
REMEDIAL ACTION WORK PLAN

for

OU-1 AT THE KINGS PLAZA SHOPPING CENTER

5102, 5120 & 5502 Avenue U
Brooklyn, New York

NYSDEC VCP No. A2-0403-9911
NYSDEC Site No. V00323

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CERTIFICATION

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

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



NYS Professional Engineer 076438

8/18/16

Date

A handwritten signature in blue ink, appearing to read "Joel Landes", written over a horizontal line.

Signature

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LIST OF ACRONYMS

Acronym	Definition
AOC	Area of Concern
ASP	Analytical Services Protocol
AST	Aboveground Storage Tank
AWQS	Ambient Water Quality Standards
BCP	Brownfield Cleanup Program
BOA	Brownfield Opportunity Area
CAMP	Community Air Monitoring Program
C/D	Construction/Demolition
CFR	Code of Federal Regulations
CQAP	Construction Quality Assurance Plan
COC	Certificate of Completion
cPAH	Carcinogenic Polycyclic Aromatic Hydrocarbon
CSUL	Comprehensive Subsurface Utility Location
cVOC	Chlorinated Volatile Organic Compound
DER	Division of Environmental Remediation
DMM	Division of Materials Management
DUSR	Data Usability Summary Report
ELAP	Environmental Laboratory Approval Program
EM	Electromagnetic
EPA	United States Environmental Protection Agency
ESA	Environmental Site Assessment
ESI	Environmental Site Investigation
FER	Final Engineering Report
FINDS	Facility Index System/Facility Registry System
GPR	Ground Penetrating Radar
HASP	Health and Safety Plan
IRMWP	Interim Remedial Measures Work Plan

Acronym	Definition
LNAPL	Light, Non-Aqueous-Phase Liquid
MTBE	Methyl Tertiary Butyl Ether
NYCRR	New York Codes, Rules and Regulations
NYCDEP	New York City Department of Environmental Protection
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	Department of Transportation
ORC	Oxygen Release Compound
OSHA	United States Occupational Safety and Health Administration
PAH	Polycyclic Aromatic Hydrocarbon
PBS	Petroleum Bulk Storage
PCB	Polychlorinated Biphenyls
PCE	Tetrachloroethene
PID	Photoionization Detector
PPE	Personal Protective Equipment
ppm	Parts per million
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QEP	Qualified Environmental Professional
QHD	Queens Highway Datum
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCA	Recycled Concrete Aggregate
RCRA	Resource Conservation and Recovery Act
REC	Recognized Environmental Condition
RI	Remedial Investigation
RIR	Remedial Investigation Report
SCO	Soil Cleanup Objective

Acronym	Definition
SEQRA	State Environmental Quality Review Act
SMD	Submembrane Depressurization System
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System
SQG	Small Quantity Generator
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCE	Trichloroethene
TCL	Target Compound List
TOGS	Technical and Operational Guidance Series
USGS	United States Geological Survey
UST	Underground Storage Tank
VCP	Voluntary Cleanup Program
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

This Remedial Action Work Plan (RAWP) was prepared by Langan Engineering, Environmental, Surveying, and Landscape Architecture, D.P.C. (Langan) on behalf of Macerich Management Company, LLC (Macerich). Macerich (the owner) entered into a Voluntary Cleanup Agreement (VCA) with the New York State Department of Environmental Conservation (NYSDEC) following the 2012 purchase of the Kings Plaza Shopping Center from the original volunteer (Vornado Realty Trust). The Kings Plaza Shopping Center (also known as “the mall”) encompasses approximately 31 acres and consists of three tax lots (Block 8470, Lot Nos. 50, 55, and 114) located at 5102, 5120, and 5502 Avenue U in the Borough of Brooklyn, Kings County, New York. The VCA addresses one operable unit (OU-1) the Site, located on the eastern side of Lots 50 and 55. OU-1 is approximately 0.96 acres and encompasses the central and southern portions of the East 55th Street mall access road and is bound by OU-2 to the north, Mill Basin, which connects with Jamaica Bay, to the south, the mall building to the west, and the Lowe’s building to the east. OU-2, which is not included in this RAWP is approximately 0.22-acres and encompasses the northern portion of the East 55th Street mall access road and is bound by Avenue U to the north, OU-1 to the south, the mall building to the west, and the Lowe’s building to the east. OU-1 is also referred to herein as the Site. The Site is currently subject to the Voluntary Cleanup Program (VCP) agreement number A2-0403-9911 and two amendments from 2009 and 2014, and a Stipulation agreement for Spill No. 06-03800. Macerich and Vornado Realty Trust are both Volunteers in the VCP. Spill No. 06-03800 was closed by NYSDEC on 6 July 2006.

This RAWP summarizes the nature and extent of contamination as determined from data gathered during previous investigations at OU-1. The RAWP recommends chlorinated volatile organic compound (cVOC) source removal, chemox polishing, a site-wide asphalt cap, and monitored natural attenuation for addressing impacted soil, groundwater, and soil vapor within the Site boundaries. The remedy described in this document is consistent with the procedures defined in DER-10 and complies with all applicable standards, criteria, and guidance. The remedy described in this document also complies with all applicable Federal, State and local laws, regulations and requirements.

Site Description/Physical Setting/Site History

The site consists of approximately 620-linear feet of asphalt paved road (East 55th Street), concrete sidewalks, and truck ramp, located on the eastern portion of the mall property. The site is bound by Avenue U (OU-2) to the north, Lowes Home Improvement Center to the East, Mill Basin to the south and the Kings Plaza Mall to the west. The mall is located at 5102, 5120,

and 5502 Avenue U in the Borough of Brooklyn, Kings County, New York. The lot at 5102 Avenue U (Block 8470, Lot 50) is improved with a parking garage, a mall office, and a marina store. The lot at 5120 Avenue U (Block 8470, Lot 55) is improved with a two to four-story building with retail shops, a parking garage, a power plant, a water treatment facility, and concrete walkways. The lot at 5502 Avenue U (Block 8470, Lot 114) is improved with a one-story Lowe's Home Improvement building and associated asphalt parking. The Site has approximately 900 feet of frontage along Avenue U and 1,000 feet of frontage along Flatbush Avenue. A Site Location Map and Site Plan are provided as Figures 1 and 3, respectively.

The finished floor elevation of the Mall building ranges from approximately el 10.8-feet¹ along Avenue U (north side of the Site) to approximately el 11.7-feet along the southern portion of East 55th Street (south side of Site) (NAVD 88 datum). Entrances to the first floor of the Mall building are located along East 55th Street and Avenue U. The elevation of the Site is approximately el 8-feet (NAVD 88 datum).

Land use within a half mile of the site is highly urbanized. Surrounding use within a half-mile radius includes residential and commercial properties, the Mill Basin waterway cross streets and avenues, residential neighborhoods, and park land. In general, historical uses of the Site included an oil terminal, manufacturing of plastics, auto repair and a gas station.

OU-3, at 5502 Avenue U is subject to a NYSDEC stipulation agreement under the Spills Program (Spill Nos. 98-15289, reported on March 25, 1999), Spill No. 08-13330, reported on March 11, 2009, and Spill No. 09-04813, reported on July 24, 2009). Remediation of these spills is not subject to the VCA and is not included in this RAWP.

Summary of the Remedial Investigations

The Supplemental Remedial Investigation (SRI) and Soil Vapor Investigation (SVI) for the Site were completed by Langan between August 19, 2013 through March 27, 2014. The SRI and SVI field program included the following:

1. Advancement of 20 soil borings in a grid around MW-39 and collection of 56 grab soil samples for laboratory analyses;
2. Installation of 2 down-gradient groundwater monitoring wells;

¹ ELEVATIONS ARE PRESENTED IN NORTH AMERICAN VERTICAL DATUM 1988.

3. Gauging of all Site monitoring wells to determine groundwater flow direction;
4. Collection of 13 groundwater samples from the new and existing monitoring wells for laboratory analyses;
5. Installation of 8 permanent exterior and 6 permanent interior soil vapor points and the collection of 14 vapor samples, 4 indoor air samples and ambient air samples;
6. Implementation of an LNAPL extraction pilot study, which included the monthly extraction of LNPL from all OU-1 wells with measurable LNAPL and a subsequent assessment of product extraction and feasibility;
7. Completion of a fish and wildlife exposure assessment;
8. Implementation of a tidal fluctuation study.

Summary of the Remedial Investigation Findings

- Stratigraphy: Three stratigraphic units were evaluated during this SRI within the chlorinated volatile organic compounds (cVOC) delineation area: historical fill, a native sand layer, and an organic clay layer. The historical fill extends to depths of up to approximately 10 feet below ground surface (bgs) and is comprised of a brown, fine to coarse grained sand with some silt, some gravel, and trace anthropogenic materials (i.e., coal, brick, concrete, wood, and metal). The underlying sand layer is approximately 2 to 10 feet thick and primarily comprised of gray-brown fine to medium sand with some silt, trace gravel and shell fragments. Finally, an organic clay layer was observed at approximately 10 to 12 feet bgs in the cVOC source area delineation zone. The clay unit is interrupted by fine sand lenses at various depths. The clay unit was not encountered during the installation of two monitoring wells (LMW-1 and LMW-2) near the Mill Basin waterway (see Appendix B – Figure 9).
- Hydrogeology: Groundwater underlying the Site ranged from approximately el -0.24 to el 4.02 (10.85 to 6.06 feet bgs). Based on a groundwater contour map derived from the March 2014 measurements, local groundwater flow is estimated to flow to the south toward the Mill Basin.
- Chlorinated VOC Impacts: Source areas of cVOC-impacted soil were identified during the SRI at a majority of soil boring locations. Chlorinated VOC-impacted soil extends to an average depth of 12 feet bgs. Field screening of soil cores indicated the potential presence of dense non-aqueous phase liquid (DNAPL) in soil boring SB06; however, well gauging with an oil-water interface probe, sounding the well bottom, and analytical data from soil samples did not reveal the presence of DNAPL at the Site. Although DNAPL does not appear to exist within the overburden, cVOC impacts in overburden soil and groundwater samples indicate residual cVOC source material may be present and bound within the clay layer.

- Petroleum Impacted Groundwater: Light non-aqueous phase liquid (LNAPL) was encountered in multiple monitoring wells (see Appendix B – Table 2) during installation and sampling activities at OU-1 and approximately 27 gallons of LNAPL was removed during seven monthly extraction events. Based on measurable volumes, it is our opinion that LNAPL extraction is reaching its limits of effectiveness as discussed in more detail in section 2.1.6.
- Groundwater Impacts: cVOCs and petroleum concentrations exceeded TOGS AWQS.
 - a. Interpolation of groundwater results indicated that cVOC impacts are isolated near monitoring wells MW-39 and ERF-12, which are located within the cVOC source area, with no significant lateral migration. Petroleum-impacted groundwater was encountered throughout OU-1 but does not appear to be migrating into Mill Basin as discussed in more detail in section 2.1.6.
 - b. The clay layer's lower permeability and higher organic content is likely retarding the downward migration of cVOC impacts as discussed in more detail in section 2.1.6.
 - c. The presence of dichloroethene (DCE) isomers and vinyl chloride in groundwater indicates that natural attenuation of tetrachloroethene (PCE) and trichloroethene (TCE) via reductive dechlorination is occurring.
- Exterior Soil Vapor Impacts: Exterior subsurface soil vapor results show the presence of chlorinated and petroleum-related VOCs above ambient air sample results. Soil vapor concentrations are not a concern within OU-1 because OU-1 is a roadway with no occupied structures and is covered by a permeable surface.
- Interior Soil Vapor Impacts: Sub-slab soil vapor results within the mall building show the presence of cVOCs in soil vapor at concentrations exceeding New York State Department of Health (NYSDOH) Air Guidance Values (AGVs); however, indoor air quality samples did not identify concentrations exceeding NYSDOH AGVs, indicating that a complete pathway is not present.
- The results of the Fish and Wildlife Impact Assessment (FWIA) indicate that it is unlikely that petroleum and cVOC-impacted groundwater at OU-1 is causing adverse effects on fish and wildlife resources because of the lack of exposure pathways and the low ecological value of adjacent aquatic resources (i.e. aquatic plants, invertebrates, and vertebrates) present in the Mill Basin.
- Sufficient analytical data was gathered during this SRI and SVI to establish site-specific soil cleanup levels and to develop a remedy for the site. The remedy is described and evaluated in this RAWP. The remedy for the site will address fill impacted with cVOCs; groundwater impacted with cVOCs, and petroleum compounds; and, soil vapor impacted with VOCs and petroleum compounds.

Qualitative Human Health Exposure Assessment

Complete exposure pathways have the following five elements: (1) a contaminant source, (2) a contaminant release and transport mechanism, (3) a point of exposure; (4) a route of exposure, and (5) a receptor population. An analysis of each element is discussed below for OU-1 and OU-2. Based on the conceptual site model and the review of environmental data, there is potential exposure for indoor air; however, this risk can be mitigated through continued monitoring and by sealing cracks in the adjacent building's concrete floors. No complete on-site or off-site exposure pathways appear to be present at OU-1, OU-2 and in adjacent buildings for soil and groundwater.

Current Conditions

Contaminant sources include historical fill with varying levels of semivolatile organic compounds (SVOCs), historical releases of petroleum and chlorinated VOCs that are impacting groundwater, and petroleum and chlorinated VOCs in soil vapor. Contaminant release and transport mechanisms include volatilization of contaminants from the soil and groundwater matrices to the soil vapor phase, and existing soil vapor contaminants. There is a low risk of exposure under current conditions. Exposure to dust is limited by the site cover consisting of asphalt, concrete slab and the Site building. The site surface cover prevents contact with soils, groundwater is not currently accessible and soils are not currently being disturbed except during investigation.

Construction/Remediation Activities

During remediation activities, points of exposure include disturbed and exposed contaminated soil during excavation, dust and organic vapors generated during excavation activities, and contaminated groundwater that will be encountered during excavation and dewatering operations. Routes of exposure include ingestion and dermal absorption of contaminated soil and groundwater, inhalation of organic vapors arising from contaminated soil and groundwater, and inhalation of dust arising from contaminated soil. The receptor population includes the construction and remediation workers and, to a lesser extent, the public adjacent to the Site. All five elements exist; therefore, the potential for completed exposure pathways is present. However, the risk can be avoided or minimized by applying appropriate health and safety measures, such as monitoring the air for organic vapors and dust, using vapor and dust suppression measures, maintaining Site security, and wearing the appropriate PPE.

In accordance with a HASP, a Soil/Materials Management Plan, and a CAMP, measures such as conducting an air-monitoring program, donning PPE, and applying vapor and dust suppression

measures to prevent off-site migration of contaminants during construction will be implemented. Such measures would prevent completion of these potential migration pathways.

Proposed Future Conditions

For the proposed future conditions, some residual contaminants may remain and may include those listed under current conditions. Contaminant release and transport mechanisms include volatilization of contaminants from soil vapor or the groundwater matrix to the soil vapor phase. If institutional and/or engineering controls are not implemented, points of exposure include potential cracks in the foundation or lower-level slab of the proposed development. Routes of exposure may include inhalation of vapors entering the building; these routes may not exist depending on the effectiveness of the remediation. The receptor population includes the building tenants and customers. The possible routes of exposure will be avoided or mitigated by the impermeable (concrete and asphalt) Site cap and institutional and engineering controls.

The following conclusions were developed from the human health exposure assessment:

- There is a low risk of exposure under current conditions. Exposure to dust from contaminated soil is eliminated by the site cover, which consists of asphalt, concrete slab and the Site building. There is a moderate risk of exposure during remediation activities. This risk can be avoided or minimized by following the appropriate health and safety, vapor and dust suppression, and Site security measures.
- The existence of a complete exposure pathway for Site contaminants to human receptors under future conditions is unlikely, as cVOC source soil will be excavated and transported to an off-site disposal facility, residual petroleum impacts will be isolated by an asphalt cap, groundwater is not currently used as a potable water source locally and future use is unlikely without regulatory oversight, and the potential pathway for soil vapor intrusion into the building will be addressed through a vapor mitigation system and continued monitoring.
- It is unlikely that a complete exposure pathway exists for the migration of site contaminants to off-site human receptors for current, remediation phase, or future conditions. Monitoring and control measures would be used during remediation to prevent completion of this pathway. Under future conditions, the site will be remediated and institutional and engineering controls will be implemented to prevent completion of this pathway.

Summary of the Remedy

The RAWP will be executed by accomplishing the following tasks:

1. Excavation and off-site disposal of soils exhibiting visual and olfactory indications of gross impacts within the previously delineated cVOC area. The existing asphalt surface cover will be demolished to facilitate excavation;
2. If encountered (as contingency plan); removal of any underground storage tanks (USTs), fuel dispensers, underground piping or other structures associated with a source of contamination;
3. Localized dewatering, if required, will be treated as necessary prior to discharge to the municipal sewer system;
4. Collection and analysis of documentation soil samples to document residual soil conditions;
5. In-situ chemical oxidation (ISCO) in the excavation area to polish residual soil and groundwater impacts;
6. Importing of soil to be used for backfill in compliance with this plan and in accordance with applicable laws and regulations. Imported soil will be sampled and analyzed in accordance with NYSDEC DER-10 Section 5.4 prior to import to the Site, and will meet Restricted Commercial Use SCOs. Recycled concrete aggregate (RCA) and imported virgin stone will not be sampled.
7. Development and implementation of plans for the protection of on-site workers, community, and environment during remediation and construction activities;
8. Installation of a vapor mitigation system beneath the sidewalk along the western side of East 55th Street to mitigate residual soil vapor;
9. Monitoring for soil vapor intrusion in adjacent occupied buildings owned by the volunteer will be performed during and after the treatment phase;
10. Monitored natural attenuation sampling for impacted groundwater.
11. Implementation of a passive oil recovery program in select Subject Property monitoring wells, utilizing oil absorbent socks;
12. Management and maintenance of the existing Site cover system consisting of asphalt pavement and sidewalks;
13. Implementation of long-term Institutional Controls in the form of an Environmental Easement and Site Management Plan.

