local injury resulting from cold. The stages of frostbite and their symptoms are as follows:

a. Frostbite or incipient frostbite is the sudden blanching or whitening of the skin.
b. Superficial frostbite is the waxy or white skin which is firm to the touch (tissue underneath is still resilient)
c. Deep frostbite is the tissues are cold, pale and solid

Appendix H: Accident Report Form

CONTRACTOR ACCIDENT REPORT

INJURED PERSON:______________________________REPORT DATE:__________

SOCIAL SECURITY NO.:____

DOCTOR / HOSPITAL NAME:____

____

____

HOME ADDRESS:____

OCCUPATION:_______________________________AGE:__________SEX:________

ADDRESS ACCIDENT OCCURRED: TIME OF ACCIDENT_________AM PM

____

____

____

DATE STOPPED WORK BECAUSE OF THIS INJURY:________________________

NATURE OF INJURY & PART(S) OF BODY AFFECTED:______________________

____

____

____

DID YOU PROVIDE MEDICAL CARE? IF YES, WHEN ? _____________________

____

HAS EMPLOYEE RETURNED TO WORK YES NO

IF YES, DATE:____

WHAT WAS EMPLOYEE DOING WHEN INJURED ?
(PLEASE BE SPECIFIC. IDENTIFY TOOLS, EQUIPMENT OR MATERIAL THE EMPLOYEE WAS USING)

____

____

____

____

HOW DID THE ACCIDENT OR EXPOSURE OCCUR ?
(PLEASE DESCRIBE FULLY THE EVENTS THAT RESULTED IN INJURY. TELL WHAT HAPPENED AND HOW IT HAPPENED.)
PLEASE USE SEPARATE SHEET IF NECESSARY

____

____

____

____

____

____

OBJECT OR SUBSTANCE THAT DIRECTLY INJURED EMPLOYEE:____________

____

____

____

____

DATE SUPERVISOR FIRST KNEW OF INJURY:______________________________

SUPERVISOR SIGNATURE:____

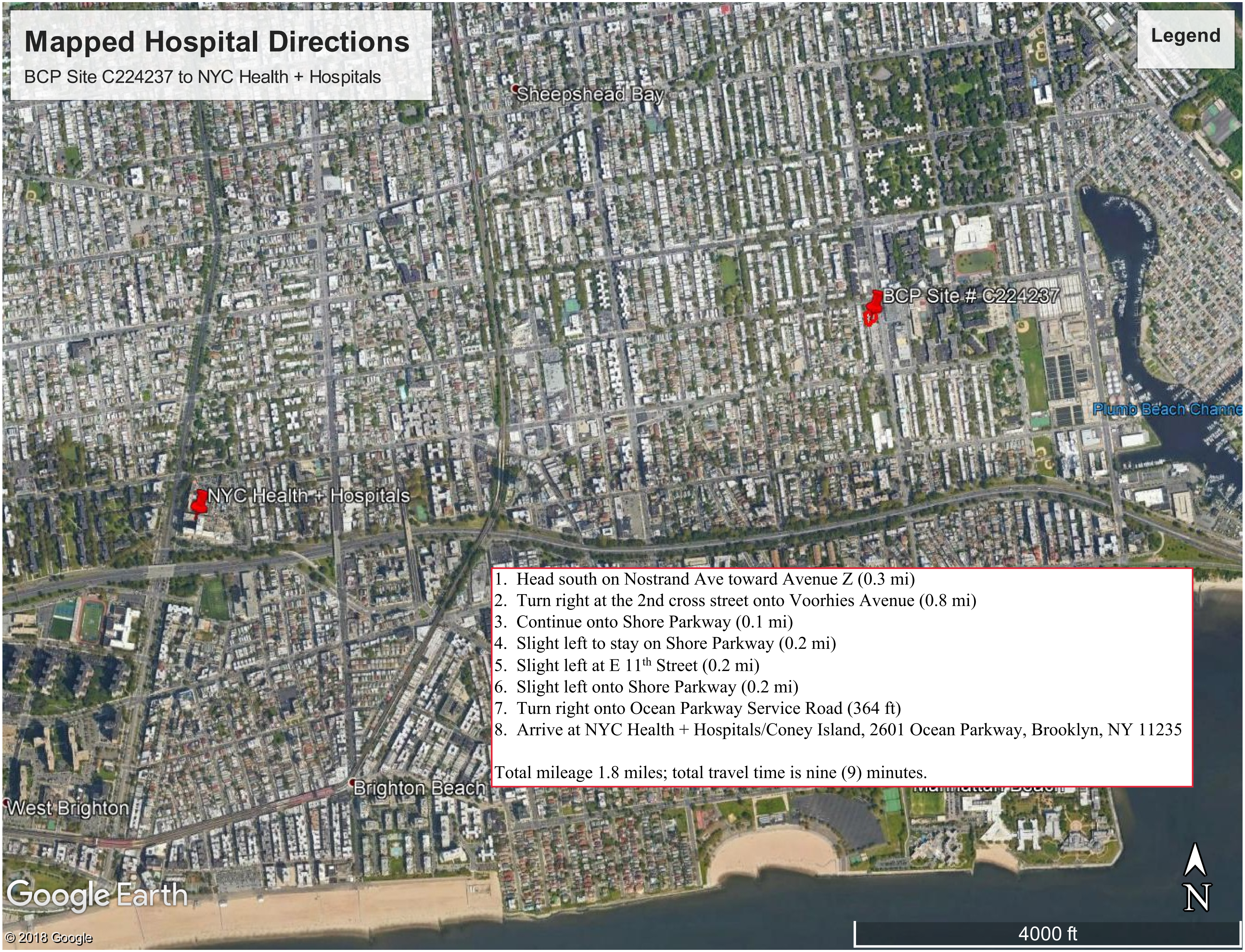
TITLE:____

ACC-95

Appendix I: Mapped Hospital Directions

Mapped Hospital Directions

BCP Site C224237 to NYC Health + Hospitals



1. Head south on Nostrand Ave toward Avenue Z (0.3 mi)
2. Turn right at the 2nd cross street onto Voorhies Avenue (0.8 mi)
3. Continue onto Shore Parkway (0.1 mi)
4. Slight left to stay on Shore Parkway (0.2 mi)
5. Slight left at E 11th Street (0.2 mi)
6. Slight left onto Shore Parkway (0.2 mi)
7. Turn right onto Ocean Parkway Service Road (364 ft)
8. Arrive at NYC Health + Hospitals/Coney Island, 2601 Ocean Parkway, Brooklyn, NY 11235

Total mileage 1.8 miles; total travel time is nine (9) minutes.

Appendix J: Data Sheets for Contaminants of Concern

Agency for Toxic Substances & Disease Registry

Gasoline, Automotive: ToxFAQs™

ToxFAQs™ for Automotive Gasoline

(Gasolina de Automóvil)

September 1996
CAS# 8006-61-9

This fact sheet answers the most frequently asked health questions about automotive gasoline. For more information, you may call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to automotive gasoline most likely occurs from breathing its vapor at a service station while filling a car's fuel tank. At high levels, automotive gasoline is irritating to the lungs when breathed in and irritating to the lining of the stomach when swallowed. Exposure to high levels may also cause harmful effects to the nervous system. Automotive gasoline has been found in at least 23 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

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What is automotive gasoline?

The gasoline discussed in this fact sheet is automotive used as a fuel for engines in cars. Gasoline is a colorless, pale brown, or pink liquid, and is very flammable.

Gasoline is a manufactured mixture that does not exist naturally in the environment. Gasoline is produced from petroleum in the refining process.

Typically, gasoline contains more than 150 chemicals, including small amounts of benzene, toluene, automotive gasolineylene, and sometimes lead. How the gasoline is made determines which chemicals are present in the gasoline mixture and how much of each is present. The actual composition varies with the source of the crude petroleum, the manufacturer, and the time of year.

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What happens to automotive gasoline when it enters the environment?

- Small amounts of the chemicals present in gasoline evaporate into the air when you fill the gas tank in your car or when gasoline is accidentally spilled onto surfaces and soils or into surface waters.
- Other chemicals in gasoline dissolve in water after spills to surface waters or underground storage tank leaks into the groundwater.
- In surface releases, most chemicals in gasoline will probably evaporate; others may dissolve and be carried away by water; a few will probably stick to soil.
- The chemicals that evaporate are broken down by sunlight and other chemicals in the air.
- The chemicals that dissolve in water also break down quickly by natural processes.

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How might I be exposed to automotive gasoline?

- Breathing vapors at a service station when filling the car's fuel tank is the most likely way to be exposed.
- Working at a service station.
- Using equipment that runs on gasoline, such as a lawn mower.
- Drinking contaminated water.
- Being close to a spot where gasoline has spilled or leaked into the soil.

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How can automotive gasoline affect my health?

Many of the harmful effects seen after exposure to gasoline are due to the individual chemicals in the gasoline mixture, such as benzene and lead. Inhaling or swallowing large amounts of gasoline can cause death.

Inhaling high concentrations of gasoline is irritating to the lungs when breathed in and irritating to the lining of the stomach when swallowed. Gasoline is also a skin irritant. Breathing in high levels of gasoline for short periods or swallowing large amounts of gasoline may also cause harmful effects on the nervous system.

Serious nervous system effects include coma and the inability to breathe, while less serious effects include dizziness and headaches.

There is not enough information available to determine if gasoline causes birth defects or affects reproduction.

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How likely is automotive gasoline to cause cancer?

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have not classified automotive gasoline for carcinogenicity. Automotive gasoline is currently undergoing review by the EPA for cancer classification.

Some laboratory animals that breathed high concentrations of unleaded gasoline vapors continuously for 2 years developed liver and kidney tumors. However, there is no evidence that exposure to gasoline causes cancer in humans.

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Is there a medical test to show whether I've been exposed to automotive gasoline?

Laboratory tests are available that can measure elevated blood or urine levels of lead (as an indication of exposure to leaded gasoline only), benzene, or other substances that may result from exposure to gasoline or other sources. These methods are sensitive enough to measure background levels and levels where health effects may occur. These tests aren't available in most doctors' offices, but can be done at special laboratories that have the right equipment.

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Has the federal government made recommendations to protect human health?

The EPA has established many regulations to control air pollution. These are designed to protect the public from the possible harmful health effects of gasoline.

The American Conference of Governmental Industrial Hygienists (ACGIH) set a maximum level of 890 milligrams of gasoline per cubic meter of air (890 mg/mÂ³) for an 8-hour workday, 40-hour workweek.

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Glossary

Carcinogenicity: Ability to cause cancer.

CAS: Chemical Abstracts Service.

Crude petroleum: Petroleum that has not been processed.

Dissolve: To disappear gradually.

Evaporate: To change into a vapor or a gas.

Irritant: A substance that causes an abnormal reaction.

Mixture: A combination of two or more components.

Refining process: The process by which petroleum is purified to form gasoline.

Tumor: An abnormal mass of tissue.

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References

Agency for Toxic Substances and Disease Registry (ATSDR). 1996. Managing Hazardous Materials Incidents. Volume III – Medical Management Guidelines for Acute Chemical Exposures: Automotive Gasoline. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological Profile for automotive gasoline. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

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Where can I get more information?

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

For more information, contact:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE, Mailstop F-32
Atlanta, GA 30333
Phone: 1-888-42-ATSDR (1-888-422-8737)
FAX: (770)-488-4178
Email: ATSDRIC@cdc.gov

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ATSDR Agency for Toxic Substances & Disease Registry

Fuel Oils / Kerosene: ToxFAQs™

ToxFAQs™ for Fuel Oils

(Aceites Combustibles)

September 1996
CAS# 8008-20-6, 70892-10-3, 68476-30-2, 68476-34-6, 68476-31-3

This fact sheet answers the most frequently asked health questions about fuel oils. For more information, you may call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Fuel oils are liquid mixtures produced from petroleum, and their use mostly involves burning them as fuels. Drinking or breathing fuel oils may cause nausea or nervous system effects. However, exposure under normal use conditions is not likely to be harmful. Fuel oils have been found in at least 26 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

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What are fuel oils?