1.0 INTRODUCTION

This Remedial Action Work Plan (RAWP) was prepared by Langan Engineering, Environmental, Surveying, and Landscape Architecture, D.P.C. (Langan) on behalf of Macerich Management Company, LLC (Macerich), for Operable Unit 1 (OU- 1), which is located on the eastern side of the Kings Plaza Shopping Center, also known as the mall driveway (the "Site"). The mall is located at 5102, 5120, and 5502 Ave. U, borough of Brooklyn, Kings County, NY, identified as Block 8470, Lot Nos. 50, 55, and 114. OU-1 and OU-2 are located on the eastern portion of Lot Nos. 50 and 55. OU-1 is approximately 0.96-acres and encompasses the central and southern portions of the East 55th Street mall access road, and is bound by OU-2 to the north, Mill Basin, which connects with Jamaica Bay, to the south, the mall building to the west, and the Lowe's building to the east. OU-2 is located off-site and is approximately 0.22-acres and encompasses the northern portion of the East 55th Street mall access road, and is bound by Avenue U to the north, OU-1 to the south, the mall building to the west, and the Lowe's building to the east.

This RAWP summarizes the nature and extent of contamination as determined from data gathered during the Remedial Investigation (RI), performed between August 2013 and March 2014. The RAWP recommends a chlorinated volatile organic compound (cVOC) source removal, chemox polishing, a site-wide asphalt cap, and monitored natural attenuation for addressing impacted soil, groundwater and soil vapor within the Site boundaries. The remedy described in this document is consistent with the procedures defined in DER-10 and complies with all applicable standards, criteria and guidance. The remedy described in this document also complies with all Federal, State and local laws, regulations and requirements.

Per DER-10 Section 3.10, a Fish and Wildlife Resources Impact Analysis (FWRIA) has been performed and can be found in Section 2.1.6. This RAWP includes appropriate measures for delineating and protecting the identified resource and for monitoring construction related impacts consistent with DER-10 FWRIA Part 3. These resources are identified on remedial drawings. The NYSDEC Regional Division of Fish and Wildlife and Marine Resources and the NYS Natural Heritage Program will be contacted, as defined in DER-10, and, at a minimum, all substantive technical requirements for applicable resource related permits (e.g. 6 New York Codes, Rules and Regulations (NYCRR) Parts 608, 661, 663) will be met.

1.1 Site Location and Description

The site consists of approximately 620-linear feet of asphalt paved road (East 55th Street), concrete sidewalks, and truck ramp, located on the eastern portion of the Kings Plaza Shopping Center. The Kings Plaza Shopping Center, an approximately 31-acre parcel of land consisting of three tax lots;

Block 8470, Lot 50 - 5102 Avenue U (Map 23B improved with a parking garage, a mall office, and a marina store.)

Block 8470, Lot 55 - 5120 Avenue U (Map 23B) improved with a two to four-story mall building, a parking garage, a power plant, a water treatment facility, and concrete walkways

Block 8470, Lot 114 - 5502 Avenue U (Map 23B improved with a one-story Lowe's building and associated asphalt parking lot

There are no changes proposed for the current development. A Site Location Map and Site Plan are provided as Figures 1 and 3, respectively. The Site survey is provided in Appendix A.

The finished floor elevation of the Mall building ranges from approximately el 10.8 along Avenue U (north side of the Site) to approximately el 11.7 along the southern portion of East 55th Street (south side of Site) (NAVD 88 datum). Entrances to the first floor of the Mall building are located along East 55th Street and Avenue U.

1.2 Description of Surrounding Property

Land use within a half mile of the site is highly urbanized. Surrounding use within a half-mile radius includes residential and commercial properties, the Mill Basin waterway cross streets and avenues, residential neighborhoods, and park land.

The nearest ecological receptor is the Mill Basin waterway, which connects with Jamaica Bay, abutting the site to the south. The nearest sensitive receptor is a park located approximately 250 feet south of the site. An Area Land Usage map showing ecological and sensitive receptors is provided as Figure 2 and summarized in the table below.

#	Name	Address
1	Marine Park (Community Park)	Located between Shore Parkway, Avenue U, Gerritsen Avenue, and Flatbush Ave
2	Monsignor Crawford Field (Recreation Field/Courts)	Avenue U between East 58 Street, East 59 Street, and East 60 Street
3	Lindower Park (Community Park)	Strickland Avenue between Mill Avenue and East 60 Place

There is no school, day care facility, or hospital within a half mile of the site. Additionally, the online NYSDEC Environmental Resource Mapper identifies approximately one-mile radius of the site as containing rare plants and/or rare animals. An area of significant natural communities is located approximately 0.75 miles to the east of the site. The RI for this Site indicates that it is unlikely that petroleum and chlorinated volatile organic compound (cVOC)-impacted groundwater at the site is causing adverse effects on fish and wildlife resources because of the lack of exposure pathways and the low ecological value of adjacent aquatic resources present in the Mill Basin.

1.3 Site History

1.3.1 Past Uses and Ownership

According to a February 2013 Phase I Environmental Site Assessment (ESA), the southern portion of the Kings Plaza Shopping Center was part of Mill Creek in 1907. The northern portion of the shopping center included approximately 300 linear feet of East 52nd Street through East 58th Street and an area labeled as bulkhead. The area was backfilled and the Standard Oil Company of New York was developed east of OU-1 and OU-2 in approximately 1930. OU-1 and OU-2 were developed as a plastic resins manufacturing facility operated by Presto Plastics from approximately 1940 until the late 1960's. Presto Plastics manufactured various plastic products such as plastic film, polyvinyl chloride (PVC) sheeting, and laminates, and the operations likely included the use of

solvents. In addition, the southern portion of OU-1 was utilized as a garage and an auto repair facility circa 1950. OU-1 and OU-2 have been used as an asphalt-paved roadway for the Kings Plaza Shopping Center since the late 1960's.

1.3.2 Previous Environmental Reports

Langan prepared the following reports for the Subject Property:

- Phase I ESA of Kings Plaza Shopping Center, February 8, 2013;
- Supplemental Remedial Investigation Work Plan for OU-1 at Kings Plaza Shopping Center, August 1, 2013;
- Supplemental Remedial Investigation (SRI) Report for OU-1 at Kings Plaza Shopping Center, May 23, 2014; and,
- Monthly Progress Reports OU-1, OU-2 and OU-3, , Inc., dated March 2013 through May 2015;

The following previous environmental reports were reviewed and summarized in the February 8, 2013 Phase I and the May 23, 2014 SRI Report, provided in Appendix C:

- Contamination Assessment/Site Investigation, prepared by IVI Environmental, Inc., July 29, 1997;
- Phase III Underground Storage Tank Closure and Replacement for the Underground Storage Tank Area Operable Unit No. 1, prepared by IVI Environmental, Inc., April 24, 2000;
- Remedial Investigation Report (RIR) Addendum and Remedial Action Work Plan (RAWP) Addendum, prepared by Excel Environmental Resources, Inc. (Excel), September 2004;
- Emergency Response Report OU-1 UST's, prepared by Excel Environmental Resources, Inc., January 2007;
- Emergency Action Interim Remedial Measures Report, prepared by Excel Environmental Resources, Inc., August 2007;
- Remedial Action Progress Report Kings Plaza Shopping Center (OU-1), prepared by Excel Environmental Resources, Inc., July 2008;
- Interim Remedial Action Report In-Situ Groundwater Remediation at MW-39 (OU-1), prepared by Excel Environmental Resources, Inc., August 2008; and

- Draft Remedial Action Work Plan, prepared by Excel Environmental Resources, Inc., June 2010;
- Phase I ESA of Kings Plaza Shopping Center prepared by Certified Environments Inc., July 27, 2012; and,
- Monthly Progress Reports OU-1, prepared by Excel Environmental Resources, Inc., dated July 2010 through January 2012.

1.3.2.1 OU-1 Fuel Oil Releases

A brief summary of the Fuel Oil Release and associated investigation is presented below:

- Based on Langan's initial site reconnaissance on April 17, 2013, measurable light non-aqueous phase liquid (LNAPL) was identified in 10 of 27 monitoring wells in OU-1 (EFR-2, EFR-4, EFR-5, EFR-11 HV-2, HV-3, HV-5, MW-3, MW-21, and MW-35);
- Petroleum impacts at OU-1 resulted from a release of #2 fuel oil from multiple historical 15,000-gallon USTs that were previously located along East 55th Street on the northwest corner of the Kings Plaza Shopping Center. Fuel oil was discovered in groundwater monitoring wells during the July 1997 contamination assessment/site investigation completed by IVI. This study led to the remediation and removal of six 15,000-gallon USTs in this area and enrollment of the site into the VCP. Approximately 750 tons of impacted soil was removed and disposed of off-site; however, some impacted soil was left in place due to proximity to the mall structure. Four new 15,000 gallon USTs were installed in the previous tank areas and a high vacuum dual-phase extraction system was installed to address residual LNAPL on the water table;
- In 2006, a second fuel oil release occurred when the replacement UST system failed (NYSDEC Spill No. 0603800). These USTs were removed along with approximately 3,850 tons of petroleum-impacted soil and 35,000 gallons of groundwater and LNAPL. Spill No. 06-03800 was closed by NYSDEC on 6 July 2006;; and

- Remedial activities associated with the VCP were conducted by Excel until November 2012. These remedial activities consisted of bi-weekly dual phase vacuum extraction of LNAPL and associated water from impacted monitoring wells. According to available records, approximately 15,694 gallons of LNAPL and water have been recovered from wells within OU-1 between 2006 and 2012. The individual volumes of recovered LNAPL and water are unknown.

1.3.2.2 OU-1 Chlorinated Solvent Release

A brief summary of the investigations associated with the cVOC release at OU-1 is presented below:

- cVOCs were first reported by IVI in July 1997 in their Contamination Assessment/Site Investigation report. cVOCs, including cis-1,2-dichloroethene (cDCE) and vinyl chloride (VC), were reported in a groundwater sample at concentrations exceeding the NYSDEC Division of Water Technical and Operation Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards (AWQS) for Class GA groundwater in one monitoring well (MW-1) located in the southern portion of OU-1;
- In 2003 and 2004, one or more cVOCs, including tetrachloroethylene (PCE) and several of its daughter products, were reportedly identified in groundwater above NYSDEC TOGS 1.1.1 AWQS in five monitoring wells (MW-1, MW-11, MW-20, MW-37, and MW-39) in OU-1 (Excel, September 2004). The highest concentrations of cVOCs were observed in MW-39 (results dated August 11, 2004):
 - PCE – 11,000 micrograms per liter (µg/L)
 - TCE – 6,800 µg/L
 - cDCE – 13,000 µg/L
 - VC – 3,200 µg/L
- In June 2003, Excel conducted an additional subsurface investigation, which included 14 soil borings, to delineate the source of cVOCs in shallow soil near MW-39. The detected concentration of TCE was above the Technical

and Administrative Guidance Memorandum 4046 (TAGM) Recommended Soil Cleanup Objective (RSCO), the applicable standard at the time of the investigation, in one soil boring (39-4) at a concentration of 3.2 milligrams per kilogram (mg/kg). Excel concluded that there was no evidence of top-down discharge and no indication that the cVOC impacts were associated with recent mall operations.

- In June 2005, Excel injected RegenOx™, a chemical oxidation product, in five borings near MW-39 at depths ranging between 15 to 18 feet below grade surface (bgs), which correspond to the top of the confining clay layer (Excel, August 2008). A second chemical oxidation injection event was conducted in August 2005 and RegenOx™ was injected in 14 borings near MW-39. Excel conducted seven rounds of groundwater sampling following the injections to monitor for the natural attenuation of cVOCs. The results of groundwater samples collected in March 2006 (last sampling event) reportedly indicated that concentrations of TCE (780 µg/L) and PCE (3,100 µg/L) have decreased in MW-39; however, daughter products, including cDCE have increased (26,000 µg/L) compared to pre-injection levels. Excel interrupted the in-situ chemical oxidation of cVOC-impacted soil and groundwater following the March 2006 sampling event after the second oil spill occurred within OU-1 in March 2006 due to the presence of LNAPL near MW-39, which would have preferentially oxidized the spilled petroleum product rather than the dissolved cVOCs.

1.3.2.3 OU-2 Historical Fill

According to the July 2012 Phase I Environmental Site Assessment (ESA) of the Kings Plaza Shopping Center by Certified Environments Inc., the Presto Plastics Products Company, Inc. and its successors occupied OU-2 from the early 1940's until the mid-1960's and reportedly stored hazardous chemicals in USTs. According to the July 29, 1997 Contamination

Assessment/Site Investigation Report by IVI Environmental, Inc. (IVI), approximately 20 railroad tankers (50 feet long by 10 feet wide) used for storage of petroleum and/or chemical storage were uncovered and removed from the site in 1969. The tankers were reportedly buried in the vicinity of the Macy's building and East 55th Street.

IVI and Excel conducted numerous subsurface investigations throughout the site between 1997 and 2003. These investigations were documented in multiple reports summarized in the Remedial Investigation Report (RIR)/Remedial Action Workplan (RAW) for the Former Presto Plastics Facility, OU-2, prepared by Excel and dated April 2001. Based on the results of the investigations:

- Historical fill, which exceeded NYSDEC TAGM (and exceeds current Part 375 reuse criteria) levels for semi-volatile organic compounds (SVOCs), specifically Polycyclic aromatic hydrocarbons (PAHs), and meets the NYSDEC definition of historic fill, was identified under OU-2 up to approximately 10 feet below grade surface (bgs); and
- Groundwater slightly exceeded NYSDEC Division of Water Technical and Operation Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards (AWQS) and guidance values for Class GA water for SVOCs at OU-2.

1.3.2.4 Supplemental Remedial Investigation, August 2013 – March 2014

The SRI was implemented between August 19, 2013, and March 27, 2014 in order to:

- Evaluate current site conditions;
- Delineate cVOC-impacted soil, groundwater and soil vapor; and
- Evaluate the extractability of LNAPL present in the subsurface.

The results of the SRI are described in Section 2.

1.3.3 Sanborn Maps

All Sanborn Maps available for this Site were reviewed prior to preparation of the RAWP. Review of the features shown on the Sanborn Maps are described in the February 8, 2013 Phase I ESA and are consistent with the Site history provided in this RAWP. The Sanborn Maps are provided as Appendix E of the Phase I ESA (Appendix C).

1.4 **Significant Threat Determination**

The SRI Report was submitted for review by NYSDEC and the New York State Department of Health (NYSDOH) on May 23, 2014. NYSDEC and NYSDOH have not confirmed a significant threat determination for the site; however, they have determined that the potential for vapor intrusion exists for the mall. This RAWP includes installation of a vapor mitigation system. The SRI Report was approved by NYSDEC on April 24, 2015.

2.0 **DESCRIPTION OF REMEDIAL INVESTIGATION FINDINGS**

Langan conducted a remedial investigation between August 19, 2013, and March 27, 2014 to characterize the nature and extent of contamination at the Site. Investigation activities included a geophysical survey, soil boring advancement, monitoring well installation, soil vapor probe installation, and collection of soil, groundwater and soil vapor samples.

The RI was conducted in general accordance with the NYSDEC-approved SRIWP and SVIWP, the NYCRR Title 6 Part 375 (6 NYCRR Part 375), the NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation (May 2010), and NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006). Previous investigations reference TAGM standards; however, 6 NYCRR Part 375 currently governs the site.

2.1 **Field Investigation**

The RI consisted of the following:

- Completion of a ground penetrating radar (GPR) survey to locate subsurface utilities within the investigation area;

- Advancement of 20 soil borings near MW-39 to delineate the cVOC-impacted area;
- Visual, photoionization detector (PID), field screening of soil, and collection of soil samples from each boring for laboratory analysis;
- Installation of two down-gradient groundwater monitoring wells in the southern portion of OU-1 and collection of groundwater samples from up to 13 new and existing monitoring wells within OU-1 and OU-2;
- Installation of eight permanent soil vapor points on the sidewalks adjacent to the Macy's, Kings Plaza Shopping Center, and Lowe's buildings and collection of one soil vapor sample from each point;
- Installation of six permanent sub-slab soil vapor points in the interior of the mall building adjacent OU-1 and collection of one soil vapor sample from each point with accompanying four indoor air and ambient air samples;
- Survey of soil borings, monitoring wells, and OU-1 soil vapor points and gauging of monitoring wells to determine groundwater flow and contour;
- Implementation of an LNAPL extraction pilot study consisting of the monthly extraction of LNAPL from all OU-1 wells with measurable LNAPL using a submersible pump or peristaltic pump;
- Completion of a fish and wildlife exposure assessment;
- Implementation of a tidal fluctuation study;
- Assessment of product extraction and feasibility; and
- Completion of a SRI Report.

2.1.1 Utility Mark Out and Geophysical Investigation

Prior to the start of any subsurface work, the drilling contractor, Eastern Environmental Solutions, Inc. (Eastern) of Manorville, New York, contacted the New York City One-Call Center and requested a utility mark-out to locate buried utilities within the sidewalk and streets surrounding the site. Eastern was not required to obtain New York City Department of Transportation (NYCDOT) permits to drill in the roadway and on the sidewalks of East 55th Street because this portion of the road is within the mall property.

NOVA Geophysical Services, Inc. (NOVA) of Mineola, New York conducted a geophysical investigation under the supervision of a Langan environmental field engineer. The survey included GPR and

electromagnetic detector (EM) equipment to investigate for the presence of USTs and locate buried utilities in the vicinity of each boring location. Borings were relocated as necessary to avoid subsurface utilities and anomalies (i.e. other subsurface impediments).

2.1.2 Drilling and Soil Logging

The soil investigation included 20 environmental delineation soil borings (SB01 through SB17, SB19, SB21, and SB22) in the southern part of OU-1 to delineate the source area of chlorinated solvents around MW-39. The borings were completed by Eastern under Langan supervision using a Geoprobe® 6610 DT Track Rig on August 26 and 27, 2013. The borings were completed using a step-out method based on field observations (visual, olfactory, and PID measurements) to depths of approximately 15 feet bgs. As a result of the step-out method, borings SB21 and SB22 were completed in the western and northwestern corner of the site instead of proposed soil borings SB18 and SB20, which were not completed because field observation did not indicate the presence of impacted soil in the nearby delineation borings. Soil boring locations are shown in Appendix B (Figure 3).

2.1.2.1 Soil Sampling Methodology

Soil samples were collected continuously from each boring in 5-foot dedicated acetate Macro-Core® sleeves to a depth of approximately 15 feet bgs. Four field-screening techniques were used to qualitatively determine the presence of cVOC-impacts and dense non-aqueous phase liquid (DNAPL) in soil. These techniques consisted of visual assessment, olfactory screening, PID monitoring, and hydrophobic-dye testing. Visual assessment was used to detect staining or discoloration of soil cores. Olfactory screening was used to identify odors that could indicate cVOC impacts. A MiniRAE 2000 PID was used to measure total organic vapor (TOV) concentrations in soil. The PID was equipped with an 11.7 electron-volt lamp. OIL-IN-SOIL™ field-screening test kits were used to detect the presence of DNAPL on soil samples. OIL-IN-SOIL™ test kits contain a surfactant-impregnated, SUDAN IV (red dye) that changes color in the presence of DNAPL. Shake

tests using the OIL-IN-SOIL™ field-screening test kit were performed on soil that had visual or olfactory evidence of contamination or on soil that displayed elevated TOV concentrations, and according to the manufacturer's directions. Boring logs that document these observations were included as Appendix E of the SRIR.

2.1.2.2 Environmental Soil Sampling Analytical Program

Fifty-six grab soil samples, including three duplicate samples, were collected from the 20 soil borings, and analyzed for 6 NYCRR Part 375 VOCs via United State Environmental Protection Agency (USEPA) method 8260B. Soil samples were collected into laboratory-supplied EnCore™ samplers, and were picked up and delivered via courier service to Test America Laboratories, Inc. (Test America), a New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP)-certified laboratory in Edison, New Jersey under standard chain-of-custody protocol.

A summary table showing soil samples and corresponding analysis is provided in Appendix B (Table 1). Laboratory Analytical Services Protocol category B (ASP-B) data packages and chain-of-custody documentation were provided in Appendix F of the SRIR.

2.1.3 Groundwater Monitoring

Two monitoring wells, LMW-1 and LMW-2, were installed in the southern portion of OU-1 on August 20, 2013 and were screened across the water-table interface. LMW-1 and LMW-2 were constructed with a 2-inch-diameter 5-foot polyvinyl chloride (PVC) sump threaded to 10 feet of 0.01-inch slot screen and riser to surface. Clean sand (Morie #2) was used to fill the annulus around the well screen to approximately two feet above the top of the screened interval. A bentonite seal was then placed above the sand and the remaining borehole annulus was filled using clean sand (Morie #2). Monitoring wells were finished with a locking well cap and flush-mounted manhole covers.

Monitoring well locations are depicted in Appendix B (Figure 3). Monitoring well construction logs were provided in Appendix G of the SRIR.

2.1.3.1 Monitoring Well Development

LMW-1 and LMW-2 were developed on August 21 and 23, 2013. Prior to development, monitoring wells were gauged for the presence of LNAPL and/or DNAPL using a Solinst oil-water interface probe. The monitoring wells were mechanically surged from the bottom to the top of the screened interval with either a Proactive SS Monsoon submersible pump or a Waterra Hydrolift pump combined with a surge block to agitate and remove fine particles. The wells were considered developed when a minimum of three well volumes were removed, the water-quality parameters (pH, temperature, conductivity, reduction oxidation potential [ORP], and dissolved oxygen [DO]) were stable, and the turbidity was below 50 Nephelometric Turbidity Units (NTUs). Wells were allowed to equilibrate for approximately one week prior to sampling.

Well-development logs were provided as Appendix H of the SRIR.

2.1.3.2 Synoptic Groundwater Gauging

Nine synoptic groundwater gauging events were performed between August 19, 2013 through March 18, 2014. The depth-to-water (DTW) was measured with an oil-water interface probe to the nearest 0.01 foot. Water levels were recorded and converted to elevations relative to North American Vertical Datum of 1988 (NAVD88) for groundwater contouring purposes. The thickness of LNAPL (if present) and the depth to the bottom of each well was also measured.

DTW measurements, groundwater elevations and depth of petroleum product for each event are provided in Appendix B (Table 2). Groundwater contour maps based on measurements collected during the October 2013 through March 2014 gauging events are presented as Figures 5A through 5G of the SRIR.

2.1.3.3 Groundwater Sampling

Three quarterly groundwater monitoring events were performed during the SRI. The first round of groundwater samples was collected between August 28 and September 3, 2013, at least one week after the new monitoring wells were developed. The second and third groundwater sampling events were conducted on December 3 and 4, 2013, and on March 19, 2014, respectively. The monitoring wells were purged and sampled, using low-flow purging techniques, using a Proactive SS Monsoon submersible pump with dedicated polyethylene tubing at a rate of 1-liter per minute or less. Water-quality parameters (pH, temperature, specific conductance, turbidity, ORP, and DO) were measured and recorded at approximately 5-minute intervals. Measurements were collected until the parameters stabilized to within 10% for at least three consecutive readings. Groundwater water-quality parameter logs from all three groundwater sampling events were provided in Appendix I of the SRIR.

Quarterly Sampling Event	Sampling Date	Wells Sampled
1	August/September 2013	LMW-1, LMW-2, EFR-1, EFR-3, EFR-6, EFR-12, HV-1, MW-1, MW-4, MW-8, MW-36, MW-39, and MW-46
2	December 2013	LMW-1, LMW-2, EFR-12, HV-1, MW-1, MW-4, MW-36, MW-39, and MW-46
3	March 2014	LMW-1, LMW-2, EFR-12, MW-4, MW-36, MW-39, and MW-46

Notes:

1. Groundwater samples were not collected from EFR-1, EFR-3, EFR-6 and MW-8 during the December 2012 sampling event due to measurable LNAPL identified in the wells.
2. Groundwater samples were not collected from EFR-1, EFR-3, EFR-6, HV-1, MW-1, and MW-8 during the March 2014 sampling event due to measurable LNAPL identified in the wells and snow piles covering monitoring well locations.

Groundwater samples were delivered via courier service to Test America under standard chain-of-custody protocol and analyzed for TCL VOCs by USEPA method 8260B and TCL SVOCs by USEPA method 8270. A sample summary showing groundwater samples and corresponding analysis is provided in Appendix B (Table 1). Groundwater sampling logs were provided as Appendix I of the SRIR. Laboratory ASP-B data packages and chain-of-custody documentation were provided in Appendix F of the SRIR.

2.1.4 Tidal Influence Study

Langan conducted a tidal influence study over a 10-day period to determine the potential influence of tidal fluctuations on onsite groundwater due to the Mill Basin. The study was conducted in monitoring wells MW-4, HV-1, LMW-1, and LMW-3, which are located in the Lowe's parking lot within the Former Standard Oil Parcel (OU-3). The procedure for the tidal influence study consisted of inserting a pressure transducer/data logger (Micro-Diver) in each monitoring well to measure the temperature and water pressure. The static groundwater level in each monitoring well was then measured using an oil-water interface meter. The pressure transducers were programmed to collect a hydraulic head measurement once every minute between August 30, 2013 and September 10, 2013. Once the measurement period was completed, the data was downloaded and the groundwater elevations in each well were calculated.

Hydraulic head data is depicted on Figure 6 of the SRIR.

2.1.5 Soil Vapor Investigation

Eight soil vapor points were installed in OU-1 on August 21, 2014 and six soil vapor points were installed inside the mall, adjacent to OU-1 between March 24 and 26, 2014. Installation and sampling logs were included in Appendix J of the SRIR. Vapor points were installed to approximately 6 inches below the concrete slab. Eight exterior sub-slab, six interior sub-slab, four indoor air and three outdoor/ambient air samples were collected and submitted to Alpha for analysis of VOCs via EPA Method TO-15.

2.1.6 Summary of Remedial Investigation Findings

RI findings and conclusions include the following:

1. **Stratigraphy:** Three stratigraphic units were evaluated during this SRI in the cVOC delineation area: historical fill, a native sand layer, and an organic clay layer. The historical fill extends to depths of up to approximately 10 feet bgs and is comprised of a brown, fine to coarse grained sand with some silt, some gravel, and trace anthropogenic materials (i.e., coal, brick, concrete, wood, and metal). The underlying sand layer is primarily comprised of gray-brown fine to medium sand with some silt, trace gravel and shell fragments. This unit is approximately 2 to 10 feet thick. Finally, an organic clay layer was observed at approximately 10 to 12 feet bgs in the cVOC source area delineation zone. The clay unit is interrupted by fine sand lenses at various depths. The clay unit was not encountered in the two monitoring wells near the Mill Basin waterway.
2. **Hydrogeology:** Groundwater underlying the Site ranged from approximately el -0.24 to el 4.02 (10.85 to 6.05 feet bgs). Based on a groundwater contour derived from the March 2014 measurements, local groundwater is estimated to flow to the south toward the Mill Basin.
3. **cVOC Impacts:** Source areas of cVOC-impacted soil were identified during the SRI at a majority of soil boring locations. cVOC-impacted soil extends to an average depth of 12 feet bgs. Two “shake tests” on soil cores revealed positive indications of DNAPL in SB06 and SB22; however, well gauging with an oil-water interface probe, sounding the well sumps, and analytical data did not reveal indications of DNAPL at the site. Based on these lines of evidence, it appears that DNAPL does not exist in the overburden. cVOC impacts in overburden soil and groundwater samples indicate residual cVOC source material may be present and bound within the clay layer. Soil analytical results are summarized in Appendix B (Figure 8 and Table 4).
4. **Petroleum Impacted Groundwater:** LNAPL was encountered in multiple monitoring wells in OU-1 and approximately 27 gallons of

LNAPL was removed during seven monthly extraction events. Based on measurable volumes, it is our opinion that LNAPL extraction is reaching its limits of effectiveness. LNAPL extraction volumes are summarized in Appendix B (Table 3). Although the data does not show a clear decreasing trend across all wells, the flow into the wells is extremely slow and product recovery is minimal.

5. Groundwater Impacts: Groundwater cVOC, and petroleum concentrations exceeded TOGS AWQS. Groundwater analytical results are summarized in in Appendix B (Figure 9 and Table 5)
 - a. Interpolation of groundwater results indicated that cVOC impacts are isolated near monitoring wells MW-39 and ERF-12, which are located within the cVOC source area, with no significant lateral migration. Petroleum-impacted groundwater was encountered throughout OU-1 but does not appear to be migrating into Mill Basin based on low and decreasing concentrations of VOCs and SVOCs in down gradient wells and absence of petroleum product in the down gradient wells.
 - b. The clay layer's lower permeability and higher organic content is likely retarding the downward migration of cVOC impacts.
 - c. The presence of DCE isomers and vinyl chloride in groundwater indicates that natural attenuation of PCE and TCE via reductive dechlorination is occurring.
6. Exterior Soil Vapor Impacts: Exterior subsurface soil vapor results show the presence of chlorinated and petroleum VOCs above ambient air sample results. Soil vapor concentrations are not a concern within OU-1 because OU-1 is a roadway with no occupied structures and is covered with a permeable surface. Exterior soil vapor analytical results are summarized in in Appendix B (Figure 7 and Table 6A).
7. Interior Soil Vapor Impacts: Sub-slab soil vapor results within the mall building show the presence of cVOCs in soil vapor; however, indoor air quality samples did not identify concentrations exceeding NYSDOH AGVs. Based on our discussions with NYSDEC and NYSDHOS, vapor mitigation is not warranted. Interior soil vapor analytical results are summarized in in Appendix B (Figure 7 and Table 6B).

8. The results of the FWIA indicate that it is unlikely that petroleum and cVOC-impacted groundwater at OU-1 is causing adverse effects on fish and wildlife resources because of the lack of exposure pathways and the low ecological value of adjacent aquatic resources (i.e. aquatic plants, invertebrates, and vertebrates) present in the Mill Basin.
9. Sufficient analytical data was gathered during this RI and SRI to establish site-specific soil cleanup levels and to develop a remedy for the site. The remedy will be described and evaluated in a RAWP prepared in accordance with NYS VCP guidelines, dated May 2002. The remedy for the site will need to address fill impacted with cVOCs; groundwater impacted with cVOCs, and petroleum compounds; and, soil vapor impacted with VOCs and petroleum compounds.

2.2 Geological Conditions

Provided below is a description of the stratigraphic layers and hydrogeology observed in the Site subsurface. Three site-specific geologic units were described the RI. These units are listed in depth order (shallow to deep):

- Historical fill
- Native Sand
- Organic Clay

2.2.1 Historical Fill

This unit was observed in all the soil borings. The unit is primarily characterized as a brown fine to coarse sand, silt, and varying amounts of brick, gravel, wood, coal, and concrete. The fill layer extends up to approximately 5.5 to 10 feet bgs.

2.2.2 Native Sand Layers

The fill layer is underlain by a fine sand unit, which is primarily comprised of gray-brown fine to medium sand with some silt, trace gravel and shell fragments. This unit is approximately 2 to 10 feet thick in the cVOC source area delineation zone; however, the sand unit extends as deep as

30 feet bgs near the Mill Basin waterway in monitoring wells LMW-1 and LMW-2.

2.2.3 Organic Clay Layer

An organic clay unit was observed underlying the fine sand unit at approximately 10 to 12 feet bgs in the cVOC source delineation area. This unit is primarily comprised of black-gray organic clay with some silt and trace fine sand. The clay unit is interrupted by fine sand lenses at various depths in most of the borings. Langan's April 2003 geotechnical investigation of the site revealed that the organic clay layer ranges in thickness from approximately 4.5 to 16.5 feet with an average thickness of 10 feet. The clay unit was not encountered near the Mill Basin waterway in monitoring wells LMW-1 and LMW-2.

2.2.4 Hydrogeology

Nine synoptic groundwater gauging events were performed from August 19, 2013 through March 18, 2014. Based on these measurements, groundwater elevation at the site ranged between el. -0.24 at LMW-1 (located in southern portion of OU-1 near the Mill Basin) to el. 4.02 at EFR-3 (located in the center of OU-1). The groundwater flow is to the south toward the Mill Basin in the southern portion of OU-1 and to the northwest in the northern portion of OU-1 and in OU-2 with a mound in the northern portion of OU-1.

Groundwater contour maps are presented as Figures 5A through 5G of the SRIR and a summary of groundwater elevations is presented as in Appendix B (Table 2).

2.2.5 Tidal Influence Study Results

Langan conducted a tidal influence study over a 10-day period to determine the potential influence of tidal fluctuations on onsite groundwater due to the Mill Basin. The data indicates that tidal influence is minimal over most of the site. The following is a summary of the tidal influence study:

- Hydraulic heads in monitoring wells MW-2 and LMW-3, both located over 200 feet north of the Mill Basin, remained relatively constant over the 10-day period.
- Data from HV-1 suggests that the well became flooded by a precipitation event on September 1, 2013 and recovery took several days; therefore, the results at this well are not valid.
- Daily tidal fluctuations recorded in monitoring well LMW-1 (located closest to the Mill Basin) indicated a tidal influence with groundwater elevation fluctuations ranging between el. 0.039 to el. 1.912.

Based on the data collected during the study, there are likely two factors that dictate the influence of tidal fluctuations in monitoring wells across the site: distance from the Mill Basin waterway and permeability of the geologic units. MW-4 is over 400 hundred feet from Mill Basin while LMW-1 is less than 20 feet away. The water table at monitoring wells MW-4 and LMW-3 is within the fine sand unit, which is underlain by an organic clay layer. However, the water table at LMW-1 is located within fine to coarse sand unit with no clay unit along the Mill Basin. Combined together, these factors likely create conditions where hydraulic heads in wells near the Mill Basin would be heavily influenced by tides while wells like MW-4 and LMW-3 would show minimal influence in hydraulic heads.

Tidal influence study results are graphically presented in Figure 6 of the SRIR.

2.3 Contaminant Conditions

2.3.1 Conceptual Site Model

A conceptual Site model has been developed based on the findings of the RI. The purpose of the conceptual Site model is to develop a simplified framework for understanding the distribution of impacted materials, potential migration pathways, and potentially complete exposure pathways, as discussed below.

Potential Sources of Contamination

Potential sources of impacts at OU-1 and OU-2 have been identified in Section 2.1 and are based on investigations completed for the site. The following potential sources were identified:

OU-1

- Petroleum impacts in groundwater, LNAPL, and soil vapor from two fuel oil spills; and,
- cVOC contamination from historic Presto Plastics operations, contributing to soil, groundwater, and soil vapor impacts at the site;

Exposure Media

OU-1

- Analytical data indicates that petroleum and cVOC impacted media includes soil, groundwater and soil vapor.

Receptor Populations

The site is capped with concrete/or asphalt and is currently used for commercial purposes. The buildings adjacent to the site are occupied by the Kings Plaza Shopping Center tenants to the west and by a Lowe's Home Improvement store to the east. The southern portion of the site abuts the Mill Basin waterway. Human receptors include the adjacent mall and Lowe's customers and workers. The site is located in an area zoned for industrial use; however, there are residential communities (approximately 100-feet) to the north, west, and east of the site. There are also residential properties and a park across the Mill Basin waterway to the south. There are approximately 200 adult employees at the adjoining mall and Lowe's store during normal working hours and several thousand customers during the course of a week.

2.3.2 Description of Areas of Concern

2.3.2.1 OU-1: Fuel Oil Release

Two historical releases of #2 fuel oil occurred in 1997 and 2006, due to leaking USTs. Previous investigations at the Site identified soil, groundwater and soil vapor exceedances of petroleum-related compounds at OU-1, along East 55th Street.

2.3.2.2 OU-1: Chlorinated Solvent Release

Elevated cVOC concentrations were identified in soil, groundwater and soil vapor near monitoring well MW-39, located in the southern portion of OU-1.

2.3.3 Nature and Extent of Contamination

This section evaluates the nature and extent of soil, groundwater and soil vapor contamination at the Site and off-site.

2.3.3.1 OU-1: Chlorinated Volatile Organic Compounds in Soil

Chlorinated VOCs were detected during Langan's 2013 investigation at concentrations exceeding Unrestricted Use SCOs in 26 soil samples collected from 11 of the soil borings. The highest cVOC concentrations (up to 13,191 mg/kg) were detected at soil borings SB06 and SB09. cVOCs were also detected in soil at concentrations that exceed their Commercial Use SCOs in borings SB06, SB09, and SB12, which, based on the use of the Site, is the applicable criteria for the protection of public health. The concentrations of PCE and its daughter compounds are highest immediately above or within the organic clay layer encountered at approximately 10 to 12 feet bgs. This unit may be a potential barrier to the downward migration of cVOCs, though samples taken from fine sand lenses within the clay unit also indicated cVOC impacts.