Fuel oils are a variety of yellowish to light brown liquid mixtures that come from crude petroleum. Some chemicals found in fuel oils may evaporate easily, while others may more easily dissolve in water.

Fuel oils are produced by different petroleum refining processes, depending on their intended uses. Fuel oils may be used as fuel for engines, lamps, heaters, furnaces, and stoves, or as solvents.

Some commonly found fuel oils include kerosene, diesel fuel, jet fuel, range oil, and home heating oil. These fuel oils differ from one another by their hydrocarbon compositions, boiling point ranges, chemical additives, and uses.

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What happens to fuel oils when they enter the environment?

- Some chemicals found in fuel oils may evaporate into the air from open containers or contaminated soil or water.
- Some chemicals found in fuel oils may dissolve in water after spills to surface waters or leaks from underground storage tanks.
- Some chemicals found in fuel oils may stick to particles in water, which will eventually cause them to settle to the bottom sediment.
- Some of the chemicals found in fuel oils may be broken down slowly in air, water, and soil by sunlight or small organisms.
- Some of the chemicals found in fuel oils may build up significantly in plants and animals.

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How might I be exposed to fuel oils?

- Using a home kerosene heater or stove, or using fuel oils at work.
- Breathing air in home or building basements that has been contaminated with fuel oil vapors entering from the soil.
- Drinking or swimming in water that has been contaminated with fuel oils from a spill or a leaking underground storage tank.
- Touching soil contaminated with fuel oils.
- Using fuel oils to wash paint or grease from skin or equipment.

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How can fuel oils affect my health?

Little information is available about the health effects that may be caused by fuel oils. People who use kerosene stoves for cooking do not seem to have any health problems related to their exposure.

Breathing some fuel oils for short periods may cause nausea, eye irritation, increased blood pressure, headache, light-headedness, loss of appetite, poor coordination, and difficulty concentrating. Breathing diesel fuel vapors for long periods may cause kidney damage and lower your blood's ability to clot.

Drinking small amounts of kerosene may cause vomiting, diarrhea, coughing, stomach swelling and cramps, drowsiness, restlessness, painful breathing, irritability, and unconsciousness. Drinking large amounts of kerosene may cause convulsions, coma, or death. Skin contact with kerosene for short periods may cause itchy, red, sore, or peeling skin.
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How likely are fuel oils to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that some fuel oils (heavy) may possibly cause cancer in humans, but for other fuel oils (light) there is not enough information to make a determination. IARC has also determined that occupational exposures to fuel oils during petroleum refining are probably carcinogenic in humans.

Some studies with mice have suggested that repeated contact with fuel oils may cause liver or skin cancer. However, other mouse studies have found this not to be the case. No studies are available in other animals or in people on the carcinogenic effects of fuel oils.
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Is there a medical test to show whether I've been exposed to fuel oils?

There is no medical test that shows if you have been exposed to fuel oils. Tests are available to determine if some of the chemicals commonly found in fuel oils are in your blood. However, the presence of these chemicals in blood may not necessarily mean that you have been exposed to fuel oils.
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Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) and the Air Force Office of Safety and Health (AFOSH) have set a permissible exposure level (PEL) of 400 parts of petroleum distillates per million parts of air (400 ppm) for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that average workplace air levels not exceed 350 milligrams of petroleum distillates per cubic meter of air (350 mg/mÂ³) for a 40-hour workweek.

The Department of Transportation (DOT) lists fuel oils as hazardous materials and, therefore, regulates their transportation.
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Glossary

Carcinogenic: Able to cause cancer.

CAS: Chemical Abstracts Service.

Evaporate: To change into a vapor or a gas.

Hydrocarbon: Any compound made up of hydrogen and carbon.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Sediment: Mud and debris that have settled to the bottom of a body of water.
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References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological Profile for fuel oils. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.
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Where can I get more information?

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

For more information, contact:

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Division of Toxicology
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Email: ATSDRIC@cdc.gov

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Volatile Organic Compounds (VOCs) in Commonly Used Products

People spend most of their time indoors – at home, school and work. This makes the quality of the indoor air you breathe important. This fact sheet focuses on certain kinds of chemicals called *volatile organic compounds* or *VOCs* that are found in many products that we commonly use. It is designed to help you think about what VOCs may be present in your indoor air and steps you can take to reduce them.

What are VOCs?

VOCs are chemicals that easily enter the air as gases from some solids or liquids. They are ingredients in many commonly used products and are in the air of just about every indoor setting. The table to the right shows some examples of products that contain VOCs.

How do VOCs get into indoor air?

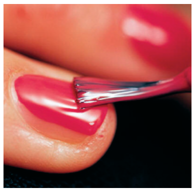
Products containing VOCs can release these chemicals when they are used and when they are stored. Many times you'll notice an odor when using these products. Product labels often list VOC ingredients and recommend that they should be used in well ventilated areas. *Ventilation* means bringing in fresh, outdoor air to mix with indoor air.

When you use a product containing VOCs indoors, the levels of these chemicals in the air increase, then decrease over time after you stop using them. The amount of time the chemical stays in the air depends on how quickly fresh air enters the room and the amount of the chemical used. Levels of VOCs will decrease faster if you open windows or doors, or use exhaust fans.

Building materials and furnishings, such as new carpets or furniture, slowly release VOCs over time. It may be necessary to ventilate areas with new carpeting or furniture for longer time periods because VOC levels can build up again after the windows are closed. If possible, unroll new carpets or store furniture outside your home (in a shed or detached garage) to minimize odors before bringing them in the home. If that's not possible, open windows, close doors and try to stay out of rooms until odors are reduced.

If VOC containing products are used outdoors near your home, you may want to close windows and nearby vents to prevent chemicals from coming inside.

Products used at home or work can release VOCs into the air when used and stored.



Examples of Household Products	Possible VOC Ingredients
Fuel containers or devices using gasoline, kerosene, fuel oil and products with petroleum distillates: paint thinner, oil-based stains and paint, aerosol or liquid insect pest products, mineral spirits, furniture polishes	BTEX (benzene, toluene, ethylbenzene, xylene), hexane, cyclohexane, 1,2,4-trimethylbenzene
Personal care products: nail polish, nail polish remover, colognes, perfumes, rubbing alcohol, hair spray	Acetone, ethyl alcohol, isopropyl alcohol, methacrylates (methyl or ethyl), ethyl acetate
Dry cleaned clothes, spot removers, fabric/ leather cleaners	Tetrachloroethene (perchloroethene (PERC), trichloroethene (TCE))
Citrus (orange) oil or pine oil cleaners, solvents and some odor masking products	d-limonene (citrus odor), a-pinene (pine odor), isoprene
PVC cement and primer, various adhesives, contact cement, model cement	Tetrahydrofuran, cyclohexane, methyl ethyl ketone (MEK), toluene, acetone, hexane, 1,1,1-trichloroethane, methyl-iso-butyl ketone (MIBK)
Paint stripper, adhesive (glue) removers	Methylene chloride, toluene, older products may contain carbon tetrachloride
Degreasers, aerosol penetrating oils, brake cleaner, carburetor cleaner, commercial solvents, electronics cleaners, spray lubricants	Methylene chloride, PERC, TCE, toluene, xylenes, methyl ethyl ketone, 1,1,1-trichloroethane
Moth balls, moth flakes, deodorizers, air fresheners	1,4-dichlorobenzene, naphthalene
Refrigerant from air conditioners, freezers, refrigerators, dehumidifiers	Freons (trichlorofluoromethane, dichlorodifluoromethane)
Aerosol spray products for some paints, cosmetics, automotive products, leather treatments, pesticides	Heptane, butane, pentane
Upholstered furniture, carpets, plywood, pressed wood products	Formaldehyde

VOCs can also get into indoor air from contaminated soils and groundwater under buildings. The chemicals enter buildings through cracks and openings in basements or slabs. When nearby soil or groundwater is contaminated, you might be asked for permission to investigate indoor air at your property. More information can be found at *www.nyhealth.gov/environmental/indoors/vapor_intrusion/*.

Should I be surprised if VOCs are in the air I breathe?

No. Because they are commonly used, some VOCs are almost always found in indoor air. The New York State Department of Health (DOH) and other agencies have studied typical levels of VOCs that may be present in indoor and outdoor air. Sometimes these levels are called *"background levels"*.

The term "background levels" can be confusing because they can vary depending on where an air sample was collected and whether VOCs were used or stored. For example, a study of VOCs in urban areas might find higher levels than another study in rural areas. Some studies look at office environments, others examine residences. Please keep in mind study findings may or may not make sense for your setting.

More information about levels of VOCs collected by DOH is available in Appendix C of the guidance for evaluating vapor intrusion at *www.nyhealth.gov/environmental/investigations/soil_gas/svi_guidance*.

How can VOCs affect human health?

Chemicals can enter the body through three major pathways (breathing, touching or swallowing). This is referred to as *exposure*. No matter how dangerous a substance or activity is, it cannot harm you without exposure.

Whether or not a person will have health effects after breathing in VOCs depends on:

1. The *toxicity* of the chemical (the amount of harm that can be caused by contact with the chemical).
2. How much of the chemical is in the air.
3. How long and how often the air is breathed.

Differences in age, health condition, gender and exposure to other chemicals also can affect whether or not a person will have health effects.

Short-term exposure to high levels of some VOCs can cause headaches, dizziness, light-headedness, drowsiness, nausea, and eye and respiratory irritation. These effects usually go away after the exposure stops. In laboratory animals, long-term exposure to high levels of some VOCs has caused cancer and affected the liver, kidney and nervous system. In general, we recommend minimizing exposure to chemicals, if possible.

How can I reduce the levels of VOCs indoors?

- Find out if products used or stored in your home contain VOCs. Information about the chemicals in many household products are listed on the front of this fact sheet and a larger list is on the National Institute of Health's website at *hpd.nlm.nih.gov/products.htm*.
- If you must store products containing VOCs, do so in tightly sealed, original containers in a secure and well-ventilated area. If possible store products in places where people do not spend much time, such as a garage or outdoor shed. Better yet, buy these products in amounts that are used quickly.
- Dispose of unneeded products containing VOCs. Many of these products are considered *household hazardous wastes* and should be disposed of at special facilities or during special household hazardous waste collection programs in your area. Contact your town or visit the New York State Department of Environmental Conservation's website at *www.dec.ny.gov/chemical/8485.html* for more information about disposing of these products.
- Use products containing VOCs in well-ventilated areas or outdoors. Open windows and doors or use an exhaust fan to increase ventilation. Repeated or prolonged ventilation may be necessary for reducing levels from building materials (new carpeting or furniture) that release VOCs slowly over time.
- Carefully read labels and follow directions for use.

Where can I find out more?

- **New York State Department of Health**
  (800) 458-1158
  www.nyhealth.gov/environmental/
- **Indoor Air Quality and Your Home** from the New York State Energy Research and Development Authority *www.nyserda.org/publications/iaq.pdf*
- **The Inside Story: A Guide to Indoor Air Quality**
  www.epa.gov/iaq/pubs/insidest.html
- **New York State Department of Environmental Conservation** website for information about household hazardous waste disposal
  www.dec.ny.gov/chemical/8485.html
- **National Institute of Health's** website for information about chemicals found in many household products.
  hpd.nlm.nih.gov/products.htm

DOH

December 2007

Volatile Organic Compounds
Health Effects Fact Sheet
November 2000

Colorado Department
of Public Health
and Environment

What Are Volatile Organic Compounds (VOCs)?

- Volatile Organic Compounds (VOCs) area a group of chemicals that contain organic carbon, and readily evaporate – changing from liquids to gases when exposed to air. Volatile Organic Compounds are usually in such solvents as paint wastes, dry cleaning chemicals, furniture stripper, carburetor cleaners and other solvents and waste sludges.
- Volatile Organic Compound Contamination in the environment is mainly the result of the historic disposal practices of industrial wastes containing these solvents. Many of them have been considered *hazardous materials* since the early 1970s, when the first environmental laws were enacted. Landfills, in particular, complied with these laws by adjusting their criteria for acceptance of appropriate landfill material, and excluded most industrial waste containing solvents.
- If used for drinking, cooking, bathing, or irrigation at relatively low concentrations, there is a possibility of exposure to Volatile Organic Compounds by: ingestion (if it is swallowed flowing from a garden hose, for example); respiration; or absorption through the skin. The amount of exposure is related to the concentration in water, and other factors.
- Volatile Organic Compounds generally do not stick (adsorb) to soils at low concentrations, and readily evaporate from water and soil when the water is used for irrigation purposes.