Results of the cVOC field screenings and depths at which impacts were identified are summarized in the following table. A complete listing of all sample depths and screenings performed is included in Appendix E of the SRIR.

TABLE B				
Boring ID	Depth Interval (feet bgs)	PID Reading (ppm)	Total cVOCs (mg/kg)	OIL-IN-SOIL™ Field Screening Test
SB06	7-8	80.4	1.27	Positive
SB09	10-11	851	13,191	Negative
SB12	12-13	1,139	417.4	Negative

Instrumental evidence (i.e., elevated PID readings) detected in soil borings SB06, SB09, and SB12 and the positive OIL-IN-SOIL™ field screening test result at SB06, which indicates the presence of DNAPL in soil at SB06, suggest a historical release(s) near SB06 and SB09. Data collected during the SRI is sufficient to delineate the distribution of cVOC contaminants in soil at the site. The interpolated extent of cVOC-impacted soil is presented in Appendix B (Figures 11, 12A, and 12B).

2.3.3.2 OU-1: Petroleum Compounds in Soil

Petroleum-impacted soil was encountered during Langan's 2013 investigation in seven of the soil borings (SB01, SB02, SB03, SB06, SB16, SB21, and SB22) near the water table interface. Petroleum impacts were characterized by elevated PID readings, petroleum odor and staining. These borings are generally located to the north of the natural gas line. The presence of petroleum-impacted soil is attributed to residual impacts from the previous fuel oil releases at OU-1.

2.3.3.3 OU-1: Chlorinated Volatile Organic Compounds in Groundwater

PCE was detected in the groundwater samples collected from MW-8, MW-39, EFR-12, and HV-1 in the central portion of OU-1. PCE concentrations in MW-39 and EFR-12, which are located

within the cVOC soil investigation area, exceed the AWQS. The highest concentration of PCE in groundwater was detected in EFR-12 at a concentration of 5,200 µg/L (December 2013), which is located less than 10 feet away from delineation soil boring SB06, located within the cVOC source area (refer to section 7.1.1).

TCE was detected in the groundwater samples collected from MW-8, MW-39, EFR-12 and HV-1 and concentrations were above the AWQS in MW-39 and EFR-12. The highest concentration of TCE in groundwater was in EFR-12 at a concentration of 3,800 µg/kg (August 2013).

Degradation products of PCE and TCE including dichloroethene, and vinyl chloride, were detected in groundwater samples above the AWQS in MW-1, MW-39, and EFR-12.

cVOC- impacted groundwater appears limited to the source area around EFR-12 and MW-39. There were no exceedances of the AWQS up-gradient of the source area in the northern portion of OU-1. In addition, none of the cVOC concentrations exceeded the AWQS in the groundwater samples collected from the down-gradient monitoring wells LMW-1 and LMW-2 suggesting that cVOC impacts are not reaching the Mill Basin waterway. The presence of these degradation products in groundwater indicates natural attenuation of PCE and TCE via reductive dechlorination.

2.3.3.4 OU-1: Petroleum Compounds in Groundwater

BTEX compounds were detected in groundwater samples collected from ten out of the 13 monitoring wells (MW-1, MW-8, MW-36, MW-39, MW-46, EFR-3, EFR-6, EFR-12, HV-1 and LMW-2) at concentrations exceeding AWQS. PAH compounds were detected at concentrations that exceeded the AWQS in groundwater samples collected from five monitoring wells (MW-4, MW-8, MW-36, EFR-6, and LMW-1). BTEX and PAH concentrations are highest near the monitoring wells that contain LNAPL in the northern portion of OU-1, and indicate that petroleum contamination is widespread throughout the site.

Benzene was detected at a concentration exceeding its AWQS in the groundwater sample collected from the down-gradient monitoring well LMW-2. None of the BTEX concentrations exceeded the AWQS for the groundwater sample collected from the down-gradient monitoring well LMW-1; however, one PAH, acenaphthene, exceeded the AWQS in LMW-2.

2.3.3.5 OU-1: Base Neutral Compounds in Groundwater

Base neutral compounds including acenaphthene, bis(2-ethylhexyl) phthalate and naphthalene were detected in 8 of 16 wells across OU-1 and OU-2 (MW-1, MW-4, MW-8, MW-36, EFR-3, EFR-6, HV-1 and LMW-1) at concentrations exceeding AWQS.

2.3.3.6 OU-1: Exterior Soil Vapor Contamination

Petroleum-related VOCs including benzene (maximum 930 $\mu\text{g}/\text{m}^3$), toluene (maximum 14,000 $\mu\text{g}/\text{m}^3$), ethylbenzene (maximum 1,300 $\mu\text{g}/\text{m}^3$), and xylenes (maximum 10,400 $\mu\text{g}/\text{m}^3$) were detected. The maximum concentrations of petroleum-related VOCs were identified in the eastern portion of OU-1 along the Lowe's building.

- PCE was identified in six of eight soil vapor samples at concentrations ranging from 280 $\mu\text{g}/\text{m}^3$ to 17,000 $\mu\text{g}/\text{m}^3$.
- TCE was detected in six of eight soil vapor samples at a maximum concentration of 730 $\mu\text{g}/\text{m}^3$.

The maximum concentrations of cVOCs were identified in the southwestern portion of OU-1 along the mall building. PCE and TCE were also detected at elevated concentrations in select soil and groundwater samples from the corresponding boring/monitoring well locations in this area, indicating a potential source.

Data collected during the SRI is sufficient to delineate the distribution of contaminants in soil vapor at the site.

2.3.3.7 OU-1: Interior Soil Vapor Contamination

Based on the results of the exterior OU-1 soil vapor investigation, the NYSDOH required sampling of sub-slab and indoor air in the mall building in the vicinity of OU-1. Sub-slab and indoor air samples were collected as part of the SVIWP. Sub-slab vapor samples collected during the SVI identified cVOCs at elevated concentrations below the floor slab; however, cVOCs were not detected in indoor air samples at concentrations above NYSDOH AGV criteria. Concentrations of PCE (maximum 2,740 $\mu\text{g}/\text{m}^3$) and TCE (maximum 104 $\mu\text{g}/\text{m}^3$) identified in sub-slab soil vapor samples during the interior soil vapor investigation exceed NYSDOH Vapor Intrusion Matrices; however, based on the low (PCE= 0.203 to 0.359 $\mu\text{g}/\text{m}^3$) and non-detect (1,2-DEC and TCE) concentrations identified in the indoor air samples, there does not appear to be an indoor vapor intrusion issue. Measures for providing sub-slab soil vapor mitigation are provided herein in section 3.2.

Carbon tetrachloride was not detected in sub-slab soil vapor; however, it was detected in all indoor air samples at concentrations ranging from 0.453 and 0.459 $\mu\text{g}/\text{m}^3$, exceeding NYSDOH criteria. Carbon tetrachloride was also detected in the outdoor ambient air sample at a concentration of 0.453 $\mu\text{g}/\text{m}^3$. The NYSDOH Vapor Intrusion Matrices requires that reasonable and practical action is taken to identify source(s) and reduce exposure. Based on the detection of carbon tetrachloride in the ambient outdoor air sample at concentrations similar to what was identified indoors, the non-detect concentrations in sub-slab soil vapor, we believe that this compound is originating from an exterior source.

2.4 Qualitative Human Exposure Assessment

To evaluate contaminant fate and transport and potential human exposure risk, this section discusses identified receptor populations and exposure pathways and provides a human health exposure assessment. The exposure assessment conforms to the May 2010 NYSDC DER-10 paragraph 3.14(c)17 and

subparagraphs and the DER-10 Appendix 3B New York State Department of Health Qualitative Human Health Exposure Assessment.

2.4.1 Potential Exposure Pathways – On-Site

Based on a review of the SRI data and previous reports, soil at the site has been impacted by petroleum, cVOCs and SVOCs. The site surface cover is composed of concrete (i.e. sidewalks) and asphalt (i.e. roadway). A potential exposure pathway exists if the site cover is penetrated. The potential migration pathway is through dermal absorption, inhalation and ingestion.

Groundwater is impacted by LNAPL, petroleum constituents, cVOCs and SVOCs throughout OU-1 and OU-2. Groundwater in New York City is not used as a potable water source, and there are no on-site wells for potable uses; therefore, there is no completion of the exposure pathway from groundwater under current site conditions.

Soil vapor at the site has been shown to be contaminated. Soil vapor results indicated the presence of several cVOCs and petroleum VOCs. There are no current points of contact within OU-1 since the site is completely covered with an asphalt cap. There is a potential exposure pathway during site investigation and excavation through dermal absorption, inhalation and ingestion; however, these activities are limited to authorized professional contractors.

2.4.2 Potential Exposure Pathways – Off-Site

Under current conditions, there is no potential pathway as the site surface cover is composed of concrete (i.e. sidewalks) and asphalt (i.e. roadway). However, a potential exposure pathway exists if the site cover is penetrated during construction or remediation activities. Soil has the potential to be transported off-site by wind in the form of dust or on the tires of vehicles or equipment leaving the site during excavation and/or remedial investigation activities.

Transport of cVOCs, petroleum VOCs and SVOCs in groundwater depends on groundwater flow, physical and chemical properties of the contaminants, and subsurface features. Vertically, the transport of contaminants is limited by the presence of an organic clay aquitard; horizontally, the southern and northwesterly groundwater flow may transport dissolved-phase cVOC, petroleum VOC and SVOC impacts off-site via diffusion and dispersion. Off-site migration of groundwater impacts is not expected to result in a complete exposure pathway for the current conditions because the site and surrounding areas obtain their drinking-water supply from surface-water reservoirs located upstate NY, and there are no known potable uses of groundwater in the area. Based on the results of this investigation, cVOC-impacted groundwater does not appear to have reached the Mill Basin waterway. SVOC and petroleum-impacted groundwater has not been identified at the Mill Basin waterway.

Potential points of exposure for cVOC-impacted soil vapor include potential cracks in adjacent building slabs. Routes of exposure may include inhalation of vapors entering the buildings. The Lowe's building is equipped with a vapor barrier and a sub-slab vapor mitigation system (VMS); therefore, the exposure pathway is not complete. Additionally, data from the soil vapor intrusion study performed within the adjacent mall building indicates that although cVOCs exist in sub-slab soil vapor, indoor air does not contain elevated cVOCs and; therefore, an exposure pathway is not complete.

2.4.3 Evaluation of Human Health Exposure

Complete exposure pathways have the following five elements: (1) a contaminant source, (2) a contaminant release and transport mechanism, (3) a point of exposure; (4) a route of exposure, and (5) a receptor population. An analysis of each element is discussed above for OU-1 and OU-2. Based on the conceptual site model and the review of environmental data, there is potential exposure for indoor air; however, this risk can be mitigated through continued monitoring and by sealing cracks in the adjacent building's concrete floors. No complete on-site or off-site exposure pathways appear to be present at OU-1, OU-2 and in adjacent buildings for other media.

2.4.3.1 Current Conditions

Contaminant sources include historical fill with varying levels of SVOCs, historical releases of petroleum and cVOCs, and petroleum and chlorinated VOCs in soil vapor.

Contaminant release and transport mechanisms include volatilization of contaminants from the soil and groundwater matrices to the soil vapor phase, and existing soil vapor contaminants. There is a low risk of exposure under current conditions. Exposure to dust is limited by the site cover consisting of asphalt, concrete slab and the Subject Property building. The site surface cover prevents contact with soils, groundwater is not currently accessible and soils are not currently being disturbed except during investigation.

2.4.3.2 Remediation Activities

During remediation activities, points of exposure include disturbed and exposed soil during excavation, dust and organic vapors generated during excavation activities, and contaminated groundwater that will be encountered during excavation and dewatering operations. Routes of exposure include ingestion and dermal absorption of contaminated soil and groundwater, inhalation of organic vapors arising from contaminated soil and groundwater, and inhalation of dust arising from contaminated soil. The receptor population includes the construction and remediation workers and, to a lesser extent, the public adjacent to the Site. All five elements exist; therefore, the potential for completed exposure pathways is present. However, the risk can be avoided or minimized by applying appropriate health and safety measures, such as monitoring the air for organic vapors and dust, using vapor and dust suppression measures, maintaining Site security, and wearing the appropriate PPE.

In accordance with a HASP, a Soil/Materials Management Plan, and a CAMP, measures such as conducting an air-monitoring program, donning PPE, and applying vapor and dust suppression measures to prevent off-site migration of contaminants during

construction will be implemented. Such measures would prevent completion of these potential migration pathways.

2.4.3.3 Proposed Future Conditions

For the proposed future conditions, some residual contaminants may remain and may include those listed under current conditions. Contaminant release and transport mechanisms include volatilization of contaminants from soil vapor or the groundwater matrix to the soil vapor phase. If institutional and/or engineering controls are not implemented, points of exposure include potential cracks in the foundation or lower-level slab of the proposed development. Routes of exposure may include inhalation of vapors entering the building; these routes may not exist depending on the effectiveness of the remediation. The receptor population includes the building tenants and customers. The possible routes of exposure will be avoided or mitigated by the impermeable (concrete and asphalt) Site cap and institutional and engineering controls.

2.4.4 Human Health Exposure Assessment Conclusions

The following conclusions were developed from this human health exposure assessment:

- There is a low risk of exposure under current conditions. Exposure to dust from contaminated soil is limited by the site cover, which consists of asphalt, concrete slab and the Subject Property building. The exposure risk can be avoided or minimized by following appropriate health and safety and vapor and dust suppression measures during remediation activities.
- There is a moderate risk of exposure during remediation activities. This risk can be avoided or minimized by following the appropriate health and safety, vapor and dust suppression, and Site security measures.

- The existence of a complete exposure pathway for Site contaminants to human receptors under future conditions is unlikely, as cVOC source soil will be excavated and transported to an off-site disposal facility, groundwater is not used as a potable water source in New York City, and the potential pathway for soil vapor intrusion into the building will be addressed through continued monitoring.
- It is unlikely that a complete exposure pathway exists for the migration of site contaminants to off-site human receptors for current, remediation phase, or future conditions. Monitoring and control measures would be used during remediation to prevent completion of this pathway. Under future conditions, the site will be remediated and institutional and engineering controls will be implemented to prevent completion of this pathway.

2.5 Remedial Action Objectives

Based on the results of the Remedial Investigation, the following Remedial Action Objectives (RAOs) have been identified for this Site.

2.5.1 Groundwater

RAOs for Public Health Protection:

- Prevent contact with, or inhalation of, volatiles emanating from contaminated groundwater.

RAOs for Environmental Protection:

- Restore ground water aquifer, to the extent practicable, to pre-disposal/pre-release conditions.
- Remove the source of ground and surface water contamination where practical

2.5.2 Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.

- Prevent inhalation of or exposure to, contaminants volatilizing from contaminated soil or contaminated soil in particulate form.

RAOs for Environmental Protection:

- Prevent migration of contaminants that would result in groundwater or surface water contamination.

2.5.3 Soil Vapor

RAOs for Public Health Protection:

- Mitigate impacts to public health resulting from for the potential for soil vapor intrusion into occupied buildings at the site.

3.0 DESCRIPTION OF REMEDIAL ACTION PLAN

The VCP guidance does not require a feasibility analysis for remedial alternatives. This section presents site specific remedial action.

3.1 Standards, Criteria, Guidance, and Remedial Action Objectives

In accordance with ECL § 27-1415 and DER-10, the objectives of the remedial action are to: (1) reduce the concentrations of COCs at the Site to meet those levels that will protect public health and the environment, and (2) isolate the Site from migration of contaminated groundwater and soil vapor from potential on-site sources. In accordance with DER-10, the Volunteer will have no remedial responsibilities with respect to groundwater contamination migrating under the Site from an off-site source; however, remedial alternatives will be developed for such a case that eliminates or mitigates on-site environmental impacts or human exposures, to the extent feasible, resulting from the off-site contamination entering the Site. Where identifiable sources of contamination are found on the Site, the sources will be removed or treated to the greatest extent feasible.

Also in accordance with DER-10, the Remedial Action Objectives (RAO) for this Site are defined as medium-specific objectives for the protection of public health and the environment and are developed based on contaminant-specific standards, criteria, and guidance (SCGs). The SCGs for the Site include:

- NYSDEC – Voluntary Cleanup Program Guide (draft 2002);
- NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation (2010);
- NYSDEC TAGM No. 4031– Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Waste Sites (1989);
- NYSDEC TOGS 1.1.1 – Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (1998);
- NYSDEC TOGS 5.1.8 – New York State Stormwater Management Design Manual (2008);
- NYSDEC TOGS 5.1.10 – New York Standards and Specifications for Erosion and Sediment Controls (2005);
- NYSDOH – Guidance for Evaluating Soil Vapor Intrusions in the State of New York (2006);
- New York State Codes, Rules and Regulations (NYCRR) Title 6 Part 364 – Waste Transporter Permits;

- 6 NYCRR Part 370 – Hazardous Waste Management System;
- 6 NYCRR Part 375 – Environmental Remediation Program (December 2006);
- 6 NYCRR Part 376 – Land Disposal Restrictions;
- 6 NYCRR Part 750 – State Pollutant Discharge Elimination System (SPDES) Regulations;
- Code of Federal Regulations (CFR) Title 29 Part 1910.120 - Hazardous Waste Operations and Emergency Response Standard;
- CFR Title 29 Part 1926 - Safety and Health Regulations for Construction; and
- NYSDEC CP-51 - Soil Cleanup Guidance (2010).
- NYSDEC CP-43 – Groundwater Monitoring Well Decommissioning Policy

In addition to the SCGs listed above, the RAOs were developed from information derived from previous environmental investigations referenced in Section 1.3, including identified contaminated media and potential public health and environmental exposure pathways, which were summarized in Section 2.4. The RAOs for this RAWP are listed in section 2.5.

3.2 Technical Description of Remedy

A remedial design program will be implemented to provide the details necessary for the construction, operation, optimization, maintenance, and monitoring of the remedial program. Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows:

- Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
- Reducing direct and indirect greenhouse gases and other emissions;
- Increasing energy efficiency and minimizing use of non-renewable energy;
- Conserving and efficiently managing resources and materials;
- Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;
- Maximizing habitat value and creating habitat when possible;
- Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and

- Integrating the remedy with the end use where possible and encouraging green and sustainable re-development.

3.3 Summary of Remedy

The remedy would be executed by accomplishing the following tasks:

- **Excavation** as described herein and off-site disposal of contaminated soil and grossly-impacted soil, as defined in 6NYCRR Part 375-1.2(u), to the extent feasible. The existing asphalt surface cover will be removed to facilitate excavation;
- If encountered (as contingency plan); removal of any underground storage tanks (USTs), fuel dispensers, underground piping or other structures associated with a source of contamination;
- Excavation of soils located above the groundwater table smear zone that exceed the protection of groundwater soil cleanup objectives (PGWSCOs), as defined by 6 NYCRR Part 375-6.8, for those contaminants found in the site's groundwater above standards. Residual contamination below the water table smear zone will be addressed by the proposed groundwater treatment remedial element;
- During excavation, **groundwater will be extracted** and treated to remove cVOCs. A groundwater extraction/excavation dewatering system will be designed and installed so that the capture zone is sufficient to cover the areal and vertical extent of the excavation area. The extracted groundwater will be containerized for off-Site disposal or treated on-site and discharged to the sewer system under permit. The groundwater will be extracted through the use of a vacuum truck, drainage sumps, and/or perimeter well points to maintain dry conditions in the excavation. The treatment system will entail a settling tank, oil/water separator, bag filters, and carbon filter vessels, if necessary. Further details of the extraction system will be determined during the remedial design.
- Collection and analysis of documentation soil samples to document residual soil conditions;
- In-situ chemical oxidation (ISCO) will be implemented to treat residual contaminants in soil and groundwater. A chemical oxidant will be applied to destroy the contaminants in place. The method and depth of application will be determined during the remedial design.

- Monitoring for soil vapor intrusion in adjacent occupied buildings owned by the volunteer will be performed during and after the treatment phase.
- **Clean fill**, meeting the requirements of 6 NYCRR Part 375-6.7(d), will be brought in to complete the backfilling of the excavation and establish the designed grades at the site. The site will be re-graded to accommodate installation of a cover system as described in remedy element #3.
- Importing of clean soil to be used for backfill in compliance with this plan and in accordance with applicable laws and regulations. Imported soil will be sampled and analyzed in accordance with NYSDEC DER-10 Section 5.4 prior to import to the Site, and will meet Restricted Commercial Use SCOs. Recycled concrete aggregate (RCA) and imported virgin stone will not be sampled.
- Development and implementation of plans for the protection of on-site workers, community, and environment during remediation and construction activities;
- **A site cover** currently exists and will be maintained to allow for commercial use of the site. Any site redevelopment will maintain the existing site cover, which consists either of the structures such as buildings, pavement, sidewalks or soil where the upper one foot of exposed surface soil meets the applicable soil cleanup objectives (SCOs) for commercial use. Replacement of the Site cover system consisting of asphalt pavement and sidewalks above the excavation area and where needed; Installation and operation of **petroleum recovery** wells to remove potentially mobile petroleum from the subsurface in areas where excavation of petroleum is infeasible. The number, depth, type and spacing of the recovery wells will be determined during the design phase of the remedy. Petroleum will be collected periodically from each well; however, if wells are determined by the Department to accumulate large quantities of petroleum over extended time periods, they can be converted to automated collection.
- **Soil vapor mitigation (SVM)** points will be installed to remove volatile organic compounds (VOCs) from the subsurface along the west side of OU-1 to address vapor migration into the adjacent mall and Macy's buildings. VOCs will be physically removed from the soil by applying a vacuum to wells that have been installed into the vadose zone (the area below the ground but above the water table). The vacuum draws air through the soil matrix which carries the VOCs from the soil to the SVM

well. The air extracted from the SVM wells is then treated (if necessary) prior to being discharged to the atmosphere.

- A provision for evaluation of the potential for soil vapor intrusion in any future on-site buildings and any existing or future adjacent off-site buildings owned by the volunteer, including provision for implementing actions recommended to address exposures related to soil vapor intrusion;
- Monitored natural attenuation sampling for impacted groundwater;
- Implementation of long-term Institutional Controls in the form of an Environmental Easement and Site Management Plan;
- provisions for the management and inspection of the identified engineering controls;
- Maintaining site access controls and Department notification; and
- Submittals necessary for the periodic reviews and certification of the institutional and/or engineering controls.

The requirements for each of the above tasks are described below. The remedial excavation extent is shown on Figures 4A and 4B. The remedial extent is based on previous data collected at the Site.

3.3.1 Fill and Soil Removal

Hot spot excavation will be completed in the vicinity of MW-39 to remove material impacted with cVOCs. Excavation into the smear zone and groundwater table to remove grossly-impacted material will be conducted where necessary and to the extent practical. Depth of excavation for the MW-39 area will be advanced to the confining clay layer, and is estimated at approximately 10 to 15-feet bgs. Excavation of source soils in the vicinity of MW-39 will require shoring of a gas line which runs through the area and will be limited by the proximity to the Subject Property building and the gas line. The remedial excavation supports will be designed by a geotechnical engineer subsequent to approval of this RAWP.

Prior to off-site disposal, a waste characterization will be performed to facilitate acceptance of waste material into a disposal facility. Waste characterization sampling will be performed from material stockpiles during remediation. Waste material streams will be kept separate and the

contractor will select disposal facilities permitted to accept the various waste streams. Excavated material will be removed from the Site and disposed at an appropriate waste disposal facility permitted to accept the material. Excavation will not be conducted in areas where removal of soil is unsafe and will threaten the structural integrity of the buildings and retaining wall that border the Site.

Based on these excavation guidelines, the estimated volume of fill and soil requiring removal and off-site disposal for cleanup is approximately 2,500 cubic yards. Additionally, construction demolition and debris associated with the asphalt pavement demolition will be removed and disposed offsite. This soil quantity estimate is based on vertical excavation limits derived from the laboratory analytical results and field observations in the RI. Soil sample results from the RI are shown in Appendix B (Figure 8), and the remedial extent is shown on Figures 4A and 4B. The final extent of excavation areas may change if additional hot spot areas (i.e., staining, odor and elevated PID readings) are identified during remedial excavation.

3.3.2 UST Removal Contingency

Based on previous investigations and reports, the presence of previously undiscovered USTs is not anticipated; however, if USTs are encountered during remedial activities, they will be decommissioned in accordance with 6NYCRR Part 613.9, NYSDEC Commissioner's Policy (CP) 51, and other applicable NYSDEC UST closure requirements. Petroleum-impacted soil, if encountered, will be excavated (if possible) and disposed off-site.

3.3.3 Excavation Dewatering

Localized dewatering may be required for remedial excavation. Prior to mobilization, the contractor will follow the New York City Department of Environmental Protection (NYCDEP) "Procedure for Obtaining Letter of Approval for Groundwater Discharge to Sanitary or Combined Sewer." Based on the NYCDEP's effluent limitations and Site groundwater data, the contractor may be required to pre-treat dewatering fluids to reduce contaminant concentrations below NYCDEP effluent limitations prior to discharge. Pretreatment may include a settling tank, bag filters, carbon filtration, etc. If the contractor will discharge more than 10,000 gallons

per day, they will also have to obtain an NYCDEP Temporary Discharge of Groundwater into the City Sewer System Permit. Collected groundwater or rainwater will be discharged, as defined by the NYCDEP permit, into the New York City sewer system, via an entry point acceptable to the NYCDEP. The dewatering and treatment system will be designed by the contractor's New York State-licensed Professional Engineer. As an alternate, the contractor may collect the water into a vessel for off-site disposal at a facility permitted to accept the dewatering fluids.

3.3.4 Documentation Soil Samples

Per NYSDEC DER policy, documentation soil sample collection would be completed from the excavation base at a frequency of one sample per 900 square feet of floor area and one sidewall sample for every 30 linear feet around the Site perimeter. Based on these criteria, approximately 14 base confirmation samples and 15 site-perimeter sidewall samples, plus required QA/QC samples, would be collected. Documentation soil samples would be analyzed for the combined Part 375 and TCL/TAL listed VOCs, SVOCs, pesticides, PCBs, and metals. No off-site excavation will be required.

3.3.5 Excavation Backfill

After the excavation and removal of impacted material associated with the cVOC release in the vicinity of MW-39, the excavated area would be backfilled to existing grade and the asphalt pavement shall be restored to existing conditions. Due to safety concerns related to the existing gas line and building foundation, we anticipate that some volume of cVOC impacted soils will be left in place. Backfill will be blended with a chemical oxidant to polish residual or inaccessible cVOCs in soil and groundwater. The quantity of imported fill material is estimated to be approximately 2,500 cubic yards. Backfill material would consist of Part 375-6.7(d)(1)(ii) SCO-compliant soil or other acceptable fill material such as virgin, native $\frac{3}{4}$ " stone from a quarry or RCA from a NYSDEC-registered facility. For material other than soil imported to the Site, requirements in DER-10 apply. Material may be imported without chemical testing for use as backfill beneath pavement, buildings or as part of the final cover, provided that it contains less than 10% by weight

material passing through a No. 80 sieve and meets DER-10 requirements. The clean fill would be segregated at a source/facility that is free of environmental issues. Qualified environmental personnel would collect representative samples at a frequency consistent with CP-51/Soil Cleanup Guidance. The samples would be analyzed for Part 375 VOCs (EPA Method 8260), SVOCs (EPA Method 8270), pesticides/PCBs (EPA Method 8082/8081) and metals by an NYSDOH ELAP-certified laboratory. Only RCA from a NYSDEC registration facility will be imported and it will not be used in the upper 1 foot of any area that will have landscaping.

3.3.6 On-Site Worker, Public Health and Environmental Protection

A Site-specific HASP has been developed and will be enforced to protect on-site workers from accidents and acute and chronic exposures from the identified contaminated media. The HASP is included as Appendix D. Public health will be protected by implementing and enforcing dust, odor, and organic vapor control as specified in Section 5.4.13, and monitoring procedures included in a site-specific CAMP. The CAMP will include continuous perimeter monitoring of dust and organic vapor using DustTrak aerosol monitors and PIDs capable of recording data and calculating 15-minute averages. A field engineer, scientist, or geologist would monitor Site perimeters for visible dust and odors. The environment will be protected by implementing and enforcing the appropriate soil erosion prevention measures (see Sections 4.3.2 and 5.4.10).

3.3.7 Soil Vapor Mitigation System Installation

An active soil vapor mitigation system will be installed beneath the sidewalk along the western side of East 55th Street. The system will consist of up to 400-feet of horizontal header pipe with up to 14 vertical well points installed to a depth of approximately 4-feet below grade. System piping will be routed to a blower with moisture separator in a weather and sound proof enclosure. The need for additional treatment of effluent air will be assessed upon startup. The mitigation system discharge point will be located above the roof line. The proposed location of system components is shown on Figure 4C; however, the exact location of system components including well points, system piping,

blower shed and discharge point will be finalized subsequent to approval of this RAWP and in the Remedial Design document.

3.3.8 Site Cover System

A Site cover system will be installed at the Site. The Site cover system will consist of asphalt pavement and concrete sidewalks. Landscaped areas are not anticipated for the Site. The cover system also serves as an engineering control for the protection of human health by establishing an incomplete exposure pathway to residual Site soils.

3.3.9 Passive Oil Recovery Program

A passive oil recovery program will be implemented upon completion of hotspot removal activities to address residual petroleum product in the subsurface along East 55th Street, especially in areas where the location of utilities prohibits additional excavation. Up to four additional 4-inch groundwater monitoring wells will be installed along East 55th street and oil absorbent socks will be placed in the wells. The new wells will be installed in areas with the greatest petroleum product thickness observed both historically and at time of remedy. Absorbent socks will be replaced quarterly.

3.3.10 Institutional Controls/Engineering Controls

Imposition of an institutional control in the form of a Deed Restriction for the controlled property that:

- Requires the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3);
- Allows the use and development of the controlled property for restricted commercial and industrial uses as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- Restricts the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH or NYCDOH; and

- Requires compliance with the Department- approved Site Management Plan (SMP).

The Deed Restriction will be recorded with the County Clerk. It requires institutional and engineering controls (IC/EC) that are part of the selected remedy, be binding upon all subsequent owners of the property. The ECs would include the appropriate surface cover system (cap). The SMP would identify long-term monitoring and maintenance requirements and certifications.

3.4 Evaluation of Remedy

The following is an evaluation of the proposed remedy based on the NYSDEC VCP remedy evaluation criteria listed below.

3.4.1 Overall Protection of Public Health and the Environment

Under the proposed plan, historical fill material would be removed and disposed of off-site as described herein. A composite Site cover/cap would make exposure pathways to residual contamination incomplete. Potential exposure pathways for residual concentrations of petroleum and cVOC compounds in groundwater and soil vapor would be eliminated by monitoring indoor air and sub-slab soil vapor, and maintaining the integrity of the floor slab in accordance with the SMP. In addition, groundwater in Brooklyn is not used as a source of drinking water.

Public health would be protected during remediation activities by implementing and enforcing dust, odor, and organic vapor control and monitoring procedures when needed. The environment would be protected by implementing and enforcing the selected soil erosion plans.

3.4.2 Standards, Criteria, and Guidance

Remediation includes removal of Site material to achieve site-specific cleanup objectives, as set forth in DER-10, Technical Guidance for Site Investigation and Remediation, CP-51 and 6 NYCRR Part 375. Remediation will also comply with standards, criteria and guidance (SCGs) that involve protection of the public health and environment during the remedial action by implementing and enforcing a Site-specific HASP. Occupational Safety and Health Administration (OSHA)

requirements for on-site construction safety will be followed by the Site contractors.

3.4.3 Short-Term Effectiveness and Permanence

Limiting the required excavation extent to the confining soil layer, encountered at depths of approximately 15 feet will reduce implementation of risky support of excavation techniques, minimize dewatering and reduce the duration of the excavation and the associated risks of a large excavation with underpinning of adjacent buildings. The number of truck trips required to haul out the impacted fill and import backfill is estimated to be 85 25-cubic yard capacity truck trips.

During remediation, dust will be controlled by the application of water spray on the haul roads, and on Site, when and where needed. Engineering controls, such as slowing the pace of work, applying foam suppressant or covering portions of the excavation will be used to minimize vapors and suppress odors when required. Work will be modified or stopped according to the action levels set in the CAMP.

3.4.4 Long-Term Effectiveness and Permanence

The magnitude of the remaining risks will be minimal because potential exposure pathways to the residually contaminated soil, groundwater, and soil vapor will be eliminated by the completion of the remedy. The remedy will remove contaminated media from the Site to soil depths up to 15 feet below existing grade. The exposure pathways to residual soil contaminants will be controlled through the use of a Site cover system/cap. Potential exposure from soil vapor VOC intrusion will be prevented by monitoring indoor air and sub-slab soil vapor, and maintaining the integrity of the floor slab in accordance with the SMP. In addition, groundwater in this area of New York City is not used for drinking water. Therefore, the long-term effectiveness of this remedy will eliminate risks and satisfy the objectives of this criterion.

3.4.5 Reduction of Toxicity, Mobility, and Volume

The remedy will reduce the toxicity through removal of cVOC-impacted source soil. Based on the post-excavation soil results, Langan will assess

the need to develop a fate and transport model to show that the mobility of residual contaminants does not represent an off-site migration concern, or remediate via placement of ORC. Regular monitoring of indoor and sub-slab soil vapor beneath the existing building will address concerns related to the toxicity and mobility of soil vapor impacted by residual on-site contamination, in accordance with the SMP.

3.4.6 Implementability

Excavation support may be required for implementation of the remedy; however, these tasks will be minimal. The remedy will consist mostly of excavation with standard bucket excavators of the targeted fill and soil. The remedy uses typical remediation methods to address Site impacts and contractors experienced in implementing the described remedy are readily available in the area of the Site.

3.4.7 Cost Effectiveness

An evaluation of cost effectiveness is not required under the VCP.

3.4.8 Community Acceptance

The proposed remediation should be acceptable to the community because the potential exposure pathways to on-site contamination will be eliminated upon completion of the remediation at the Site. A 45-day public comment period and Citizen Participation Plan are not required under the VCP.

3.4.9 Land Use

The current, intended, and reasonably anticipated future land use of the Site and its surroundings are compatible with the selected remedy of soil remediation for commercial use. The existing mall and Lowe's buildings and associated asphalt and concrete paved areas cover 100% of the Site footprint.

Summary of Remedial Actions

The proposed remediation will be protective of human health and the environment. The proposed remediation provides for removal of historic fill to the extent practical to achieve this

goal. The exposure pathways to residual contaminants will be controlled through the use of a site cover system. The proposed remediation can be implemented using standard construction equipment and methods as described below in section 5, and in a cost-effective manner while providing protection to human health and the environment.

Remedial activities will be performed in accordance with this NYSDEC-approved RAWP. All proposed deviations from the RAWP will be promptly submitted to NYSDEC for approval and fully explained in the Final Engineering Report (FER).

5.0 REMEDIAL ACTION PROGRAM

5.1 Governing Documents

The primary documents governing the remedial action are summarized in this section. Where referenced, copies of the full plan are provided in the appendices.

5.1.1 Site Specific Health & Safety Plan

The Remedial Engineer prepared a Site-specific HASP, which is included as Appendix D. The HASP will apply to all remedial and construction-related work on-site. The HASP provides a mechanism for establishing on-site safe working conditions, safety organization, procedures, and PPE requirements. The HASP meets the requirements of 29 CFR 1910 and 29 CFR 1926 (which includes 29 CFR 1910.120 and 29 CFR 1926.65). The HASP includes, but is not limited to, the following components listed below:

- Organization and Identification of key personnel;
- Training requirements;
- Medical surveillance requirements;
- List of site hazards;
- Excavation safety;
- Work zone descriptions;
- Personal safety equipment and protective clothing requirements;
- Decontamination requirements;
- Standard operating procedures;
- Protective measure Plan;
- CAMP; and
- Material Safety Data Sheets.

All remedial work performed under this plan will be in full compliance with governmental requirements, including Site and worker safety requirements mandated by Federal OSHA.

The Volunteer and associated parties preparing the remedial documents submitted to the State and those performing the construction work, are completely responsible for the preparation of an appropriate HASP and

for the appropriate performance of work according to that plan and applicable laws.

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

The Site Safety Coordinator will be David Granucci. A resume will be provided to NYSDEC prior to the start of remedial field work.