How are Human Health effects of Volatile Organic Compounds Determined?

The potential for human health effect is related to dose and exposure pathway. That is, the amount of the chemical taken into the body over time. Dose is estimated, based on the concentration of the chemical in the water. Human health effects are also related to routes of exposure, or exposure pathways. The three primary routes of exposure for humans are:

- Ingestion (swallowing),
- Respiration (lungs), and
- Dermal absorption (through the skin).

If the exposure pathway is incomplete---no human contact—there will be no exposure.

For most common chemicals, the U.S. Environmental Protection Agency (EPA) establishes standards (or acceptable levels) for drinking water that are called “Maximum Contaminant Levels” (or MCLs). These Levels are based on available health effects data, and other factors (technology, for example), for each chemical, and are designed to protect municipal drinking water supplies, and ensure public safety.

Although Maximum Contaminant Levels are not used to regulate privately owned wells, the available standards are commonly used to evaluate the quality of water in them. Colorado Ground Water Standards set limits for concentrations of various chemicals in water supplies not known to be slated for domestic use. These standards currently are comparable to the Maximum Contaminant Levels. Drinking water standards are set to protect against the possibility of health effects from these chemicals. As long as the chemical concentration in water used for in-home purposes remains below drinking water standards, health effects are unlikely to occur.

What are the Human Health Effects Associated with Volatile Organic Compounds?

Many Volatile Organic Compounds may produce health effects if humans are exposed to high enough concentrations. Most available toxicity information is based on animal testing. These results are the basis for determining human health effects, and serve as the basis for setting drinking water and air quality standards.

In general, long-term exposure to low concentrations of Volatile Organic Compounds in water or air, at or above regulatory standards—such as Maximum Contaminant Levels, may result in liver or kidney effects. These effects may include elevation of serum enzyme levels, mild cellular changes and changes in lipid metabolism. At somewhat higher concentrations, breathing some of these contaminants may cause irritation of the respiratory tract. The reproductive and developmental effects of these contaminants have been poorly studied.

Chloroform, trichloroethylene (TCE), dichloroethylene (DCE), and perchloroethylene (PCE) have been evaluated for their carcinogenic potential. Although health scientists disagree whether these chemicals might produce cancer in humans, public health officials have taken a cautious approach and have set conservative standards accordingly.

ATSDR

AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

1,2-DICHLOROETHENE
CAS # 540-59-0, 156-59-2, and 156-60-5

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1997**

This fact sheet answers the most frequently asked health questions (FAQs) about 1,2-dichloroethene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to 1,2-dichloroethene occurs mainly in workplaces where it is made or used. Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired. *cis*-1,2-Dichloroethene has been found in at least 146 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA). *trans*-1,2-Dichloroethene was found in at least 563 NPL sites. 1,2-Dichloroethene was found at 336 sites, but the isomer (*cis*- or *tran*s-) was not specified.

What is 1,2-dichloroethene?
(Pronounced 1,2-dī-klôr′ ō-ĕth′ēn)

1,2-Dichloroethene, also called 1,2-dichloroethylene, is a highly flammable, colorless liquid with a sharp, harsh odor. It is used to produce solvents and in chemical mixtures. You can smell very small amounts of 1,2-dichloroethene in air (about 17 parts of 1,2-dichloroethene per million parts of air [17 ppm]).

There are two forms of 1,2-dichloroethene; one is called *cis*-1,2-dichloroethene and the other is called *trans*-1,2-dichloroethene. Sometimes both forms are present as a mixture.

What happens to 1,2-dichloroethene when it enters the environment?

- ☐ 1,2-Dichloroethene evaporates rapidly into air.
- ☐ In the air, it takes about 5-12 days for half of it to break down.
- ☐ Most 1,2-dichloroethene in the soil surface or bodies of water will evaporate into air.
- ☐ 1,2-Dichloroethene can travel through soil or dissolve in water in the soil. It is possible that it can contaminate groundwater.
- ☐ In groundwater, it takes about 13-48 weeks to break down.
- ☐ There is a slight chance that 1,2-dichloroethene will break down into vinyl chloride, a different chemical which is believed to be more toxic than 1,2-dichloroethene.

How might I be exposed to 1,2-dichloroethene?

- ☐ Breathing 1,2-dichloroethene that has leaked from hazardous waste sites and landfills.
- ☐ Drinking contaminated tap water or breathing vapors from contaminated water while cooking, bathing, or washing dishes.
- ☐ Breathing 1,2-dichloroethene, touching it, or touching contaminated materials in the workplace.

How can 1,2-dichloroethene affect my health?

Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired; breathing very high levels can kill you.

When animals breathed high levels of *trans*-1,2-dichloroethene for short or longer periods of time, their livers and lungs were damaged and the effects were more severe with longer exposure times. Animals that breathed very high levels of *trans*-1,2-dichloroethene had damaged hearts.

Animals that ingested extremely high doses of *cis*- or *trans*-1,2-dichloroethene died.

Lower doses of *cis*-1,2-dichloroethene caused effects on the blood, such as decreased numbers of red blood cells, and also effects on the liver.

The long-term (365 days or longer) human health effects after exposure to low concentrations of 1,2-dichloroethene aren't known. One animal study suggested that an exposed fetus may not grow as quickly as one that hasn't been exposed.

Exposure to 1,2-dichloroethene hasn't been shown to affect fertility in people or animals.

How likely is 1,2-dichloroethene to cause cancer?

The EPA has determined that *cis*-1,2-dichloroethene is not classifiable as to its human carcinogenicity.

No EPA cancer classification is available for *trans*-1,2-dichloroethene.

Is there a medical test to show whether I've been exposed to 1,2-dichloroethene?

Tests are available to measure concentrations of the breakdown products of 1,2-dichloroethene in blood, urine, and tissues. However, these tests aren't used routinely to determine whether a person has been exposed to this compound. This is because after you are exposed to 1,2-dichloroethene, the breakdown products in your body that are detected with these tests may be the same as those that come from exposure to other chemicals. These tests aren't available in most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum allowable level of *cis*-1,2-dichloroethene in drinking water at 0.07 milligrams per liter of water (0.07 mg/L) and *trans*-1,2-dichloroethene at 0.1 mg/L.

The EPA requires that any spills or accidental release of 1,000 pounds or more of 1,2-dichloroethene must be reported to the EPA.

The Occupational Health Safety and Health Administration (OSHA) has set the maximum allowable amount of 1,2-dichloroethene in workroom air during an 8-hour workday in a 40-hour workweek at 200 parts of 1,2-dichloroethene per million parts of air (200 ppm).

Glossary

Carcinogenicity: Ability of a substance to cause cancer.
CAS: Chemical Abstracts Service.
Fertility: Ability to reproduce.
Ingest: To eat or drink something.
Milligram (mg): One thousandth of a gram.
ppm: Parts per million.
Solvent: A chemical that can dissolve other substances.

References

This ToxFAQs information is taken from the 1996 Toxicological Profile for 1,2-Dichloroethene produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Tetrachloroethylene - ToxFAQs™

CAS # 127-18-4

This fact sheet answers the most frequently asked health questions (FAQs) about tetrachloroethylene. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Tetrachloroethylene is a manufactured chemical used for dry cleaning and metal degreasing. Exposure to very high concentrations of tetrachloroethylene can cause dizziness headaches, sleepiness, incoordination confusion, nausea, unconsciousness, and even death. Tetrachloroethylene has been found in at least 945 of the 1,699 National Priorities List sites identified by U.S. Environmental Protection Agency (EPA).

What is tetrachloroethylene?

Tetrachloroethylene is a nonflammable colorless liquid. Other names for tetrachloroethylene include perchloroethylene, PCE, perc, tetrachloroethene, and perchlor. Most people can smell tetrachloroethylene when it is present in the air at a level of 1 part in 1 million parts of air (1 ppm) or more.

Tetrachloroethylene is used as a dry cleaning agent and metal degreasing solvent. It is also used as a starting material (building block) for making other chemicals and is used in some consumer products.

What happens to tetrachloroethylene when it enters the environment?

- Tetrachloroethylene can be released into air, water, and soil at places where it is produced or used.
- Tetrachloroethylene breaks down very slowly in the air and so it can be transported long distances in the air. Half of the amount in the air will degrade in approximately 100 days.
- Tetrachloroethylene evaporates quickly from water into air. It is generally slow to break down in water.
- Tetrachloroethylene may evaporate quickly from shallow soils or may filter through the soil and into the groundwater below. It is generally slow to break down in soil.

How might I be exposed to tetrachloroethylene?

- When you bring clothes from the dry cleaners, they will release small amounts of tetrachloroethylene into the air.
- When you drink water containing tetrachloroethylene, you are exposed to it. You might also be exposed to tetrachloroethylene that is released into the air during showering and bathing.
- People residing near contaminated sites or dry cleaning locations may be exposed to higher levels than the general population.
- People working in the dry cleaning industries or using metal degreasing products may be exposed to elevated levels of tetrachloroethylene.

How can tetrachloroethylene affect my health?

Breathing high levels of tetrachloroethylene for a brief period may cause dizziness or drowsiness, headache, and incoordination; higher levels may cause unconsciousness and even death.

Exposure for longer periods to low levels of tetrachloroethylene may cause changes in mood, memory, attention, reaction time, and vision.

Studies in animals exposed to tetrachloroethylene have shown liver and kidney effects, and changes in brain chemistry, but we do not know what these findings mean for humans.

How likely is tetrachloroethylene to cause cancer?

Studies in humans suggest that exposure to tetrachloroethylene might lead to a higher risk of getting bladder cancer, multiple myeloma, or non-Hodgkin's lymphoma, but the evidence is not very strong.

In animals, tetrachloroethylene has been shown to cause cancers of the liver, kidney, and blood system.

EPA considers tetrachloroethylene likely to be carcinogenic to humans by all routes of exposure. The International Agency for Research on Cancer (IARC) considers tetrachloroethylene probably carcinogenic to humans. The Department of Health and Human Services (DHHS) considers tetrachloroethylene to be reasonable anticipated to be a human carcinogen.

How can tetrachloroethylene affect children?

It is not known whether children are more susceptible than adults to the effects of tetrachloroethylene.

A few studies in humans have suggested that exposure to tetrachloroethylene increased the numbers of babies with birth defects, but these studies were not large enough to clearly answer the question. Studies in animals exposed by inhalation or stomach tube have not shown clear evidence of specific birth defects.

How can families reduce the risks of exposure to tetrachloroethylene?

- Tetrachloroethylene has been found in low levels in some food. You can minimize the risk of your family's exposure by peeling and thoroughly washing fruits and vegetables before cooking.
- Use bottled water if you have concerns about the presence of tetrachloroethylene in your tap water. You may also contact local drinking water authorities and follow their advice.
- Prevent children from playing in dirt or eating dirt if you live near a waste site that has tetrachloroethylene.
- Tetrachloroethylene is widely used as a scouring solvent that removes oils from fabrics, as a carrier solvent, as a fabric finish or water repellant, and as a metal degreaser/cleaner. Follow instructions on product labels to minimize exposure to tetrachloroethylene.

Is there a medical test to show whether I've been exposed to tetrachloroethylene?

Tetrachloroethylene and its breakdown products (metabolites) can be measured in blood and urine. However, the detection of tetrachloroethylene or its metabolites cannot predict the kind of health effects that might develop from that exposure. Because tetrachloroethylene and its metabolites leave the body fairly rapidly, the tests need to be conducted within days after exposure.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set an 8-hour time weighted average permissible exposure limit of 100 ppm, an acceptable ceiling exposure limit of 200 ppm, and a maximum peak of 300 ppm (not to be exceeded for more than 5 minutes of any 3-hour period).

The National Institute for Occupational Safety and Health (NIOSH) recommends that workplace exposure to tetrachloroethylene be minimized due to concerns about its carcinogenicity.

References

This ToxFAQs™ information is taken from the 2014 Toxicological Profile for Tetrachloroethylene (Draft for Public Comment) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services in Atlanta, GA

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636, FAX: 770-488-4178.

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Trichloroethylene - ToxFAQs™

CAS # 79-01-6

This fact sheet answers the most frequently asked health questions (FAQs) about trichloroethylene. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Trichloroethylene is used as a solvent for cleaning metal parts. Exposure to very high concentrations of trichloroethylene can cause dizziness, headaches, sleepiness, incoordination, confusion, nausea, unconsciousness, and even death. The Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC) classify trichloroethylene as a human carcinogen. Trichloroethylene has been found in at least 1,045 of the 1,699 National Priorities List sites identified by the EPA.

What is trichloroethylene?

Trichloroethylene is a colorless, volatile liquid. Liquid trichloroethylene evaporates quickly into the air. It is nonflammable and has a sweet odor.

The two major uses of trichloroethylene are as a solvent to remove grease from metal parts and as a chemical that is used to make other chemicals, especially the refrigerant, HFC-134a. Trichloroethylene was once used as an anesthetic for surgery.

What happens to trichloroethylene when it enters the environment?

- Trichloroethylene can be released to air, water, and soil at places where it is produced or used.
- Trichloroethylene is broken down quickly in air.
- Trichloroethylene breaks down very slowly in soil and water and is removed mostly through evaporation to air.
- It is expected to remain in groundwater for long time since it is not able to evaporate.
- Trichloroethylene does not build up significantly in plants or animals.

How might I be exposed to trichloroethylene?

- Breathing trichloroethylene in contaminated air.
- Drinking contaminated water.
- Workers at facilities using this substance for metal degreasing are exposed to higher levels of trichloroethylene.
- If you live near such a facility or near a hazardous waste site containing trichloroethylene, you may also have higher exposure to this substance.

How can trichloroethylene affect my health?

Exposure to moderate amounts of trichloroethylene may cause headaches, dizziness, and sleepiness; large amounts may cause coma and even death. Eating or breathing high levels of trichloroethylene may damage some of the nerves in the face. Exposure to high levels can also result in changes in the rhythm of the heartbeat, liver damage, and evidence of kidney damage. Skin contact with concentrated solutions of trichloroethylene can cause skin rashes.

There is some evidence exposure to trichloroethylene in the work place may cause scleroderma (a systemic autoimmune disease) in some people. Some men occupationally-exposed to trichloroethylene and other chemicals showed decreases in sex drive, sperm quality, and reproductive hormone levels.

How likely is trichloroethylene to cause cancer?

There is strong evidence that trichloroethylene can cause kidney cancer in people and some evidence for trichloroethylene-induced liver cancer and malignant lymphoma. Lifetime exposure to trichloroethylene resulted in increased liver cancer in mice and increased kidney cancer and testicular cancer in rats.

The National Toxicology Program (NTP) has determined that trichloroethylene is a "known human carcinogen". The EPA and the International Agency for Research on Cancer (IARC) have determined that trichloroethylene is "carcinogenic to humans."

Trichloroethylene

CAS # 79-01-6

How can trichloroethylene affect children?

It is not known whether children are more susceptible than adults to the effects of trichloroethylene.

Some human studies indicate that trichloroethylene may cause developmental effects such as spontaneous abortion, congenital heart defects, central nervous system defects, and small birth weight. However, these people were exposed to other chemicals as well.

In some animal studies, exposure to trichloroethylene during development caused decreases in body weight, increases in heart defects, changes to the developing nervous system, and effects on the immune system.

How can families reduce the risk of exposure to trichloroethylene?

- Avoid drinking water from sources that are known to be contaminated with trichloroethylene. Use bottled water if you have concerns about the presence of chemicals in your tap water. You may also contact local drinking water authorities and follow their advice.
- Discourage your children from putting objects in their mouths. Make sure that they wash their hands frequently and before eating.
- Prevent children from playing in dirt or eating dirt if you live near a waste site that has trichloroethylene.
- Trichloroethylene is used in many industrial products. Follow instructions on product labels to minimize exposure to trichloroethylene.

Is there a medical test to show whether I've been exposed to trichloroethylene?

Trichloroethylene and its breakdown products (metabolites) can be measured in blood and urine. However, the detection of trichloroethylene or its metabolites cannot predict the kind of health effects that might develop from that exposure. Because trichloroethylene and its metabolites leave the body fairly rapidly, the tests need to be conducted within days after exposure.

Has the federal government made recommendations to protect human health?

The EPA set a maximum contaminant goal (MCL) of 0.005 milligrams per liter (mg/L; 5 ppb) as a national primary drinking standard for trichloroethylene.

The Occupational Safety and Health Administration (OSHA) set a permissible exposure limit (PEL) of 100 ppm for trichloroethylene in air averaged over an 8-hour work day, an acceptable ceiling concentration of 200 ppm provided the 8 hour PEL is not exceeded, and an acceptable maximum peak of 300 ppm for a maximum duration of 5 minutes in any 2 hours.

The National Institute for Occupational Safety and Health (NIOSH) considers trichloroethylene to be a potential occupational carcinogen and established a recommended exposure limit (REL) of 2 ppm (as a 60-minute ceiling) during its use as an anesthetic agent and 25 ppm (as a 10-hour TWA) during all other exposures.

References

This ToxFAQs™ information is taken from the 2014 Toxicological Profile for Trichloroethylene (Draft for Public Comment) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ Ion the web: www.atsdr.cdc.gov/toxFAQs.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Vinyl Chloride - ToxFAQs™

CAS # 75-01-4

This fact sheet answers the most frequently asked health questions (FAQs) about vinyl chloride. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to vinyl chloride occurs mainly in the workplace. Breathing high levels of vinyl chloride for short periods of time can cause dizziness, sleepiness, unconsciousness, and at extremely high levels can cause death. Breathing vinyl chloride for long periods of time can result in permanent liver damage, immune reactions, nerve damage, and liver cancer. This substance has been found in at least 616 of the 1,662 National Priority List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is vinyl chloride?

Vinyl chloride is a colorless gas. It burns easily and it is not stable at high temperatures. It has a mild, sweet odor. It is a manufactured substance that does not occur naturally. It can be formed when other substances such as trichloroethane, trichloroethylene, and tetrachloroethylene are broken down. Vinyl chloride is used to make polyvinyl chloride (PVC). PVC is used to make a variety of plastic products, including pipes, wire and cable coatings, and packaging materials.

Vinyl chloride is also known as chloroethene, chloroethylene, and ethylene monochloride.

What happens to vinyl chloride when it enters the environment?

- Liquid vinyl chloride evaporates easily. Vinyl chloride in water or soil evaporates rapidly if it is near the surface.
- Vinyl chloride in the air breaks down in a few days to other substances, some of which can be harmful.
- Small amounts of vinyl chloride can dissolve in water.
- Vinyl chloride is unlikely to build up in plants or animals that you might eat.

How might I be exposed to vinyl chloride?

- Breathing vinyl chloride that has been released from plastics industries, hazardous waste sites, and landfills.
- Breathing vinyl chloride in air or during contact with your skin or eyes in the workplace.
- Drinking water from contaminated wells.

How can vinyl chloride affect my health?

Breathing high levels of vinyl chloride can cause you to feel dizzy or sleepy. Breathing very high levels can cause you to pass out, and breathing extremely high levels can cause death.

Some people who have breathed vinyl chloride for several years have changes in the structure of their livers. People are more likely to develop these changes if they breathe high levels of vinyl chloride. Some people who work with vinyl chloride have nerve damage and develop immune reactions. The lowest levels that produce liver changes, nerve damage, and immune reaction in people are not known. Some workers exposed to very high levels of vinyl chloride have problems with the blood flow in their hands. Their fingers turn white and hurt when they go into the cold.

The effects of drinking high levels of vinyl chloride are unknown. If you spill vinyl chloride on your skin, it will cause numbness, redness, and blisters.

Animal studies have shown that long-term exposure to vinyl chloride can damage the sperm and testes.

Vinyl Chloride

CAS # 75-01-4

How likely is vinyl chloride to cause cancer?

The U.S. Department of Health and Human Services (DHHS) has determined that vinyl chloride is a known carcinogen. Studies in workers who have breathed vinyl chloride over many years showed an increased risk of liver, brain, lung cancer, and some cancers of the blood have also been observed in workers.

How can vinyl chloride affect children?

It has not been proven that vinyl chloride causes birth defects in humans, but studies in animals suggest that vinyl chloride might affect growth and development. Animal studies also suggest that infants and young children might be more susceptible than adults to vinyl chloride-induced cancer.

How can families reduce the risk of exposure to vinyl chloride?

Tobacco smoke contains low levels of vinyl chloride, so limiting your family's exposure to cigarette or cigar smoke may help reduce their exposure to vinyl chloride.

Is there a medical test to determine whether I've been exposed to vinyl chloride?

The results of several tests can sometimes show if you have been exposed to vinyl chloride. Vinyl chloride can be measured in your breath, but the test must be done shortly after exposure. This is not helpful for measuring very low levels of vinyl chloride.

The amount of the major breakdown product of vinyl chloride, thiodiglycolic acid, in the urine may give some information about exposure. However, this test must be done shortly after exposure and does not reliably indicate the level of exposure.

Has the federal government made recommendations to protect human health?

Vinyl chloride is regulated in drinking water, food, and air. The EPA requires that the amount of vinyl chloride in drinking water not exceed 0.002 milligrams per liter (mg/L) of water.

The Occupational Safety and Health Administration (OSHA) has set a limit of 1 part vinyl chloride per 1 million parts of air (1 ppm) in the workplace.

The Food and Drug Administration (FDA) regulates the vinyl chloride content of various plastics. These include plastics that carry liquids and plastics that contact food. The limits for vinyl chloride content vary depending on the nature of the plastic and its use.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2006. Toxicological Profile for Vinyl Chloride (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1996**

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polycyclic aromatic hydrocarbons?

(Pronounced pŏl′ĭ-sī′klĭk ăr′ə-măt′ĭk hī′drə-kar′bənz)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

What happens to PAHs when they enter the environment?

- ❑ PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- ❑ PAHs can occur in air attached to dust particles.
- ❑ Some PAH particles can readily evaporate into the air from soil or surface waters.
- ❑ PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.
- ❑ PAHs enter water through discharges from industrial and wastewater treatment plants.
- ❑ Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- ❑ Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- ❑ In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- ❑ PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to PAHs?

- ❑ Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.
- ❑ Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- ❑ Coming in contact with air, water, or soil near hazardous waste sites.
- ❑ Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- ❑ Drinking contaminated water or cow's milk.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

☐ Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

How can PAHs affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

How likely are PAHs to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Is there a medical test to show whether I've been exposed to PAHs?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m^3 averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m^3 for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

MATERIAL SAFETY DATA SHEET

(POLYCHLORINATED BIPHENYLS)

COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients Name: polychlorinated biphenyls (PCBs)

HAZARD IDENTIFICATION

Reports of Carcinogenicity: YES

HEALTH HAZARDS ACUTE AND CHRONIC

- **Eyes**: Moderately irritating to eye tissues.
- **Skin**: Can be absorbed through intact skin, may cause de-fatting, potential for chloracne.
- **Inhalation**: Possible liver injury.
- **Ingestion**: Slightly toxic; reasonably anticipated to be carcinogenic.

EFFECTS OF OVER-EXPOSURE

Can cause dermatological symptoms; however, these are reversible upon removal of exposure source.

FIRST AID MEASURES

- **Eyes**: Irrigate immediately with copious quantities of running water for at least 15 minutes if liquid or solid PCBs get into them.
- **Skin:** Contaminated clothing should be removed and the skin washed thoroughly with soap and water. Hot PCBs may cause thermal burns.
- **Inhalation**: Remove to fresh air; if skin rash or respiratory irritation persists, consult a physician (if electrical equipment arcs over, PCBs may decompose to produce hydrochloric acid).
- **Ingestion**: Consult a physician. Do not induce vomiting or give any oily laxatives. (If large amounts are ingested, gastric lavage is suggested).