5.1.2 Quality Assurance Project Plan

The RE prepared a Quality Assurance Project Plan (QAPP) that describes the quality control components employed so that the proposed remedy accomplishes the remedial goals, remedial action objectives, and is completed in accordance with the design specifications. The QAPP is provided in Appendix E and includes:

- Responsibilities of key personnel and their organizations for the proposed remedy;
- Qualifications of the quality assurance officer;
- Sampling requirements including methodologies, quantity, volume, locations, frequency, acceptance and rejection criteria; and
- Description of the reporting requirements for quality assurance activities including daily reports during invasive field work, weekly quality assurance review reports, periodic quality assurance and quality control audits, and other report and data submissions.

5.1.3 Construction Quality Assurance Plan

The RE prepared a Construction Quality Assurance Plan (CQAP) that describes the quality control components employed so that the proposed remedy accomplishes the remedial goals, remedial action objectives, and is completed in accordance with the design specifications. Because the remedy is being accomplished through excavation and restoration, the contractor and construction manager will have the primary responsibility to provide construction quality. A list of engineering personnel involved in

implementation of the COAP and procedures that will be carried out by the remedial engineering team are identified below.

The following project personnel are anticipated for oversight of the RAWP implementation.

Remedial Engineer (RE):	Joel Landes, P.E.
Project Manager:	Jamie P. Barr, L.E.P.
Langan Health & Safety Officer:	Tony Moffa, CHMM
Site Safety Coordinator	David Granucci
Qualified Environmental Professional (QEP)	Ryan Wohlstrom
Field Team Leader	David Granucci
Quality Assurance Officer	Jamie P. Barr, L.E.P.

A QEP or the RE will directly supervise field engineers, scientists and geologists that will be on-site during remedial action to monitor particulates and organic vapor in accordance with the CAMP. Weekly reports will be submitted to the NYSDEC and NYSDOH and will include in daily reports the CAMP results and underline the results exceeding the action levels specified in the CAMP.

A QEP or the RE will directly supervise field engineers, scientists and geologists that will meet with the Construction Superintendent on a daily basis to discuss the plans for that day and schedule upcoming activities. The field engineers/scientists and geologists will document all remedial activities in daily and weekly reports submitted in a timely manner to the NYSDEC and NYSDOH project managers. This document will be forwarded to the Field Team Leader on a daily basis and to the Project Manager and the RE on a weekly basis.

A QEP or the RE will directly supervise field engineers, scientists and geologists that will screen the excavation with a PID during intrusive activities. All readings will be noted in the record. Elevated readings will be reported to the NYSDEC and NYSDOH in the daily reports. The field

engineers, scientists and geologists will collect the excavation endpoint samples in accordance with the NYSDEC DER-10 Guidance.

A photo log will be kept to document remediation activities by still photos. The photo log may also be used to record activities recorded in the daily, weekly, and monthly reports.

The project field book will be used to document all sampling activities and how they correspond to the RAWP. All observations, field and/or laboratory tests will be recorded in the project field book or on separate logs. Recorded field observations may take the form of notes, charts, sketches, or photographs.

The Field Team Leader will maintain the current field book and all original field paperwork during the performance of work. The Project Manager will maintain the field paperwork after completion and will maintain all submittal document files.

5.1.4 Soil/Materials Management Plan

The RE prepared a Soil/Materials Management Plan, which includes detailed plans for managing all soils/materials that are disturbed at the Site, including excavation, handling, storage, transport and disposal. It also includes controls that will be applied to these efforts to facilitate effective, nuisance-free performance in compliance with all applicable Federal, State and local laws and regulations (see Section 5.4).

5.1.5 Stormwater Pollution Prevention Plan

Erosion and sediment controls will be in conformance with requirements presented in the New York State Guidelines for Urban Erosion and Sediment Control. Erosion and sediment controls that will be implemented are described in Section 4.3.2 (Erosion and Sedimentation Controls) and 5.4.10 (Stormwater Pollution Prevention). A Stormwater Pollution Prevention Plan (SWPPP) is not necessary because the project will disturb less than an acre, and stormwater discharge will be to a combined sewer, in accordance with the New York City generic stormwater pollution discharge elimination system permit.

5.1.6 Community Air Monitoring Program

A CAMP has been prepared by the RE and is included in the HASP (see Appendix E).

5.1.7 Contractors Site Operations Plan

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

5.2 General Remedial Construction Information

5.2.1 Project Organization

This Section presents the anticipated project organization and associated roles, including key personnel, descriptions of duties, and lines of authority in the management of the RAWP. Information regarding the organization/personnel and their associated responsibilities is provided below.

5.2.2 Remediation Engineer (RE)

The RE for this project will be Joel Landes, P.E. The RE is a registered professional engineer licensed by the State of New York. The RE will have primary direct responsibility for implementation of the remedial program for the Kings Plaza Shopping Center Site (NYSDEC VCP Site No. A2-0403-9911). The RE will certify in the FER that the remedial activities were observed by qualified environmental professionals under his supervision and that the remediation requirements set forth in the RAWP and any other relevant provisions of ECL 27-1419 have been achieved in full conformance with that Plan. Other RE certification requirements are listed later in this RAWP.

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

The RE will review all pre-remedial plans submitted by contractors for compliance with this RAWP and will certify compliance in the FER.

In the FER, the RE will provide the certifications listed in Section 10.1.

5.2.3 Work Hours

The hours for operation of remedial construction will conform local ordinances.

5.2.4 Site Security

The work area perimeter will be secured with gated, signed, construction fencing with points of entry in accordance with NYCDOB and NYCDOT permits and requirements. The purpose of the fencing is to limit Site access to authorized personnel, protect pedestrians from Site activities, and maintain Site security.

5.2.5 Traffic Control

Site traffic will be controlled through designated points of access along Avenue U. Access points will be continuously monitored and a flagging system will be used to protect workers, pedestrians and authorized guests. Traffic will also adhere to applicable local, state and federal law.

5.2.6 Contingency Plan

Contingency plans, as described below, have been developed to effectively deal with unexpected discoveries of additional contaminated media.

5.2.6.1 Discovery of Additional Targeted Contaminated Soil

During remedial activities, the soil will be continuously monitored by the RE's field representatives using a PID and visual and olfactory field screening techniques to identify additional soil that may not be suitable for the current disposal facility. Soil so identified will be confirmed by collecting and analyzing a sample in accordance with disposal facility requirements. If the facility is not permitted to receive the suspect materials, the material will be disposed off-site at a permitted facility able to receive the material based on the characterization data.

5.2.7 Worker Training and Monitoring

Worker training and monitoring will be conducted in accordance with the HASP, included as Appendix D.

5.2.8 Agency Approvals

There are no State Environmental Quality Review Act (SEQRA) requirements for this project. All permits or government approvals required for remedial construction have been, or will be, obtained prior to the start of remedial construction.

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

5.2.9 NYSDEC VCP Signage

A project sign will be erected at the main entrance to the Site prior to the start of any remedial activities. The sign will indicate that the project is being performed under the New York State Voluntary Cleanup Program. The sign will meet the detailed specifications provided by the NYSDEC Project Manager.

5.2.10 Pre-Construction Meeting with NYSDEC

A meeting will be conducted to discuss project roles and responsibilities with the RE, Volunteer, construction manager, remediation contractor and the NYSDEC. This meeting will take place prior to the start of major construction activities.

5.2.11 Emergency Contact Information

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

5.3 Site Preparation

5.3.1 Mobilization

Prior to commencing the remedial excavation, the remediation contractor will mobilize to the Site and prepare for remedial activities. Descriptions of mobilization and Site preparation activities may include the following.

- Identifying the location of all aboveground and underground utilities (e.g., power, gas, water, sewer, telephone), equipment, and structures (as necessary to implement the remediation);
- Mobilizing necessary remediation personnel, equipment, and materials to the Site;
- Constructing one or more stabilized construction entrances consisting of nonhazardous material capped with a gravel roadway at or near the Site exit, which takes into consideration the Site setting and Site perimeter;
- Constructing an equipment decontamination pad for trucks, equipment, and personnel that come into contact with impacted materials during remedial activities;
- Installing erosion and sedimentation control measures;
- Installing temporary fencing or other temporary barriers to limit unauthorized access to areas where remediation activities will be conducted.

5.3.2 Erosion and Sedimentation Controls

Based on the size of the Site and the planned excavation, select common erosion and sedimentation control practices will be necessary. Best Management Practices (BMP) for soil erosion will be selected to minimize erosion and sedimentation off-site from the start of the remediation to the completion of development.

5.3.3 Temporary Gravel Construction Entrance(s)

Temporary gravel construction entrances may be installed on-site at the existing curb cuts along Avenue U. The entrance will be graded so that runoff water will be directed on Site. The contractor will protect and maintain the existing sidewalks and roadway at Site access points.

5.3.4 Utility Marker and Easements Layout

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

The presence of utilities and easements on the Site has been investigated by the RE. Utilities will be marked prior to remediation and excavations will be limited so as to not damage existing utilities. It has been determined that no risk or impediment to the planned work under this RAWP is posed by known utilities or easements on the Site.

5.3.5 Sheeting and Shoring

Appropriate management of structural stability of on-site or off-site structures during on-site activities, including excavation, is the sole responsibility of the Volunteer and its contractors. The Volunteer and its contractors are solely responsible for safe execution of all invasive and

other work performed under this Plan. The Volunteer and its contractors must obtain any local, State or Federal permits or approvals that may be required to perform work under this Plan. Further, the Volunteer and its contractors are solely responsible for the implementation of all required, appropriate, or necessary health and safety measures during performance of work under the approved Plan.

5.3.6 Equipment and Material Staging

The contractor will notify the RE and Macerich Management Company, LLC, in writing with receipt confirmed, of pending Site work mobilization at least 30 calendar days in advance. During mobilization, construction equipment will be delivered to the Site, temporary facilities constructed, and temporary utilities installed. The contractor will place and maintain temporary toilet facilities within the work areas for usage by all Site personnel. The contractor will provide drinking water for all Site personnel.

5.3.7 Decontamination Area

The contractor will construct decontamination pads at each Site entrance/exit planned for construction vehicle usage. The location of decontamination pads may change periodically to accommodate the contractor's sequencing of work. The pads will be constructed by the contractor to collect wastewater for off-site disposal or treatment and discharge, if generated during decontamination activities. The design will consider adequate space to decontaminate Site equipment and vehicles, and sloping and liners to facilitate collection of wastewater. Collected decontamination wastewater shall be either discharged in accordance with the contractor's NYCDEP permit or tested and transported to an off-site disposal facility that is permitted to accept this waste, in accordance with applicable city, state, and federal regulations.

If the contractor uses high pressure washing methods, the contractor shall provide splash protection around the vehicle decontamination facility. Splash protection shall minimize potential contamination from splatter and mist movement off-site during the vehicle decontamination process. Splash protection shall be temporary and stable and capable of being dismantled in the event of high winds.

Accumulated truck rinsate and decontamination materials will be collected and commingled with other waste streams for disposal, as appropriate. The contractor will maintain the decontamination pad(s) throughout the duration of Site work. Prior to demobilization, the contractor will deconstruct the pads and dispose of materials as required.

5.3.8 Site Fencing

The work area perimeter will be secured with gated, signed, construction fencing. The purpose of the fencing is to limit Site access to authorized personnel, protect pedestrians from Site activities, and maintain Site security.

5.3.9 Demobilization

The contractor will be responsible for demobilizing all labor, equipment, and materials not designated for off-site disposal from the Site. The RE will be required to document that the remediation contractor decontaminates all equipment and materials prior to removal from the Site. The RE will document performance by the excavation contractor of any follow-up coordination and maintenance for the following activities: removal of sediment and erosion control measures and disposal of materials in accordance with acceptable rules and regulations; removal of any residual contaminated material or wastes; equipment decontamination; and general refuse disposal.

5.4 Reporting

Periodic reports and an FER will be required to document the remedial action. The Project RE responsible for certifying reports will be an individual licensed to practice engineering in the State of New York; Joel Landes, P.E. of Langan, will have this responsibility. Should Mr. Landes become unable to fulfill this responsibility, another suitably qualified New York State professional engineer will take his place. All daily and monthly Reports will be included in the FER. In addition to the periodic reports and the FER, copies of all relevant contractor documents will be submitted to the NYSDEC.

5.4.1 Daily Reports

Daily reports will be completed by the end of each day following the reporting period, submitted to NYSDEC and NYSDOH by noon of the next working day, and maintained on-site. The daily reports will include:

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

Daily reports are not intended to be the mode of communication for notification to the NYSDEC of emergencies (accident, spill), requests for changes to the RAWP or other sensitive or time critical information. However, such conditions must also be included in the daily reports. Emergency conditions and changes to the RAWP will be addressed directly to NYSDEC Project Manager via personal communication as soon as possible.

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

The NYSDEC-assigned project number will appear on all reports.

5.4.2 Weekly Reports

Weekly reports will be submitted to NYSDEC and NYSDOH Project Managers by the Friday of the following week of the reporting period and will include the following information, as well as the information required in the Brownfield Cleanup Agreement:

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

5.4.3 Other Reporting

Photographs will be taken of remedial activities and submitted to NYSDEC in digital (JPEG) format. Photos will illustrate the remedial program elements and will be of acceptable quality. Representative photos of the Site prior to any remedial actions will be provided. Representative photos will be provided of each contaminant source area and Site structures before, during and after remediation. Photos will be submitted to NYSDEC on CD or other acceptable electronic media and will be sent to NYSDEC's Project Manager (2 copies) and to NYSDOH's Project Manager (1 copy). CD's will have a label and a general file inventory structure that separates photos into directories and sub-directories according to logical Remedial Action components. A photo log keyed to photo file ID numbers will be prepared to provide explanation for all representative photos.

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

5.4.4 Complaint Management Plan

The management plan for documenting complaints is detailed below.

Item	Description
Approach	Complaints regarding remediation or construction activities/operations to be minimized and mitigation measures implemented to reduce the incidence of complaints. Report immediately to the NYSDEC Project Manager
Objective	To manage environmental complaints from the community regarding construction or remediation.
Implementation Strategy/Mitigation Measures	All complaints will be documented on a complaint register. The register will be maintained as an ongoing record. The entry will include following information: • Time, date and nature of complaint; • Type of communication (telephone, letter, personal, etc.); • Name, contact address and contact number; • Response and investigation undertaken as a result of the complaint; and action taken and signature of responsible person. Each complaint will be investigated as soon as practical in relation to requirements.
Monitoring	A representative from the Volunteer or the Remediation Engineer or a NYSDEC Public Relation Officer will follow up on the complaint within two weeks of receipt to ensure it is resolved.
Reporting	The NYSDEC Project Manager or her supervisor will be notified immediately. Complaint and resolutions will be discussed with the NYSDEC Public Officer and documented in weekly reports.
Corrective Action	Should an incident of failure to comply occur in relation to the management of environmental complaints, one or more of the following corrective actions will be undertaken as appropriate: • Conduct additional training of staff to handle environmental complaints; • Investigate why the environmental complaint was not addressed within the specified time frame; and • Investigate complaint and action follow-up according to results of investigation.

5.4.5 Deviations from the RAWP

An addendum to this RAWP will be submitted for approval to the NYSDEC and NYSDOH for any deviations and will include:

- Reasons for deviating from the approved RAWP;
- Approval process to be followed for changes/editions to the RAWP; and
- Effect of the deviations on overall remedy.

6.0 REMEDIAL ACTION: MATERIAL REMOVAL FROM SITE

6.1 Soil Cleanup Objectives

Soil will be excavated to the extents defined herein. Soil and materials management on-site and off-site will be conducted in accordance with the Soil/Materials Management Plan as described below.

6.2 Remedial Performance Evaluation (Post-Excavation Sampling)

Documentation soil samples will be collected and analyzed to evaluate soil/fill remaining in place. Documentation samples will be sampled for analysis of 6 NYCRR Part 375 list and TCL/TAL list VOCs. Documentation sampling will be collected in accordance with NYSDEC DER-10. Samples will be collected from the excavation bottom at a frequency of one sample per 900 square feet. Sidewall samples will be collected at a frequency of one sample per 30 feet of sidewall. Should additional documentation sampling be deemed necessary, documentation sampling will occur in accordance with NYSDEC DER-10 and Soil Cleanup Guidance CP-51. No additional excavation will be required based on the documentation sample results.

Soil documentation samples will be transported under standard chain-of-custody protocol to an NYSDOH ELAP-approved laboratory for analysis of the Site soil contaminants of concern. Laboratory analyses will be conducted in accordance with EPA SW-846 methods and NYSDEC Analytical Services Protocol (ASP) Category B deliverable format. The quality assurance and quality control procedures required by the NYSDEC ASP and SW-846 methods will be followed. This will include instrument calibration, standard compound spikes, surrogate compound spikes, and analysis of quality control samples. The laboratory will provide sample bottles, which are pre-cleaned and preserved. Where there are differences in the SW-846 and NYSDEC ASP requirements, the NYSDEC ASP shall take precedence.

A data usability summary report (DUSR) will be included in the FER. Quality control procedures for the sampling are included in the QAPP, included as Appendix E. Confirmation analytical results will be provided in NYSDEC electronic data deliverable (EDD) format for EQuIST™. Guidance on sampling frequency is presented in Section 5.4 of DER-10.

The FER will provide a tabular summary and map of all documentation samples..

6.3 Estimated Material Removal Quantities

The estimated quantity of soil/fill to be removed from the Site is 2,500 cubic yards (including cVOC-impacted source soils and SVOC- and petroleum-impacted historic fill). The estimated quantity of soil/fill to be imported for backfill is 2,500 cubic yards.

6.4 Soil/Materials Management Plan

This section presents the approach to managing, disposing and reuse of soil, fill, and debris excavated from the Site. This plan is based on the current knowledge of Site conditions, and will be augmented with the additional data collected during remediation. A field engineer, scientist or geologist, under the direction of the RE or a QEP, will monitor and document the handling and transport of contaminated material removed from the Site for disposal as a regulated solid waste. A field engineer, scientist or geologist, under the direction of the RE or a QEP, will assist the remedial contractor in identifying impacted materials during excavation, determining materials suitable for direct load out versus temporary on-site stockpiling, selection of samples for waste characterization, and determining the proper off-site disposal facility. Separate stockpile areas will be constructed as needed for the various materials to be excavated or generated, with the intent to most efficiently manage and characterize the materials and to avoid comingling impacted materials with non-impacted soil.