FIRE FIGHTING MEASURES: Flash Point: >141 ^{o}C (285.8 ^{o}F)

EXTINGUISHING MEDIA: PCBs are fire-resistant compounds.

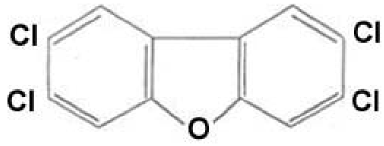
FIRE-FIGHTING PROCEDURES

Standard fire-fighting wearing apparel and self-contained breathing apparatus should be worn when fighting fires that involve possible exposure to chemical combustion products. Fire fighting equipment should be thoroughly cleaned and decontaminated after use.

UNUSUAL FIRE/EXPLOSION HAZARD

If a PCB transformer is involved in a fire-related incident, the owner of the transformer is required to report the incident. Consult and follow appropriate federal, provincial and local regulations.

<u>Note</u>: When askarel liquid becomes involved in a fire, toxic by-products of combustion are typically produced including polychlorinated dibenzofurans and polychlorinated dibenzodioxins, both known carcinogens. The structures of these chemical species are as follows:

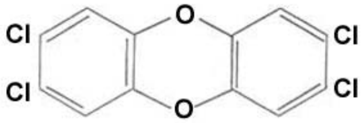


$C_{12}H_{8-n}Cl_nO$

$n = 4 - 8$

TCDF

2,3,7,8-tetrachlorodibenzofuran



$C_{12}H_{8-n}Cl_nO_2$

$n = 4 - 8$

TCDD

2,3,7,8-tetrachloro-dibenzo-p-dioxin

<u>Note</u>: 2,3,7,8-tetrachloro-dibenzo-p-dioxin is one of the most potent teratogenic, mutagenic and carcinogenic agents known to man.

SPILL RELEASE PROCEDURES

Cleanup & disposal of liquid PCBs are strictly regulated by the federal government. Ventilate area. Contain spill/leak. Remove spill by means of absorptive material. Spill clean-up personnel should use proper protective clothing. All wastes and residues containing PCBs should be collected, containerized, marked and disposed of in the manner prescribed by applicable federal, provincial and local laws.

HANDLING AND STORAGE PRECAUTIONS

Care should be taken to prevent entry into the environment through spills, leakage, use, vaporization, or disposal of liquid. Avoid prolonged breathing of vapours or mists. Avoid contact with eyes or prolonged contact with skin. Comply with all federal, provincial and local regulations.

OTHER PRECAUTIONS

Federal regulations require PCBs, PCB items, storage areas, transformer vaults, and transport vehicles to be appropriately labelled.

RESPIRATORY PROTECTION

Use OHSA approved equipment when airborne exposure limits are exceeded. Full facepiece equipment is recommended and, if used, replaces need for face shield and/or chemical splash goggles. The respirator use limitations specified by the manufacturer must be observed.

VENTILATION

Provide natural or mechanical ventilation to control exposure levels below airborne exposure levels.

PROTECTIVE GLOVES: Wear appropriate chemical resistant gloves to prevent skin contact.

EYE PROTECTION: Wear chemical splash goggles and have eye baths available.

OTHER PROTECTIVE EQUIPMENT

Wear appropriate protective clothing. Provide a safety shower at any location where skin contact can occur.

WORK HYGIENIC PRACTICES

Wash thoroughly after handling. Supplemental safety and health : none

PHYSICAL/CHEMICAL PROPERTIES

- **Vapour pressure:** (mm Hg @100 °F) 0.005 - 0.00006
- **Viscosity:** (CENTISTOKES) 3.6 - 540
- **Stability indicator/materials to avoid:** Yes
- **Stability Condition to Avoid:** PCBs are very stable, fire-resistant compounds.

HAZARDOUS DECOMPOSITION PRODUCTS

Carbon monoxide, carbon dioxide, hydrogen chloride, phenolics, aldehydes, furans, dioxins

WASTE DISPOSAL METHODS

Consult the applicable PCB regulations prior to any disposal of PCBs or PCB-contaminated items.

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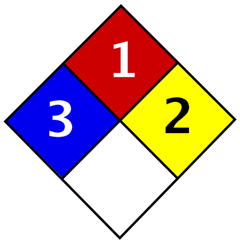

Health	3
Fire	1
Reactivity	2
Personal Protection	E

Material Safety Data Sheet
Arsenic MSDS

Section 1: Chemical Product and Company Identification

Product Name: Arsenic

Catalog Codes: SLA1006

CAS#: 7440-38-2

RTECS: CG0525000

TSCA: TSCA 8(b) inventory: Arsenic

CI#: Not applicable.

Synonym:

Chemical Name: Arsenic

Chemical Formula: As

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
Arsenic	7440-38-2	100

Toxicological Data on Ingredients: Arsenic: ORAL (LD50): Acute: 763 mg/kg [Rat]. 145 mg/kg [Mouse].

Section 3: Hazards Identification

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

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to kidneys, lungs, the nervous system, mucous membranes.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. 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:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: 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: Flammable in presence of open flames and sparks, of heat, of oxidizing materials.

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 highly 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, acids, moisture.

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: 0.01 from ACGIH (TLV) [United States] [1995]
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: 74.92 g/mole

Color: Silvery.

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

Boiling Point: Not available.

Melting Point: Sublimation temperature: 615°C (1139°F)

Critical Temperature: Not available.

Specific Gravity: 5.72 (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.

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, acids, moisture.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 145 mg/kg [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH.
Causes damage to the following organs: kidneys, lungs, the nervous system, mucous membranes.

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

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

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

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

Toxicity of the Products of Biodegradation: The products of degradation are 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: CLASS 6.1: Poisonous material.

Identification: : Arsenic UNNA: UN1558 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Arsenic
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: Arsenic
Pennsylvania RTK: Arsenic
Massachusetts RTK: Arsenic
TSCA 8(b) inventory: Arsenic

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):
R22- Harmful if swallowed.
R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 2

Personal Protection: E

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

Health: 3

Flammability: 1

Reactivity: 2

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.

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

Barium Metal

MSDS # 84.00

Section 1: Product and Company Identification

Barium Metal

Synonyms/General Names: Barium
Product Use: For educational use only
Manufacturer: Columbus Chemical Industries, Inc., Columbus, WI 53925.

24 Hour Emergency Information Telephone Numbers
CHEMTREC (USA): 800-424-9300 **CANUTEC (Canada): 613-424-6666**
ScholAR Chemistry; 5100 W. Henrietta Rd, Rochester, NY 14586; (866) 260-0501; www.Scholarchemistry.com

Section 2: Hazards Identification

Soft, silvery, lustrous metal immersed in heavy mineral oil; no odor.

WARNING! Flammable solid, dangerous when wet, highly toxic by ingestion.
Flammable solid, keep away from all ignition sources. Contact with water produces flammable gas.
Target organs: Central nervous system, kidneys.

HMIS (0 to 4)

Health	**3**
Fire Hazard	**3**
Reactivity	**2**

This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Section 3: Composition / Information on Ingredients

Barium Metal (7440-39-3), 100%

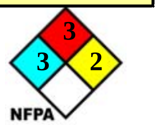
Section 4: First Aid Measures

Always seek professional medical attention after first aid measures are provided.

Eyes:	Immediately flush eyes with excess water for 15 minutes, lifting lower and upper eyelids occasionally.
Skin:	Immediately flush skin with excess water for 15 minutes while removing contaminated clothing.
Ingestion:	Call Poison Control immediately. Rinse mouth with cold water. Give victim 1-2 tbsp of activated charcoal mixed with 8 oz water.
Inhalation:	Remove to fresh air. If not breathing, give artificial respiration.

Section 5: Fire Fighting Measures

Flammable solid. When heated to decomposition, emits acrid fumes and explosive hydrogen gas.
Protective equipment and precautions for firefighters: Do Not Use carbon dioxide, foam, water or halogenated extinguishing agents. Use class D extinguisher or smother with dry sand, dry clay, dry ground limestone or dry graphite. Firefighters should wear full fire fighting turn-out gear and respiratory protection (SCBA). Material is not sensitive to mechanical impact or static discharge.



Section 6: Accidental Release Measures

Use personal protection recommended in Section 8. Isolate the hazard area and deny entry to unnecessary and unprotected personnel. Remove all ignition sources and ventilate area. Sweep up spill and place material in a dry container for disposal. See Section 13 for disposal information.

Section 7: Handling and Storage Red

Handling: Use with adequate ventilation and do not breathe dust or vapor. Avoid contact with skin, eyes, or clothing. Wash hands thoroughly after handling.
Storage: Store in Flammable Area [Red Storage] with other flammable materials and away from any strong oxidizers. Store in a dedicated flammables cabinet. Store in a cool, dry, well-ventilated, locked store room away from incompatible materials.

Section 8: Exposure Controls / Personal Protection

Use ventilation to keep airborne concentrations below exposure limits. Have approved eyewash facility, safety shower, and fire extinguishers readily available. Wear chemical splash goggles and chemical resistant clothing such as gloves and aprons. Wash hands thoroughly after handling material and before eating or drinking. Use NIOSH-approved respirator with a dust cartridge. Exposure guidelines: Barium compounds: OSHA PEL: 0.5 mg/m^3 and ACGIH TLV: 0.5 mg/m^3, STEL: N/A.

Section 9: Physical and Chemical Properties

Molecular formula	Ba.	**Appearance**	Silver metal in heavy mineral oil.
Molecular weight	137.33.	**Odor**	No odor.
Specific Gravity	3.62 g/mL @ 20°C..	**Odor Threshold**	N/A.
Vapor Density (air=1)	N/A.	**Solubility**	Reacts violently with water.
Melting Point	850°C.	**Evaporation rate**	N/A *(Butyl acetate = 1).*
Boiling Point/Range	1695°C.	**Partition Coefficient**	N/A *(log P_{OW}).*
Vapor Pressure (20°C)	N/A.	**pH**	N/A.
Flash Point:	N/A.	**UEL**	N/A.
Autoignition Temp.:	N/A.	**LEL**	N/A.

N/A = Not available or applicable

Section 10: Stability and Reactivity

Avoid heat and ignition sources
Stability: Stable under normal conditions of use.
Incompatibility: Water, acids, chlorine, iodine, bromine and oxidizing agents.
Shelf life: Indefinite if stored properly.

Section 11: Toxicology Information

Acute Symptoms/Signs of exposure: ***Eyes***: Stinging pain, burns, watering of eyes, inflammation of eyelids and conjunctivitis. Avoid looking at burning magnesium. ***Skin***: Irritation, redness, burns. Powdered metal ignites readily on skin causing burns. ***Ingestion***: Nausea, vomiting and headache. ***Inhalation***: Rapid irregular breathing, headache, burns to mucous membranes. Inhalation of dust or fumes causes metal fume fever.
Chronic Effects: Repeated/prolonged skin contact may cause dryness or rashes.
Sensitization: none expected
Barium: LD50 [oral, rat]; Not Available; LC50 [rat]; Not Available; LD50 Dermal [rabbit]; Not Available
Material has not been found to be a carcinogen nor produce genetic, reproductive, or developmental effects.

Section 12: Ecological Information

Ecotoxicity (aquatic and terrestrial): Ecological impact has not been determined

Section 13: Disposal Considerations

Check with all applicable local, regional, and national laws and regulations. Local regulations may be more stringent than regional or national regulations. Use a licensed chemical waste disposal firm for proper disposal.

Section 14: Transport Information

DOT Shipping Name:	Barium.	**Canada TDG:**	Barium .
DOT Hazard Class:	4.3, pg II.	**Hazard Class:**	4.3, pg II.
Identification Number:	UN1400.	**UN Number:**	UN1400.