The following three material types are reasonably anticipated to be encountered during the remediation:

- Contaminated, Non-hazardous Material – This material refers to historical fill and native materials that contain contaminants and will not be reused on-site. This material will be excavated throughout the Site to 15 feet as part of the remedy. This material will be transported off-site, and disposed at a facility permitted to accept the material. Characterization sampling will be completed in conformance with the requirements of the disposal facility and post-excavation documentation samples will be collected to document residual soil conditions.
- Petroleum-Impacted, Non-hazardous Material – This material refers to petroleum-impacted historic fill or native material, associated with the historical releases of #2 fuel oil that contains contaminants, and will not be reused on-site. Grossly-impacted material with free product that may

be a source to groundwater contamination will be excavated where possible as part of the remedy, transported off-site, and disposed at a facility permitted to accept the material. Characterization sampling will be completed to conform to the requirements of the disposal facility and post-excavation documentation samples will be collected to document residual soil conditions.

- Hazardous Material – If determined hazardous during waste characterization sampling, this material will include soil with hazardous levels of cVOCs. This material is not currently anticipated based on the RI data. Excavated hazardous material will not be reused on-site, and must be transported off-site and disposed at a facility certified to accept the material. Hazardous material will be removed as shown on the remediation excavation drawing as part of the remedy. Post-excavation documentation samples will be collected to document residual soil conditions.

6.4.1 Soil Screening Methods

Visual, olfactory and PID soil screening and assessment will be performed by an engineer, geologist or scientist under the direct supervision of a PE or qualified environmental professional during all remedial and development excavations into known or potentially contaminated material (Residual Contamination Zone). Soil screening will be performed regardless of when the invasive work is done and will include all excavation and invasive work performed during the remedy, prior to issuance of the Certificate of Completion.

All contaminant sources (including but not limited to tanks and hotspots) identified during Site Characterization, Remedial Investigation, and Remedial Action will be surveyed by a surveyor licensed to practice in the State of New York. This information will be provided on maps in the FER.

Field screening for evidence of contamination will be performed by field engineers, scientists or geologists under the direct supervision of the RE or QEP. Resumes will be provided for all personnel responsible for field screening (i.e. those representing the RE) of invasive work for known or unknown contaminant sources during remediation and development work.

6.4.2 Stockpile Methods

Soil stockpile areas, if needed for the different soil materials, will be constructed for staging of Site soil, pending loading or characterization testing. Separate stockpile areas will be constructed to avoid comingling materials of differing waste types. All stockpile areas will meet the following minimum requirements:

- The excavated soil will be placed onto a minimum thickness of 10-mil low-permeability liner of sufficient strength and thickness to prevent puncture during use; separate stockpiles will be created where material types are different (e.g., petroleum-impacted material stockpiled in a contaminated soil area). The use of multiple layers of thinner liners is permissible.
- Equipment and procedures will be used to place and remove the soil that will minimize the potential to jeopardize the integrity of the liner.
- Stockpiles will be covered at the designated times (see below) with minimum 6-mil plastic sheeting or tarps which will be securely anchored to the ground. Stockpiles will be routinely inspected and broken sheeting covers will be promptly replaced.
- Stockpiles will be covered upon reaching their capacity of approximately 1,000 cubic yards until ready for loading. Stockpiles that have not reached their capacity will be covered at the end of each workday.
- Active stockpiles will be covered at the end of each workday.
- Each stockpile area will be encircled with silt fences and hay bales, as needed to contain and filter particulates from any rainwater that has drained off the soils, and to mitigate the potential for surface water run-off.
- The stockpile areas will be inspected daily and noted deficiencies will be promptly addressed.

6.4.3 Materials Excavation and Load Out

Field engineers, scientists or geologists under the direct supervision of the RE or QEP will oversee all invasive work and the excavation and load-out of all excavated material. The Volunteer and its contractors are solely

responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the Site has been investigated by the RE. Utilities will be marked prior to remediation and excavations will be limited so as to not damage existing utilities. It has been determined that no risk or impediment to the planned work under this RAWP is posed by known utilities or easements on the Site.

Loaded vehicles leaving the Site will be appropriately lined, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and New York State Department of Transportation (NYSDOT) requirements (and all other applicable transportation requirements). Trucks hauling historical fill will not be lined unless the material exhibits free liquids or is grossly impacted.

During Site remediation, continuity will be achieved between the truck wash and the stone-based egress path by placing the truck wash system right before the egress path of the Site. Egress points for truck and equipment transport will be kept clean of dirt and other materials during site remediation and development, so that trucks will be decontaminated prior to departure from the Site. The RE will be responsible for documenting that all outbound trucks will be washed/cleaned at the truck wash before leaving the Site until the remedial construction is complete. Locations where vehicles enter or exit the Site shall be inspected daily for evidence of off-site sediment tracking.

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

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

The RE will ensure that Site development activities will not interfere with, or otherwise impair or compromise, remedial activities proposed in this RAWP.

Each hotspot and structure to be remediated (e.g., USTs, vaults and associated piping, etc.) will be removed and post-excavation documentary sampling completed before excavations related to Site development commence proximal to the hotspot or structure.

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

6.4.4 Materials Transport Off-Site

All transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded. Trucks will enter the Site using Avenue U or other routes approved by NYSDEC. All trucks loaded with Site materials will exit the vicinity of the Site using only approved truck routes.

A truck route to and from the site from the nearest major highway (Shore Parkway) has been selected as the most appropriate route and takes into account:

- (a) limiting transport through residential areas and past sensitive sites;
- (b) use of city mapped truck routes;
- (c) prohibiting off-Site queuing of trucks entering the facility;
- (d) limiting total distance to major highways;
- (e) promoting safety in access to highways; and
- (f) overall safety in transport;
- (g) community input [where necessary]

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

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

To the extent possible, queuing of trucks will be performed on-site in order to minimize off-site disturbance. Off-Site queuing will be minimized.

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

All truck carriages and wheels will be free from dirt and debris when leaving the Site. As required, truck wash waters will be collected and disposed of off-site in an appropriate manner.

6.4.5 Materials Disposal Off-Site

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

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

The following documentation will be obtained and reported by the RE for each disposal location used in this project to fully demonstrate and document that the disposal of material derived from the Site conforms to all applicable laws:

- (1) A letter from the RE or VCP Volunteer to the receiving facility describing the material to be disposed and requesting formal written acceptance of the material. This letter will state that material to be disposed is contaminated material generated at an environmental remediation Site in New York State. The letter will provide the project identity and the name and phone number of

the RE. The letter will include as an attachment a summary of all chemical data for the material being transported (including Site Characterization data); and

- (2) A letter from each receiving facility stating it is in receipt of the correspondence (above) and is approved to accept the material. These documents will be included in the FER.

Nonhazardous historic fill and contaminated soils taken off-site will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2

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

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

The FER will include an accounting of the destination of all material removed from the Site during this Remedial Action, including excavated soil, contaminated soil, historical fill, solid waste, and hazardous waste, non-regulated material, and fluids. Documentation associated with disposal of all material must also include records and approvals for

receipt of the material. This information will also be presented in a tabular form in the FER.

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

Hazardous wastes derived from on-site will be stored, transported, and disposed of in full compliance with applicable local, State, and Federal regulations.

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

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

6.4.6 Materials Reuse On-Site

Soil excavated during remedial activities may be reused if the requirements in this section are met. Grossly-impacted soil will not be reused. The existing asphalt pavement within the excavation extents will be removed during remediation and may be reused for backfill at the Site pending approval from NYSDEC after a Beneficial Use Determination (BUD). Reused soil must be nonhazardous and meet the lower of 6 NYCRR 375-6(b) Unrestricted Use or Protection of Groundwater SCOs or protection of Ecological Resources, which one has a lower limit, in accordance with 6NYCRR Part 375 Table 375-6.8(b) Restricted Use Soil Cleanup Objectives; and in accordance with the predetermined beneficial use determination listed in 6 NYCRR § 360-1.15(b). The Protection of Groundwater SCOs apply only to compounds or analytes detected in groundwater at concentrations that exceeded the Class GA TOGS AWQS. If any of the waste materials are used for an end use specified in Section 360-1.15(b), it will not be considered a solid waste. Soil removed

during implementation of the remedy or other purposes will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines. Reuse of soil will be coordinated in advance with the NYSDEC case manager. Material deemed unfit for reuse will be transported for off-site disposal.

6.4.7 Fluids Management

Collection and pretreatment of contaminated groundwater is anticipated for remedial excavations. All liquids to be removed from the Site, including dewatering fluids, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Liquids discharged into the New York City sewer system will be addressed through approval by NYCDEP.

This dewatering is considered a remedial component and limited dewatering may be conducted via a sump pump or well point system. Dewatering fluids will either be containerized for off-site disposal or discharged to a NYC sewer in accordance with a NYSDEC permit but will not be recharged back to the land surface of the Site. Based on the NYCDEP's effluent limitations, the contractor may be required to install additional pretreatment utilities for dewatering fluids to reduce contaminant concentration below the NYCDEP effluent limitations prior to discharge. Additional pretreatment may include bag filters, carbon filtration, etc. If the contractor's dewatering system has a pumping capacity of greater than 45 gallons per minute, a Long Island Well permit will be obtained from NYSDEC. If the contractor will discharge more than 10,000 gallons per day, they will also have to obtain a NYCDEP Temporary Discharge of Groundwater into the City Sewer System Permit. Collected groundwater or rainwater will be discharged, as defined by the NYCDEP permit, into the New York City sewer system, via an entry point acceptable to the NYCDEP. If required, the dewatering and treatment system will be designed by the contractor's New York State-licensed Professional Engineer.

6.4.8 Demarcation

After the completion of soil removal and any other invasive remedial activities and prior to backfilling, a land survey will be performed by a

New York State licensed surveyor. The survey will define the top elevation of residual contaminated soil. Although not anticipated, a physical demarcation layer, consisting of orange snow fencing material or equivalent material will be placed on this surface to provide a visual reference, where the surface is capped with clean soil (e.g., landscaped area). The demarcation layer is not required if the residual soil is capped with impervious surface cover (e.g., concrete slab). This demarcation layer will constitute the top of the 'Residuals Management Zone', the zone that requires adherence to special conditions for disturbance of contaminated residual soils defined in the SMP. The survey will measure the grade covered by the demarcation layer before the placement of cover soils, pavement and sub-soils, structures, or other materials. This survey and the demarcation layer placed on this grade surface will constitute the physical and written record of the upper surface of the 'Residuals Management Zone' in the SMP. A map showing the survey results will be included in the FER and the SMP.

6.4.9 Backfill from Off-Site Sources

Material proposed for import onto the Site will be sampled and analytical results will be approved by the RE and NYSDEC PM. The analytical results must be in compliance with provisions in this RAWP prior to receipt at the Site. Material from industrial sites, spill sites, other environmental remediation sites or other potentially contaminated sites will not be imported to the Site.

Materials imported to the site for use as backfill will meet the requirements of Appendix 5 (Allowable Constituent Levels for Imported Fill or Soil) in the NYSDEC's guidance document DER-10. Before soils or stone are brought onto the Site, the Site Contractor will supply the Remediation Engineer with the name, location, a brief history, and certified analytical test results for soils originating at the proposed site or facility for review and approval. No imported soils will be allowed onto the site before they are approved by the Remediation Engineer and NYSDEC PM. The fill must be free of organic matter, wood, trash, etc. which cannot be properly compacted. Both the subgrade soils and the clean fill will be compacted following standard construction requirements (to at least 95 % of the maximum dry density as determined by Standard

Proctor compaction test, ASTM D698). The fill gradation and surface slope will be such that it is free draining. Material from a permitted recycling facility may be used for backfill, as approved by the RE prior to importing to the Site. Any stone brought onto the Site must be certified clean from a virgin quarry.

The FER will include the following certification by the RE: "I certify that import of soils from off-Site, including source evaluation, approval and sampling, has been performed in a manner that is consistent with the methodology defined in the RAWP".

Imported soils will meet requirements of Appendix 5 (Allowable Constituent Levels for Imported Fill or Soil) in the NYSDEC's guidance document DER-10. Non-compliant soils will not be imported onto the Site without prior approval by NYSDEC. Nothing in the approved RAWP or its approval by NYSDEC should be construed as an approval for this purpose.

Soils that meet „exempt“ fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this Site, will not be imported onto the Site without prior approval by NYSDEC. Nothing in this RAWP should be construed as an approval for this purpose. Solid waste will not be imported onto the Site. Trucks entering or leaving the Site with imported/export soils and stone will be securely covered with tight fitting covers.

6.4.10 Stormwater Pollution Prevention

Silt fencing or hay bales will be installed around the perimeter of the remedial construction area, as required. Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by NYSDEC. All necessary repairs shall be made immediately. Accumulated sediments will be removed as required to keep the barrier and hay bale check functional. All undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials. Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering. Erosion and sediment control measures identified in the

RAWP shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

6.4.11 Contingency Plan

If underground tanks or other previously unidentified contaminant sources are found during on-site remedial excavation or development related construction, sampling will be performed on product, sediment and surrounding soils, etc. Chemical analytical work will be for full scan parameters Part 375 and TCL/TAL listed VOCs, SVOCs, metals, pesticides, and PCBs. These analyses will not be limited to STARS parameters where tanks are identified without prior approval by NYSDEC. Analyses will not be otherwise limited without NYSDEC approval.

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

6.4.12 Community Air Monitoring Plan (CAMP)

Community air monitoring will be conducted in compliance with the NYSDOH Generic CAMP outlined below and included in the HASP (see Appendix D).

The CAMP includes real-time monitoring for VOCs and particulates at the downwind perimeter of each designated work area when certain activities are in progress. Continuous monitoring is required for all ground intrusive activities. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting and trenching, and the installation of soil borings or monitoring wells. Periodic monitoring for VOCs is required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil,

monitoring during well baling/purging, and taking a reading prior to leaving a sample location.

CAMP monitoring for VOCs levels will be conducted with PIDs, and monitoring for dust/particulates will be conducted with particulate sensors equipped with filters to detect particulates less than 10 microns in diameter (PM10). Monitoring for particulates and odors will be conducted during all ground intrusive activities by the RE's field inspector. The work zone is defined as the general area in which machinery is operating in support of remediation activities. A portable PID will be used to monitor the work zone and for periodic monitoring for VOCs during activities such as soil and groundwater sampling. The Site perimeter will be visually monitored for fugitive dust emissions.

The following actions will be taken based on VOC levels measured:

- If total VOC levels exceed 5 ppm above background for the 15-minute average at the perimeter, work activities will be temporarily halted and monitoring continued. If levels readily decrease (per instantaneous readings) below 5 ppm above background, work activities will resume with continued monitoring.
- If total VOC levels at the downwind perimeter of the hot zone persist at levels in excess of 5 ppm above background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps work activities will resume provided that the total organic vapor level 200 feet downwind of the hot zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less – but in no case less than 20 feet, is below 5 ppm above background for the 15-minute average.
- If the total VOC level is above 25 ppm at the perimeter of the hot zone, activities will be shut down.

The following actions will be taken based on visual dust observations:

- If the downwind particulate level is 100 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) greater than background (upwind perimeter) for the

15-minute period or if airborne dust is observed leaving the work area, then dust suppression must be employed. Work may continue with dust suppression techniques provided that downwind PM10 levels do not exceed $150 \mu\text{g}/\text{m}^3$ above the background level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM10 levels are greater than $150 \mu\text{g}/\text{m}^3$ above the background level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM10 concentration to within $150 \mu\text{g}/\text{m}^3$ of the upwind level and in preventing visible dust migration.

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

6.4.13 Odor, Dust and Nuisance Control Plan

Dust, odor and nuisance control will be accomplished by the remediation contractor as described in this section. The FER will include the following certification by the RE: "I certify that all invasive work during the remediation and all invasive development work were conducted in accordance with dust and odor suppression methodology defined in the RAWP."

6.4.13.1 *Odor Control Plan*

This odor control plan is capable of controlling emissions of nuisance odors off-site. Specific odor control methods to be used on a routine basis will include application of foam suppressants or tarps over the odor or VOC source areas. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of all other complaints about the project. Implementation of all odor controls, including the halt of work, will be the responsibility of the Volunteer's RE, who is responsible for

certifying the FER. Application of odor controls is the responsibility of the remedial contractor.

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

Although not anticipated, where odor nuisances have developed during remedial work and cannot be corrected, or where the release of nuisance odors cannot otherwise be avoided due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering excavation and handling areas under tented containment structures equipped with appropriate air venting/filtering systems.

6.4.13.2Dust Control Plan

Dust suppression will include, at a minimum, the controls listed below:

- Dust suppression will be achieved through the use of a dedicated water distribution system or on-site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-Site roads will be limited in total area to minimize the area required for water truck sprinkling.

6.4.13.3 Other Nuisances

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

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

7.0 RESIDUAL CONTAMINATION TO REMAIN ON-SITE

7.1 In-Situ Chemical Oxidation or Reduction

In-situ chemical oxidation (ISCO) will be implemented to treat residual contaminants in soil and groundwater. A chemical oxidant will be applied to destroy the contaminants in place. The method and depth of application will be determined during the remedial design. Monitoring for soil vapor intrusion in adjacent occupied buildings owned by the volunteer will be performed during and after the treatment phase.

Because residual contaminated soil and groundwater will remain beneath the Site after this phase of the remedy is complete, Engineering and Institutional Controls (ECs and ICs) are required to protect human health and the environment. If necessary, based on the post-excavation analytical results, a Fate and Transport model will be developed to show that the mobility of residual contaminants does not represent an off-site migration concern.

The ECs and ICs are described hereafter. Long-term management of EC/ICs and of residual contamination will be executed under a Site-specific SMP that will be developed and included in the FER.

ECs will be implemented to protect public health and the environment by appropriately managing residual contamination. The Controlled Property (the Site) will have one EC system: a Site cover system consisting of asphalt pavement and concrete sidewalks.

The FER will report residual contamination in tabular and map form.

8.0 ENGINEERING CONTROLS

8.1 Site Cover System

Exposure to residual contaminated soils will be prevented by an engineered, Site cover system (see Figures 5A and 5B). This Site cover system will be comprised of asphalt pavement and concrete sidewalks. The area outside the remedial area is currently capped with asphalt pavement, concrete sidewalks and concrete building slab and will not be disturbed. A Site cover system plan is included as Figures 4, 5A, and 5B.

A Soil Management Plan will be included in the SMP and will outline the procedures to be followed in the event that the Site cover system and underlying residual contamination are disturbed after the Remedial Action is complete. Maintenance of this Site cover system will be described in the SMP in the FER.