Section 15: Regulatory Information

EINECS: Listed (231-149.1) .
TSCA: All components are listed or are exempt.
WHMIS Canada: B6:D2B: Reactive Flammable: Toxic Material.
California Proposition 65: Not listed.
The product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

Section 16: Other Information

Current Issue Date: January 23, 2009

Disclaimer: Scholar Chemistry and Columbus Chemical Industries, Inc., ("S&C") believes that the information herein is factual but is not intended to be all inclusive. The information relates only to the specific material designated and does not relate to its use in combination with other materials or its use as to any particular process. Because safety standards and regulations are subject to change and because S&C has no continuing control over the material, those handling, storing or using the material should satisfy themselves that they have current information regarding the particular way the material is handled, stored or used and that the same is done in accordance with federal, state and local law. ***S&C makes no warranty, expressed or implied, including (without limitation) warranties with respect to the completeness or continuing accuracy of the information contained herein or with respect to fitness for any particular use.***

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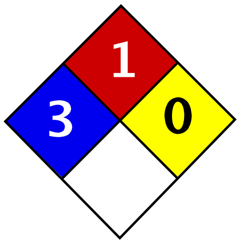

Health	3
Fire	1
Reactivity	0
Personal Protection	E

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.

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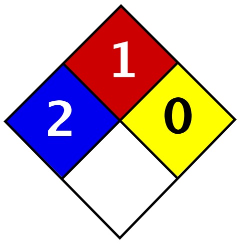
Last Updated: 11/06/2008 12:00 PM

ScienceLab.com
Chemicals & Laboratory Equipment



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

COPPER METAL
MATERIAL SAFETY DATA SHEET

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product Identity: Copper Metal

Manufacturer:	**Supplier:**	**MSDS Preparer:**
Teck Advanced Materials Inc. 13670 Danielson Street Suite H & I Poway, CA 92064 Emergency Telephone: 858-391-2935	Teck Advanced Materials Inc. 13670 Danielson Street Suite H & I Poway, CA 92064	Teck Metals Ltd. 3300 – 550 Burrard Street Vancouver, British Columbia V6C 0B3

Date of Last MSDS Revision/Edit: February 26, 2010.

Product Use: Copper is used in the manufacture of bronzes, brass, other copper alloys, and electrical conductors.

SECTION 2. COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous Ingredient	Approximate Percent by Weight	CAS Number	Occupational Exposure Limits (OELs)		LD_{50} / LC_{50} Species and Route
Copper	99.99+%	7440-50-8	OSHA PEL	0.1 mg/m^3 fume 1.0 mg/m^3 dusts/mists	LD_{50}, mouse, oral >5,000 mg/kg
			ACGIH TLV	0.2 mg/m^3 fume 1.0 mg/m^3 dusts/mists	
			NIOSH REL	0.1 mg/m^3 (Respirable) fume 1.0 mg/m^3 dusts/mists	

NOTE: OELs for individual jurisdictions may differ from OSHA PELs. Check with local authorities for the applicable OELs in your jurisdiction. OSHA - Occupational Safety and Health Administration; ACGIH - American Conference of Governmental Industrial Hygienists; NIOSH - National Institute for Occupational Safety and Health. OEL – Occupational Exposure Limit, PEL – Permissible Exposure Limit, TLV – Threshold Limit Value, REL – Recommended Exposure Limit.

Trade Names and Synonyms: Cu-CATH-1; Copper Cathode (Higher Purity Grade)

SECTION 3. HAZARDS IDENTIFICATION

Emergency Overview: Reddish metal that does not burn in bulk but may form explosive mixtures if dispersed in air as a fine powder and exposed to heat or flames. This metal is relatively non-toxic and poses little immediate hazard to personnel or the environment in an emergency situation.

Potential Health Effects: Inhalation of fumes or dust may result in irritation of the nasal mucous membranes. Inhalation of copper oxide may cause irritation of the upper respiratory tract and may result in a form of metal fume fever, characterized by flu-like symptoms such as chills, fever, nausea, and vomiting. Ingestion of copper metal may cause nausea, vomiting, headaches, dizziness, and gastrointestinal irritation. Direct eye contact may cause redness or pain. Direct skin contact may result in irritation. Discoloration of the skin often occurs from handling copper, but does not indicate any actual injury. Copper is not listed as a carcinogen by OSHA, the NTP, the ACGIH, IARC, or the EU. (See Toxicological Information, Section 11).

Potential Environmental Effects: Copper is relatively insoluble in water and, therefore, likely has low bioavailability. However, long-term exposure in aquatic and terrestrial environments or processing of the product can lead to the release of the constituent copper compounds in more bioavailable forms. These bioavailable forms have the potential to yield toxic effects on aquatic organisms. (See Ecological Information, Section 12).

EU Risk Phrase(s): Not hazardous – no applicable Risk Phrases.

SECTION 4. FIRST AID MEASURES

Eye Contact: Do not allow victim to rub eye(s). Let the eye(s) water naturally for a few minutes. If particle/dust does not dislodge, flush with lukewarm, gently flowing water for five minutes or until particle/dust is removed, while holding eyelid(s) open. If irritation persists, immediately obtain medical attention. DO NOT attempt to manually remove anything stuck to the eye.

Skin Contact: *Dust:* No health effects expected. If irritation does occur, flush with lukewarm, gently flowing water for 5 minutes. If irritation persists, obtain medical advice. *Molten Metal:* Flush contact area to solidify and cool but do not attempt to remove encrusted material or clothing. Cover burns and seek medical attention immediately.

Inhalation: Remove source of contamination or move victim from exposure area to fresh air. Obtain medical advice.
NOTE: Metal fume fever may develop 3-10 hours after exposure. If symptoms of metal fume fever (flu-like symptoms) develop, obtain medical attention.

Ingestion: Never give anything by mouth if victim is rapidly losing consciousness, or is unconscious or convulsing. Have victim rinse mouth thoroughly with water. DO NOT INDUCE VOMITING. Have victim drink 2 – 8 oz. (60 – 240 ml) of water. If vomiting occurs naturally, have victim rinse mouth with water again. Obtain medical advice and bring a copy of this MSDS.

SECTION 5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Massive metal is not considered a fire or explosion hazard. Finely-divided copper metal dust or powder may be flammable or explosive when dispersed in the air at high concentrations and exposed to heat, flame, or other ignition sources. Explosions may also occur upon contact with certain incompatible materials (see Stability and Reactivity, Section 10).

Extinguishing Media: Do NOT use water, carbon dioxide, foam, or halons. Apply dry sand, dolomite, graphite, powdered sodium chloride, soda ash, or other suitable dry powders.

Fire Fighting: Fire fighters must be fully trained and wear full protective clothing including an approved, self-contained breathing apparatus which supplies a positive air pressure within a full face-piece mask.

Flashpoint and Method: Not Applicable.

Upper and Lower Flammable Limit: Not Applicable.

Autoignition Temperature: Not Applicable.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Procedures for Cleanup: Control source of spillage if possible to do so safely. Clean up spilled material immediately, observing precautions in Section 8, Personal Protection. Molten metal should be allowed to cool and harden before cleanup. Once solidified wear gloves, pick up and return to process. Powder or dust should be cleaned up using methods which will minimize dust generation (e.g., vacuum solids, dampen material and shovel or wet sweep). Return uncontaminated spilled material to the process if possible. Place contaminated material in suitable labelled containers for later recovery in view of the commercial value of copper. Treat or dispose of waste material in accordance with all local, state/provincial, and national requirements.

Personal Precautions: Persons responding to an accidental release should wear protective clothing, gloves and a respirator (see also Section 8). Close-fitting safety goggles may be necessary in some circumstances to prevent eye contact with dust and fume. Where molten metal is involved, wear heat-resistant gloves and suitable clothing for protection from hot-metal splash.

Environmental Precautions: Copper compounds, while not readily bioavailable in the environment, have the potential to pose ecological effects to aquatic life forms under certain chemical conditions. Releases of the product to water and soil should, therefore, be prevented.

SECTION 7. HANDLING AND STORAGE

Store copper in a dry, covered area. Copper cathodes suspected of containing moisture should be THOROUGHLY DRIED before being added to a molten bath. Cathodes may contain cavities that collect moisture. Entrained moisture will expand explosively when immersed in a molten bath and potentially spatter molten metal out of the bath. Always practice good personal hygiene. Refrain from eating, drinking, or smoking in work areas. Thoroughly wash hands before eating, drinking, or smoking in appropriate, designated areas.

EU Safety Phrase(s): Not hazardous – no applicable Safety Phrases.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Protective Clothing: Gloves and coveralls or other work clothing are recommended to prevent prolonged or repeated direct skin contact when copper is processed. Appropriate eye protection should be worn where fume or dust is generated. Where hot or molten metal is handled, heat resistant gloves, goggles or faceshield, and clothing to protect from hot metal splash should be worn. Safety type boots are recommended.

Ventilation: Use adequate local or general ventilation to maintain the concentration of copper fumes in the working environment well below recommended occupational exposure limits. Supply sufficient replacement air to make up for air removed by the exhaust system.

Respirators: Where copper dust or fumes are generated and cannot be controlled to within acceptable levels by engineering means, use appropriate NIOSH-approved respiratory protection equipment (a 42CFR84 Class N, R or P-95 particulate filter cartridge or better).

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Reddish metal	**Odour:** None	**Physical State:** Solid	**pH:** Not Applicable
Vapour Pressure: 1 mm at 1083°C Negligible @ 20°C	**Vapour Density:** Not Applicable	**Boiling Point/Range:** 2595° C	**Melting Point/Range:** 1083° C
Specific Gravity: 8.94	**Evaporation Rate:** Not Applicable	**Coefficient of Water/Oil Distribution:** Not Applicable	**Odour Threshold:** None
Solubility: Insoluble in water			

SECTION 10. STABILITY AND REACTIVITY

Stability & Reactivity: Copper is stable and not considered reactive under normal temperatures and pressures. Hazardous polymerization or runaway reactions will not occur.

Incompatibilities: Copper is incompatible with acetylene, ammonium nitrate, bromates, chlorates, iodates, chlorine fluorine, chlorine trifluoride, and peroxides. Shock-sensitive compounds are formed with acetylenic compounds, ethylene oxide or azide compounds. Copper in finely-divided powder or granular form reacts with strong oxidants like chlorates, bromates, iodates and ammonium nitrate causing a potential explosion hazard.

Hazardous Decomposition Products: High temperature operations such as oxy-acetylene cutting, electric arc welding, arc-air gouging or overheating a molten metal bath may generate fumes. The fumes will contain copper oxides, which, on inhalation in sufficient quantity, can produce metal fume fever.

SECTION 11. TOXICOLOGICAL INFORMATION

General: Copper is an essential element, but can become toxic when inhaled or ingested in large doses. Individuals with a rare disorder called "Wilson's Disease" (estimated prevalence 0.003% of the population) are predisposed to accumulate copper and should not be occupationally exposed. However, in the form in which this product is sold it is relatively non-toxic. The major route of exposure would be through the generation and inhalation of copper oxide fume.

Acute:
Skin/Eye: Contact with dust or fume may cause local irritation but would not cause tissue damage.

Inhalation: An intense, short-term exposure to fumes from cutting or welding, etc. could result in the condition called metal fume fever. The symptoms of metal fume fever generally occur within 3 to 10 hours. They may include immediate dryness and irritation of the throat, tightness of the chest, and coughing that may later be followed by flu-like symptoms of fever, malaise, perspiration, frontal headache, muscle cramps, low back pain, occasionally blurred vision, nausea, and vomiting. Severe cases could cause pulmonary congestion and edema as well as acute encephalopathy with possible seizures, coma, and death. However, short-term exposures of this magnitude are unlikely in industry today. Those experiencing a single acute episode of metal fume fever generally recover slowly but without apparent residual effects.

Ingestion: Individuals reported to have ingested large quantities of copper salts have reported gastrointestinal effects including vomiting, diarrhea, nausea, abdominal pain and a metallic taste in the mouth. Effects on the kidneys and liver, and even death have also been reported in severe cases of copper poisoning. However, copper is a strong emetic and spontaneous vomiting following ingestion usually limits uptake of copper.

Chronic:
Prolonged exposure to copper dust or fume can cause irritation to the eye and skin. A green discoloration of the skin has been reported similar to that caused by wearing jewelry made of copper. Copper is not listed as a human carcinogen by the Occupational Safety and Health Administration (OSHA), the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), the American Conference of Governmental Industrial Hygienists (ACGIH) or the European Union (EU).

SECTION 12. ECOLOGICAL INFORMATION

Copper metal is relatively insoluble in water and, therefore, generally has low bioavailability. However, long-term exposure in aquatic and terrestrial environments or processing of the product can lead to the release of the constituent copper compounds in more bioavailable forms. These more bioavailable forms have the potential to yield toxic effects under specific chemical conditions (e.g., low pH). The mobility of the copper compounds in soluble forms is also media-dependent. They can bind with inorganic and organic ligands, reducing their mobility and bioavailability in both soil and water. Bioavailability is also regulated by other factors in the aquatic environment, such as hardness and dissolved organic carbon content.

SECTION 13. DISPOSAL CONSIDERATIONS

If material cannot be returned to process or salvage, dispose of in accordance with applicable regulations.

SECTION 14. TRANSPORT INFORMATION

No special shipping or transportation requirements in ingot form.

SECTION 15. REGULATORY INFORMATION

U.S.

Ingredient Listed on TSCA Inventory	Yes	
Hazardous Under Hazard Communication Standard	Yes	
CERCLA Section 103 Hazardous Substances	Yes	RQ: 5,000 lbs. (2270 kg.)*
EPCRA Section 302 Extremely Hazardous Substance	No	
EPCRA Section 311/312 Hazard Categories	No Hazard Categories Apply	
EPCRA Section 313 Toxic Release Inventory	Copper Percent by Weight - At least 99%	CAS No. 7440-50-8

*reporting not required when diameter of the pieces of solid metal released is equal to or exceeds 100 micrometers (0.004 inches).

CANADIAN:

WHMIS Classification	Not applicable. Copper is not a controlled product under WHMIS. This Material Safety Data Sheet is provided for information purposes only.

EUROPEAN UNION:

Listed on the European Inventory of Existing Commercial Chemical Substances (EINECS):	Yes
EU Classification:	Not hazardous.

SECTION 16. OTHER INFORMATION

The information in this Material Safety Data Sheet is based on the following references:

- American Conference of Governmental Industrial Hygienists, 2004, Documentation of the Threshold Limit Values and Biological Exposure Indices, 7th Edition plus updates.
- American Conference of Governmental Industrial Hygienists, 2009, Guide to Occupational Exposure Values.
- American Conference of Governmental Industrial Hygienists, 2009, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.
- Bretherick's Handbook of Reactive Chemical Hazards, 20th Anniversary Edition. (P. G. Urben, Ed.) 1995.
- Canadian Centre for Occupational Health and Safety CHEMINFO Record No: 2073, Copper - *Last Revised 2005-03.*
- Commission de la santé et la sécurité du travail, Service du répertoire toxicologique, Cuivre , 2001-07.
- Industry Canada, Controlled Products Regulations SOR/88-66, as amended.
- International Chemical Safety Cards (WHO/IPCS/ILO) ICSC:0240 – Copper (Revised Sept 1993).
- International Labour Office (WHO/ILO) Encyclopedia of Occupational Health & Safety 4th Ed. CD-ROM Version (1998).
- Merck & Co., Inc., 2001, The Merck Index, An Encyclopedia of Chemicals, Drugs, and Biologicals, Thirteenth Edition.
- National Library of Medicine, Hazardous Substance Data Bank. (*last accessed 2010 -02-03*)
- National Oceanic and Atmospheric Administration, Office of Response and Restoration, CAMEO Chemicals – Database of Hazardous Materials [http://www.cameochemicals.noaa.gov/] *last accessed 2010-02-03*
- Patty's Toxicology, 5th Edition, (E Bingham, B Cohrssen & C H Powell, Ed.) 2001.
- U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Toxicological Profile for Copper (Sept 2004).
- U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health, NIOSH Pocket Guide to Chemical Hazards. CD-ROM Edition September 2005.
- U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health, Registry of Toxic Effects of Chemical Substances (RTECS) CCOHS Web Access subscription.
- U.S. Occupational Safety and Health Administration, 1989, Code of Federal Regulations, Title 29, Part 1910.

Notice to Reader

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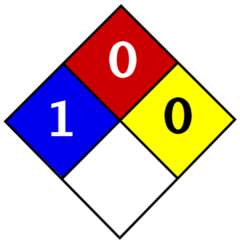

Health	1
Fire	0
Reactivity	0
Personal Protection	E

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.

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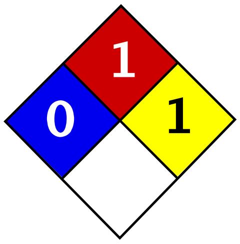

Health	1
Fire	3
Reactivity	2
Personal Protection	E

Material Safety Data Sheet
Magnesium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Magnesium

Catalog Codes: SLM4408, SLM2263, SLM3637

CAS#: 7439-95-4

RTECS: OM2100000

TSCA: TSCA 8(b) inventory: Magnesium

CI#: Not applicable.

Synonym: Magnesium ribbons, turnings or sticks

Chemical Name: Magnesium

Chemical Formula: Mg

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
Magnesium	7439-95-4	100

Toxicological Data on Ingredients: Magnesium 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:
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. 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:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

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

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

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

Special Remarks on Fire Hazards:
Magnesium turnings, chips or granules, ribbons, are flammable. They can be easily ignited. They may reignite after fire is extinguished. Produces flammable gases on contact with water and acid. May ignite on contact with water or moist air.
Magnesium fires do not flare up violently unless moisture is present.

Special Remarks on Explosion Hazards: Reacts with acids and water to form hydrogen gas with is highly flammable and eplosive

Section 6: Accidental Release Measures

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

Large Spill:
Flammable solid.
Stop leak if without risk. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe dust. Keep away from incompatibles such as oxidizing agents, acids, moisture.

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

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: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 24.31 g/mole

Color: Silver-white

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

Boiling Point: 1100°C (2012°F)

Melting Point: 651°C (1203.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.74 (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:
Very slightly soluble in hot water.
Insoluble in cold water.
Insoluble in chromium trioxides, and mineral acids, alkalies.
Slightly soluble with decomposition in hot water.
Soluble in concentrated hydrogen fluoride, and ammonium salts.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, incompatible materials, water or moisture, moist air.

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

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Violent chemical reaction with oxidizing agents.
Reacts with water to create hydrogen gas and heat. Must be kept dry.
Reacts with acids to form hydrogen gas which is highly flammable and explosive.
Magnesium forms hazardous or explosive mixtures with aluminum and potassium perchlorate; ammonium nitrate; barium nitrate, barium dioxide and zinc; beryllium oxide; boron phosphodiiodide; bromobenzyl trifluoride; cadmium cyanide; cadmium oxide; calcium carbide; carbonates; carbon tetrachloride; chlorine; chlorine trifluoride; chloroform; cobalt cyanide; copper cyanide; copper sulfate(anhydrous), ammonium nitrate, potassium chlorate and water; cupric oxide; cupric sulfate; fluorine; gold cyanide; hydrogen and calcium carbonate; hydrogen iodide; hydrogen peroxide; iodine; lead cyanide; mercuric oxide; mercury cyanide; methyl chloride; molybdenum trioxide; nickel cyanide; nitric acid; nitrogen dioxide; oxygen (liquid); performic acid; phosphates; potassium chlorate; potassium perchlorate; silver nitrate; silver oxide; sodium perchlorate; sodium peroxide; sodium peroxide and carbon dioxide; stannic oxide; sulfates; trichloroethylene; zinc cyanide; zinc oxide.

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: Not available.

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 Health Effects:
Skin: May cause skin irritation by mechanical action. May get mechanical injury or embedding of chips/particles in skin. The particles that are embedded in the wounds may retard healing.
Eyes: May cause eye irritation by mechanical action. Mechanical injury may occur. Particles or chips may embed in eye and retard healing.
Inhalation: Low hazard for ususal industrial handling. It may cause respiratory tract irritation. However, it is unlikely due to physical form. When Magnesium metal is heated during welding or smelting process, Metal Fume Fever may result from inhalation of magnesium fumes. Metal Fume Fever is a flu-like condition consisting of fever, chills, sweating, aches, pains, cough, weakness, headache, nausea, vomiting, and breathing difficulty. Other symptoms may include metallic taste, increased white blood cell count. There is no permanent ill-effect.
Ingestion: Low hazard for usual industrial handling. There are no known reports of serious industrial poisonings with Magnesium. Ingeston of large amounts of chips, turnings or ribbons may cause gastrointestinal tract irritation with nausea, vomiting, and diarrhea. Acute ingestion may also result in Hypermagnesia.
Hypermagnesia may cause hypotension, bradycardia, CNS depression, respiratory depression, and impairment of neuromuscular transmission (hyporeflexia, paralysis).

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: CLASS 4.1: Flammable solid.

Identification: : Magnesium UNNA: 1869 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Magnesium
Rhode Island RTK hazardous substances: Magnesium
Pennsylvania RTK: Magnesium

Massachusetts RTK: Magnesium
Massachusetts spill list: Magnesium
New Jersey: Magnesium
TSCA 8(b) inventory: Magnesium

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

Other Classifications:

WHMIS (Canada):
CLASS B-4: Flammable solid.
CLASS B-6: Reactive and very flammable material.

DSCL (EEC):
R11- Highly flammable.
R15- Contact with water liberates
extremely flammable gases.
S7/8- Keep container tightly closed and dry.
S43- In case of fire, use dry chemical. Never
use water.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 3

Reactivity: 2

Personal Protection: E

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

Health: 0

Flammability: 1

Reactivity: 1

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.

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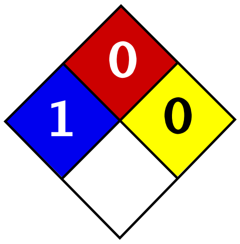
Last Updated: 11/06/2008 12:00 PM



Health	1
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Manganese MSDS

Section 1: Chemical Product and Company Identification

Product Name: Manganese

Catalog Codes: SLM2245

CAS#: 7439-96-5

RTECS: OO9275000

TSCA: TSCA 8(b) inventory: Manganese

CI#: Not available.

Synonym:

Chemical Name: Manganese

Chemical Formula: Mn

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
Manganese	7439-96-5	100

Toxicological Data on Ingredients: Manganese: ORAL (LD50): Acute: 9000 mg/kg [Rat].

Section 3: Hazards Identification

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

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to blood, lungs, brain, central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention 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. 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:
Moderate fire potential, in the form of dust or powder, when exposed to flame.
When manganese if heated in the vapor of phosphorus at a very dull red heat, union occurs with incandescence.
Concentrated nitric acid reacts with powdered manganese with incandescence and explosion.
Powdered manganese ignites in chlorine.

Special Remarks on Explosion Hazards: Moderate explosion potential, in the form of dust or powder, when exposed to flame.

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:
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, reducing agents.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above

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: 0.1 (mg/m3) from ACGIH (TLV) [United States]
TWA: 5 (mg/m3) [Canada]
TWA: 1 STEL: 3 (mg/m3) from NIOSH [United States]
TWA: 5 (mg/m3) from OSHA (PEL) [United States]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Odorless.

Taste: Not available.

Molecular Weight: 54.94 g/mole

Color: Grayish white.

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

Boiling Point: 2095°C (3803°F)

Melting Point: 1244°C (2271.2°F)

Critical Temperature: Not available.

Specific Gravity: 7.44 (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.

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, reducing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Superficially oxidized on exposure to air.
Reacts with aqueous solutions of sodium or potassium bicarbonate.
Reacts with dilute mineral acids with evolution of hydrogen and formation of divalent manganous salts.
Reacts with fluorine and chlorine to produce di or tri fluoride, and di and tri chloride, respectively.
In the form of powder, it reduces most metallic oxides on heating.
On heating, it reacts directly with carbon, phosphorus, antimony, or arsenic.
Also incompatible with hydroxides, cyanides, carbonates.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 9000 mg/kg [Rat].

Chronic Effects on Humans: May cause damage to the following organs: blood, lungs, brain, central nervous system (CNS).

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
Manganese can cross the placenta.
May cause cancer (tumorigenic) based on animal data.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: May cause skin irritaiton
Eyes: Dust may cause mechanical irritation.

Inhalation: Dust may cause respiratory tract irritation. May cause "Metal Fume Fever" which may include flu-like symptoms (fever, chills, upset stomach, vomiting, weakness, headache, body aches, muscle pains, dry mouth and throat, coughing, tightness of the chest). May affect behavior/Central Nervous system (change in motor activity, torpor, nervousness, tremor, yawning, mood swings, irritability, restlessness, fatigue, headache, apathy, languor, insomnia than somnolence, hallucinations, delusions, uncontrollable laughter followed by crying, compulsions, aggressivness, weakness in legs, memory loss, decreased libido, impotence, salivation, hearing loss, slow gait,), and respiration (dyspnea, shallow respiration, cyanosis, alveolar inflammation).
Ingestion: Repeated or prolonged exposure from ingestion may affect brain (degenerative changes), blood and metabolism.
Ingestion: May cause digestive tract irritation. There is a low gastrointesitnal absorption of manganese.
Chronic Potential Health Effects:
Inhalation: Repeated or prolonged exposure from inhalation may affect brain (degeneratiave changes), behavior/Central Nervous system with symptoms to acute exposure. May also affect liver (chronic liver disease, jaundice)
Ingestion: Repeated or prolonged exposure from ingestion may affect brain, blood and metabolism

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:
Illinois toxic substances disclosure to employee act: Manganese
Rhode Island RTK hazardous substances: Manganese
Pennsylvania RTK: Manganese
Minnesota: Manganese
Massachusetts RTK: Manganese
New Jersey: Manganese
New Jersey spill list: Manganese
Louisiana spill reporting: Manganese
California Director's List of Hazardous Substances: Manganese
TSCA 8(b) inventory: Manganese

SARA 313 toxic chemical notification and release reporting: Manganese

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): Not applicable.

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.
Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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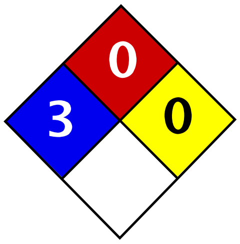
Last Updated: 11/06/2008 12:00 PM



Health	3
Fire	0
Reactivity	0
Personal Protection	

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.

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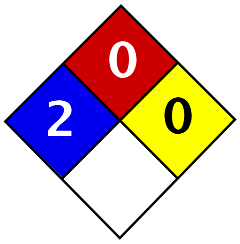

Health	2
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Nickel metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Nickel metal

Catalog Codes: SLN2296, SLN1342, SLN1954

CAS#: 7440-02-0

RTECS: QR5950000

TSCA: TSCA 8(b) inventory: Nickel metal

CI#: Not applicable.

Synonym: Nickel Metal shot; Nickel metal foil.

Chemical Name: Nickel

Chemical Formula: Ni

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
Nickel metal	7440-02-0	100

Toxicological Data on Ingredients: Nickel metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

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

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer), of ingestion, of inhalation (lung sensitizer).
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to skin.
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 if irritation occurs.

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.

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: 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:
Flammable solid.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Material in powder form, capable of creating a dust explosion. This material is flammable in powder form only.

Special Remarks on Explosion Hazards:
Material in powder form, capable of creating a dust explosion.
Mixtures containing Potassium Perchlorate with Nickel & Titanium powders & infusorial earth can explode.
Adding 2 or 3 drops of approximately 90% peroxyformic acid to powdered nickel will result in explosion.
Powdered nickel reacts explosively upon contact with fused ammonium nitrate at temperatures below 200 deg. C.

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.. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Keep away from incompatibles such as oxidizing agents, combustible materials, metals, acids.

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

Section 9: Physical and Chemical Properties

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

Odor: Odorless.

Taste: Not available.

Molecular Weight: 58.71 g/mole

Color: Silvery.

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

Boiling Point: 2730°C (4946°F)

Melting Point: 1455°C (2651°F)

Critical Temperature: Not available.

Specific Gravity: Density: 8.908 (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.
Insoluble in Ammonia.
Soluble in dilute Nitric Acid.
Slightly soluble in Hydrochloric Acid, Sulfuric Acid.

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, combustible materials, metals, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Incompatible with strong acids, selenium, sulfur, wood and other combustibles, nickel nitrate, aluminum, aluminum trichloride, ethylene, p-dioxan, hydrogen, methanol, non-metals, oxidants, sulfur compounds, aniline, hydrogen sulfide, flammable solvents, hydrazine, and metal powders (especially zinc, aluminum, and magnesium), ammonium nitrate, nitryl fluoride, bromine pentafluoride, potassium perchlorate + titanium powder + indusorial earth.

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: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.
Causes damage to the following organs: skin.
May cause damage to the following organs: kidneys, lungs, liver, upper respiratory tract.

Other Toxic Effects on Humans:

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

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose/Conc:
LDL [Rat] - Route: Oral; Dose: 5000 mg/kg
LDL [Guinea Pig] - Route: Oral; Dose: 5000 mg/kg

Special Remarks on Chronic Effects on Humans: May cause cancer based on animal test data

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Nickel dust and fume can irritate skin.
Eyes: Nickel dust and fume can irritate eyes.
Inhalation: Inhalation of dust or fume may cause respiratory tract irritation with non-productive cough, hoarseness, sore throat, headache, vertigo, weakness, chest pain, followed by delayed effects, including tachypnea, dyspnea, and ARDS. Death due to ARDS has been reported following inhalation of high concentrations of respirable metallic nickel dust. Later effects may include pulmonary edema and fibrosis.
Ingestion: Metallic nickel is generally considered not to be acutely toxic if ingested. Ingestion may cause nausea, vomiting, abdominal , and diarrhea. Nickel may damage the kidneys(proteinuria), and may affect liver function. It may also affect behavior (somnolence), and cardiovascular system (increased cornary artery resistance, decreased myocardial contractility, myocardial damage, regional or general arteriolar or venus dilation).
Chronic Potential Health Effects:
Skin: May cause skin allergy. Nickel and nickel compounds are among the most common sensitizers inducing allergic contact dermatitis.
Inhalation: Chronic inhalation nickel dust or fume can cause chronic hypertrophic rhinitis, sinusitis, nasal polyps, perforation of the nasal septum, chronic pulmonary irritation, fibrosis, pulmonary edema, pulmonary eosinophilia, Pneumoconiosis, allergies (asthma-like allergy), and cancer of the nasal sinus cavities, lungs, and possibly other organs. Future exposures can cause asthma attacks with shortness of breath, wheezing, cough, and/or chest tightness. Chronic inhalation of nickel dust or fume may also affect the liver (impaired liver function tests), and blood (changes in red blood cell count).
Ingestion: Prolonged or repeated ingestion of nickel can be a source chronic urticaria and other signs of allergy. Chronic ingestion of NIckel may also affect respiration and cause pneumoconiosis or fibrosis.
Note: In the general population, sensitization occurs from exposure to nickel-containing coins, jewelry, watches,

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:
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: Nickel metal
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: Nickel metal
Connecticut hazardous material survey.: Nickel metal
Illinois toxic substances disclosure to employee act: Nickel metal
Illinois chemical safety act: Nickel metal
New York release reporting list: Nickel metal
Rhode Island RTK hazardous substances: Nickel metal
Pennsylvania RTK: Nickel metal
Michigan critical material: Nickel metal
Massachusetts RTK: Nickel metal
Massachusetts spill list: Nickel metal
New Jersey: Nickel metal
New Jersey spill list: Nickel metal
Louisiana spill reporting: Nickel metal
California Director's List of Hazardous Substances: Nickel metal
TSCA 8(b) inventory: Nickel metal

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):
R40- Possible risks of irreversible effects.
R43- May cause sensitization by skin contact.
S22- Do not breathe dust.
S36- Wear suitable protective clothing.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

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

Health: 2

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.

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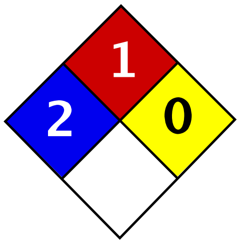

Health	2
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Selenium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Selenium

Catalog Codes: SLS2629

CAS#: 7782-49-2

RTECS: VS7700000

TSCA: TSCA 8(b) inventory: Selenium

CI#: Not available.

Synonym:

Chemical Name: Not available.

Chemical Formula: Se

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
Selenium	7782-49-2	100

Toxicological Data on Ingredients: Selenium: ORAL (LD50): Acute: 6700 mg/kg [Rat].

Section 3: Hazards Identification

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

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

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

Serious Skin Contact: Not available.

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

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

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

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

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not available.

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

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

Special Remarks on Fire Hazards: Material in powder form, capable of creating a dust explosion.

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 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. Avoid contact with eyes Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label.

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

Section 8: Exposure Controls/Personal Protection

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

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

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

Exposure Limits:
TWA: 0.2 (mg/m3)
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Solid metallic powder.)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 78.96 g/mole

Color: Not available.

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

Boiling Point: 684.9°C (1264.8°F)

Melting Point: 217°C (422.6°F)

Critical Temperature: Not available.

Specific Gravity: 4.81 (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: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 6700 mg/kg [Rat].

Chronic Effects on Humans: Not available.

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Passes through the placental barrier in animal. Excreted in maternal milk in human.

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

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

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

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Selenium powder : UN2658 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

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

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

Other Classifications:

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

DSCL (EEC): R36- Irritating to eyes.

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. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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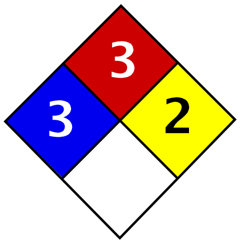

Health	3
Fire	3
Reactivity	2
Personal Protection	E

Material Safety Data Sheet
Sodium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Sodium

Catalog Codes: SLS3505

CAS#: 7440-23-5

RTECS: VY0686000

TSCA: TSCA 8(b) inventory: Sodium

CI#: Not applicable.

Synonym: Natrium

Chemical Name: Sodium

Chemical Formula: Na

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
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US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

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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
Sodium	7440-23-5	100

Toxicological Data on Ingredients: Sodium 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). Hazardous in case of skin contact (permeator), of ingestion, of inhalation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

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

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

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

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

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 115°C (239°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

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

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

Fire Fighting Media and Instructions:
Flammable solid. Moisture reactive material.
SMALL FIRE: Obtain advice on use of water. Use DRY chemical powder.
LARGE FIRE: Use water spray or fog. Do not use water jet.

Special Remarks on Fire Hazards: 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:

Flammable solid that, in contact with water, emits flammable gases.
Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Cover with dry earth, sand or other non-combustible material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal.

Section 7: Handling and Storage

Precautions:
Keep under inert atmosphere. Keep container dry. Do not breathe dust. Never add water to this product In case of insufficient ventilation, wear suitable respiratory equipment If you feel unwell, seek medical attention and show the label when possible. Avoid contact with skin and eyes Keep away from incompatibles such as oxidizing agents, acids, moisture.

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

Section 8: Exposure Controls/Personal Protection

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

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

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

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

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

Odor: Not available.

Taste: Not available.

Molecular Weight: 22.99 g/mole

Color: Silvery.

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

Boiling Point: 881.4°C (1618.5°F)

Melting Point: 97.8°C (208°F)

Critical Temperature: Not available.

Specific Gravity: 0.97 (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.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances:
Highly reactive with oxidizing agents, acids, moisture.
The product reacts violently with water to emit flammable but non toxic gases.

Corrosivity: Not available.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

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

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

Chronic Effects on Humans: Not available.

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Material is destructive to tissue of the mucous membranes and upper respiratory tract.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

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

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 4.3: Material that emits flammable gases on contact with water.

Identification: : Sodium : UN1428 PG: I

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: Sodium
Massachusetts RTK: Sodium
TSCA 8(b) inventory: Sodium
CERCLA: Hazardous substances.: Sodium

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

Other Classifications:

WHMIS (Canada): CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R17- Spontaneously flammable in air.
R38- Irritating to skin.
R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 3

Reactivity: 2

Personal Protection: E

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

Health: 3

Flammability: 3

Reactivity: 2

Specific hazard:

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

Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
-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.

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