8.2 Vapor Mitigation System

Exposure to residual soil vapor will be prevented by installation of an active soil vapor mitigation system. This soil vapor mitigation system will be comprised of up to 400-feet of horizontal header pipe with up to 10 vertical well points installed to a depth of approximately 4-feet below grade. System piping will be routed to a blower with moisture separator in a weather and sound proof enclosure. The need for additional treatment of effluent air will be assessed upon startup. The mitigation system discharge point will be located above the roof line. The proposed location of system components is shown on Figure 4C; however, the exact location of system components including well points, system piping, blower shed and discharge point will be finalized subsequent to approval of this RAWP in a Remedial Design document.

An Operation and Management Plan will be included in the SMP and will outline the procedures to be followed for regular operation of the system. Maintenance of this soil vapor mitigation system will be described in the SMP.

9.0 INSTITUTIONAL CONTROLS

After the remedy is complete, the Site will have residual contamination remaining in place. Engineering Controls for the residual contamination have been incorporated into the remedy to render the overall Site remedy protective of public health and the environment. Two elements have been designed to ensure continual and proper management of residual contamination in perpetuity: an Environmental Easement and an SMP. These elements are described in this Section.

A Site-specific Environmental Easement will be recorded with the New York City Register's Office for Kings County to provide an enforceable means of ensuring the continual and proper management of residual contamination and protection of public health and the environment in perpetuity or until released in writing by NYSDEC. It requires that the grantor of the Environmental Easement and the grantor's successors and assigns adhere to all Engineering and Institutional Controls (ECs/ICs) placed on this Site by this NYSDEC-approved remedy. ICs provide restrictions on Site usage and mandate operation, maintenance, monitoring and reporting measures for all ECs and ICs. The SMP describes appropriate methods and procedures to ensure compliance with all ECs and ICs that are required by the Environmental Easement. Once the SMP has been approved by the NYSDEC, compliance with the SMP is required by the grantor of the Environmental Easement and grantor's successors and assigns.

9.1 Environmental Easement

An Environmental Easement, as defined in Article 71 Title 36 of the Environmental Conservation Law, is required when residual contamination is left on-site after the Remedial Action is complete. As part of this remedy, an Environmental Easement approved by NYSDEC will be filed and recorded with the New York City Register's Office for Queens County. The Environmental Easement will be submitted as part of the FER.

The Environmental Easement renders the Site a Controlled Property. The Environmental Easement must be recorded with the New York City Register's Office for Kings County before the Certificate of Completion can be issued by NYSDEC. A series of Institutional Controls are required under this remedy to implement, maintain and monitor these Engineering Control systems, prevent future exposure to residual contamination by controlling disturbances of the subsurface soil. These Institutional Controls are requirements or restrictions placed on the Site that are listed in, and required by, the Environmental

Easement. Institutional Controls can, generally, be subdivided between controls that support ECs, and those that place general restrictions on Site usage or other requirements. Institutional Controls in both of these groups are closely integrated with the SMP, which provides all of the methods and procedures to be followed to comply with this remedy.

The Institutional Controls that support ECs are:

- Compliance with the Environmental Easement by the Grantee and the Grantee's successors and adherence to all elements of the SMP is required;
- All ECs must be operated and maintained as specified in the SMP;
- A Site cover system consisting of asphalt pavement, concrete sidewalks and the existing concrete building slab must be inspected, certified and maintained as required in the SMP;
- All ECs on the Controlled Property must be inspected and certified at a frequency and in a manner defined in the SMP;
- Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;
- Data and information pertinent to Site Management for the Controlled Property must be reported at the frequency and in a manner defined in the SMP;
- On-Site environmental monitoring devices, including but not limited to groundwater monitoring wells and soil vapor probes, must be protected and replaced as necessary to ensure proper functioning in the manner specified in the SMP;
- ECs may not be discontinued without an amendment or extinguishment of the Environmental Easement. The Environmental Easement may be extinguished only by release by the Commissioner of NYSDEC, or the Commissioner's designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law. Adherence to these Institutional Controls for the Site will be mandated by the Environmental Easement and will be implemented under the SMP (discussed in the next section). The Controlled Property (Site) will also have a series of Institutional Controls in the form of Site restrictions and requirements to be defined in the environmental easement.

9.2 Site Management Plan

Site Management is the last phase of remediation and begins with the approval of the FER and issuance of the Certificate of Completion for the Remedial Action. The SMP is submitted as part of the FER but will be written in a manner that allows its use as a complete and independent document. Site Management continues in perpetuity or until released in writing by NYSDEC. The property owner is responsible to ensure that all Site Management responsibilities defined in the Environmental Easement and the SMP are performed.

The Site Management Plan is intended to assess the performance and effectiveness of the remedy. The plan includes, but may not be limited to:

- Monitoring of groundwater to assess the performance and effectiveness of the remedy;
- A schedule of monitoring and frequency of submittals to the Department; and
 - Annual monitoring for vapor intrusion during the heating season for any future on-site buildings and any existing or future adjacent off-site buildings owned by the volunteer, as may be required by the Institutional and Engineering Control Plan discussed above.
- An Operation and Maintenance (O&M) Plan to ensure continued operation, maintenance, optimization, monitoring natural attenuation, inspection, and reporting of any physical components of the remedy. The plan includes, but is not limited to: Compliance monitoring of treatment systems to ensure proper O&M as well as providing the data for any necessary permit or permit equivalent reporting; and
- Maintaining site access controls and Department notification; and providing the Department access to the site and O&M records.

The SMP is intended to provide a detailed description of the procedures required to manage residual contamination left in place at the Site following completion of the Remedial Action in accordance with the VCP with the NYSDEC. This includes: (1) development, implementation, and management of all Engineering and Institutional Controls; (2) development and implementation of monitoring systems and a Monitoring Plan; (3) development of a plan to operate and maintain any mitigation, treatment, collection, containment, or recovery systems (including, where appropriate, preparation of an Operation and Maintenance Manual); and (4) submittal of Site Management Reports, performance of

inspections and certification of results, and demonstration of proper communication of Site information to NYSDEC.

To address these needs, this SMP will include three plans: (1) an Engineering and Institutional Control Plan for implementation and management of EC/ICs; (2) a Monitoring Plan for implementation of Site monitoring; and (3) a Site Management Reporting Plan for submittal of data, information, recommendations, and certifications to NYSDEC. The SMP will be prepared in accordance with the requirements in NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation and the guidelines provided by NYSDEC.

Site management activities, reporting, and EC/IC certification will be scheduled on a certification period basis. The certification period will be annual and will be due for submission to NYSDEC within 45 days of the end of the reporting period.

No exclusions for handling of residual contaminated soils will be provided in the SMP. All handling of residual contaminated material will be subject to provisions contained in the SMP.

10.0 FINAL ENGINEERING REPORT

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

Where determined to be necessary by NYSDEC, a Financial Assurance Plan will be required to ensure the sufficiency of revenue to perform long-term operations, maintenance and monitoring tasks defined in the SMP and Environmental Easement. This determination will be made by NYSDEC in the context of the FER review.

The FER will include written and photographic documentation of all remedial work performed under this remedy.

The FER will include an itemized tabular description of actual costs incurred during all aspects of the Remedial Action.

The FER will provide a thorough summary of all residual contamination left on the Site after the remedy is complete. Residual contamination includes all contamination that exceeds the Unrestricted Use SCO in 6NYCRR Part 375-6. A table that shows exceedances from Unrestricted SCOs for all soil/fill remaining at the Site after the Remedial Action and a map that shows the location and summarizes exceedances from Unrestricted SCOs for all soil/fill remaining at the Site after the Remedial Action will be included in the FER.

The FER will provide a summary of residual contamination and an explanation for why the material was not removed as part of the Remedial Action. A table and figure that shows residual contamination will be included in the FER.

The FER will include an accounting of the destination of all material removed from the Site, including excavated contaminated soil, historic fill, solid waste, hazardous waste, non-regulated material, and fluids. Documentation associated with disposal of all material must also include records and approvals for receipt of the material. It will provide an accounting of the origin and chemical quality of all material imported onto the Site.

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

10.1 Certifications

The following certification will appear in front of the Executive Summary of the FER. The certification will be signed by the RE, Joel Landes, who is a Professional Engineer registered in New York State. This certification will be appropriately signed and stamped. The certification will include the following statements:

I _____ certify that I am currently a NYS registered professional engineer, I had primary direct responsibility for the implementation of the subject construction program, and I certify that the Remedial Work Plan (or Remedial Design or Plans and Specifications) was implemented and that all construction activities were completed in substantial conformance with the DER-approved Remedial Work Plan (or Remedial Design or Plans and Specifications).

The data submitted to DER demonstrates that the remediation requirements set forth in the Remedial Work Plan (or Remedial Design or Plans and Specifications) and all applicable statutes and regulations have been or will be achieved in accordance with the time frames, if any, established in the work plan (or Remedial Design or Plans and Specifications).

All use restrictions, institutional controls, ECs and/or any operation and maintenance requirements applicable to the Site are contained in an environmental easement created and recorded pursuant to ECL 71-3605 and that any affected local governments, as defined in ECL 71-3603, have been notified that such easement has been recorded.

A SMP has been submitted for the continual and proper operation, maintenance, and monitoring of any ECs employed at the Site including the proper

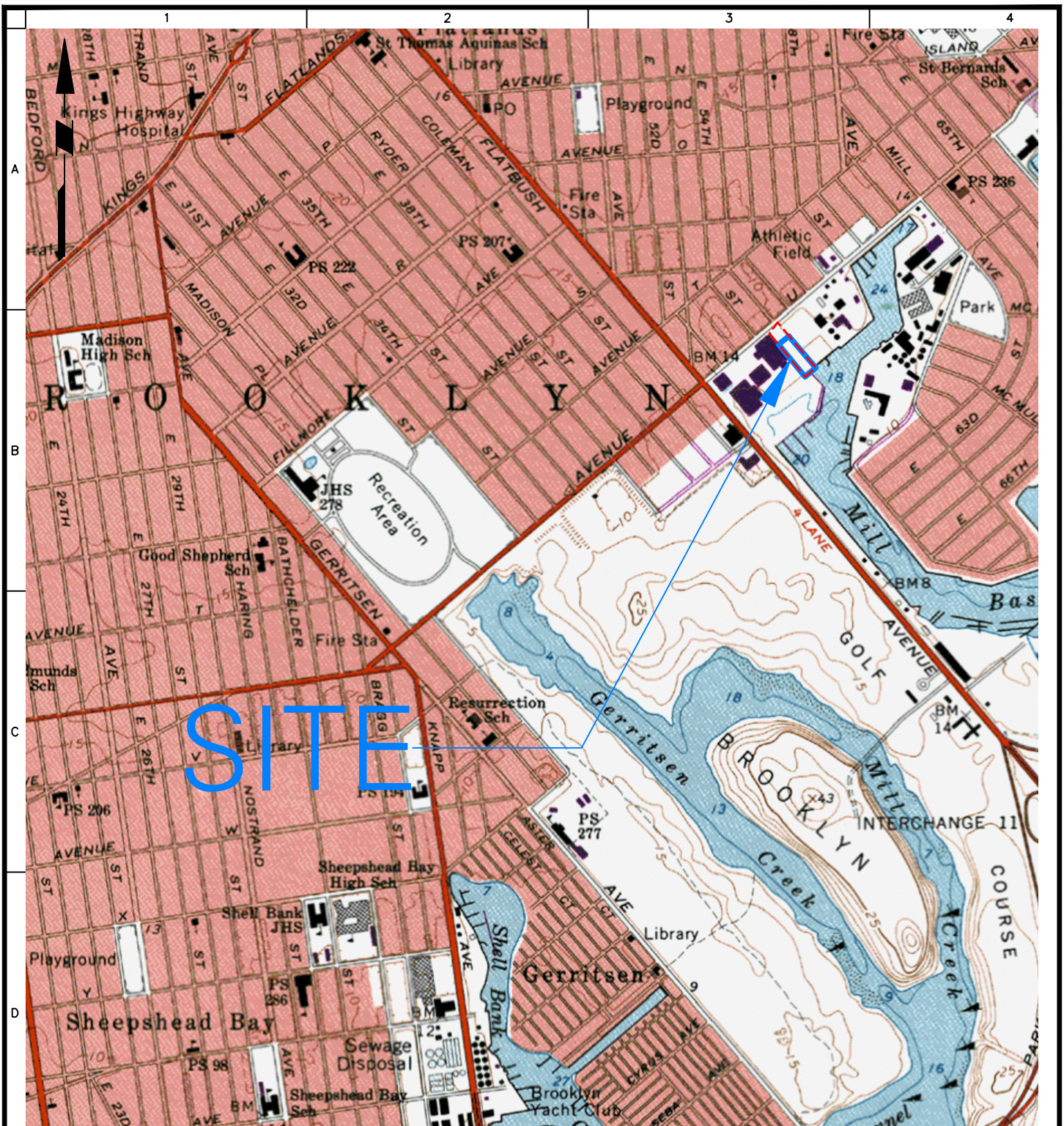
maintenance of any remaining monitoring wells, and that such plan has been approved by DER.

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

11.0 SCHEDULE

Remedial activities are anticipated to begin in spring of 2017. Mobilization will commence prior to remedial activities at the Site and is expected to take approximately 1 week. Once mobilization is complete, the remedial activities can begin, and are anticipated to take approximately 2 to 4 weeks. Within 90 days of completion of all remedial activities at the Site, a FER will be submitted to NYSDEC as detailed in Section 10.0.

FIGURES



WARNING: IT IS A VIOLATION OF THE NYS EDUCATION LAW ARTICLE 145 FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS ITEM IN ANY WAY.

LEGEND

- VCP SITE BOUNDARY
- APPROXIMATE EXTENT OF OPERABLE UNIT OU-1 (SUBJECT OF THIS RAWP)

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Langan Engineering and Environmental Services, Inc.
Langan International LLC

Collectively known as Langan

Project

KINGS PLAZA

BLOCK No. 8470, LOT Nos. 50, 55,
and 114

BROOKLYN

NEW YORK

Drawing Title

**VCP SITE
LOCATION MAP**

Project No.

140080104

Date

01/30/2015

Scale

NTS

Drawn By

HHG

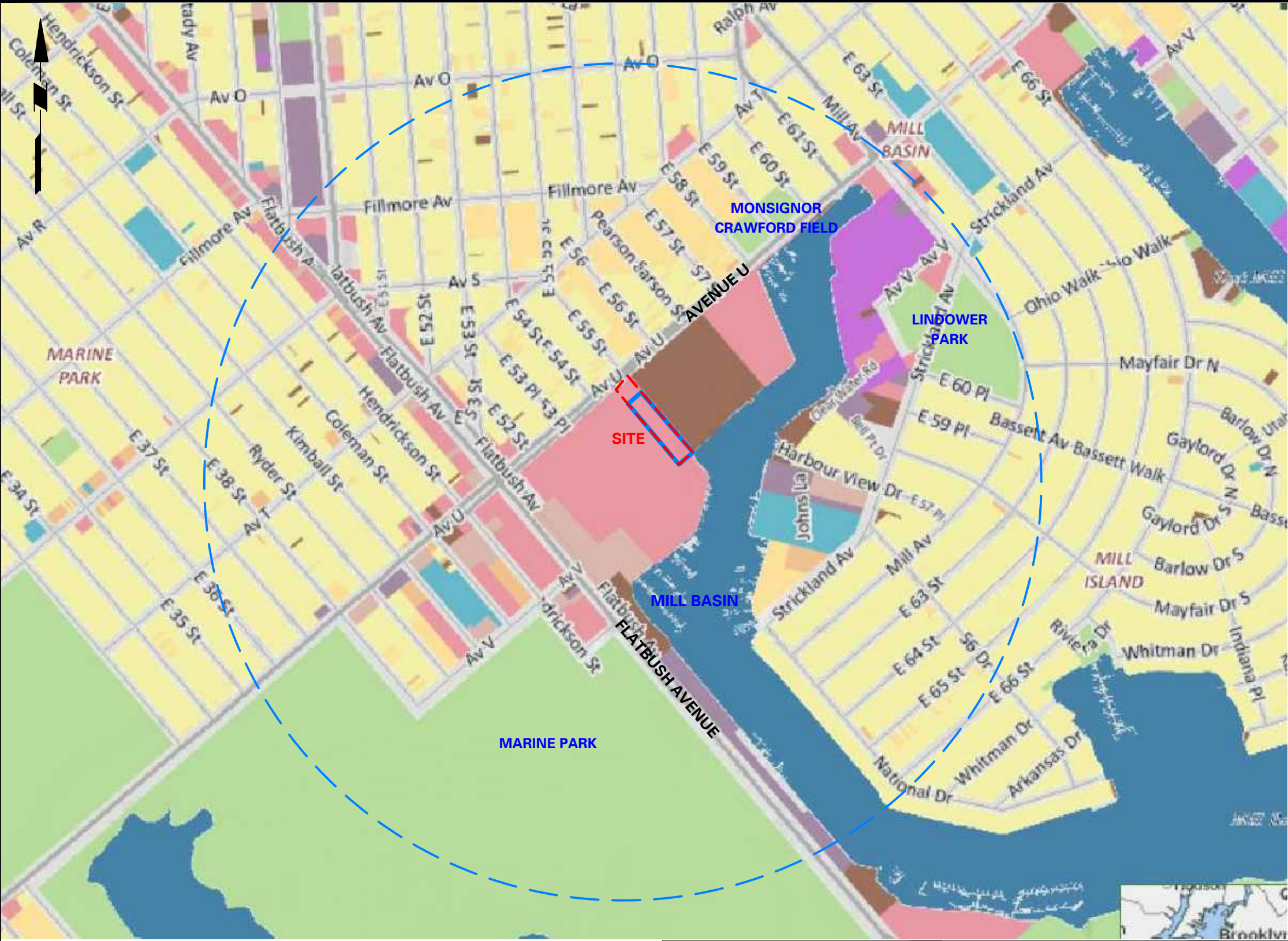
Submission Date

07/18/2016

Figure No.

1

Sheet 1 of 5



LEGEND:

- - - - VCP SITE BOUNDARY
- — — — APPROXIMATE EXTENT OF OPERABLE UNIT OU-1 (SUBJECT OF THIS RAWP)
- - - - MILL BASIN
- - - - HALF MILE RADIUS

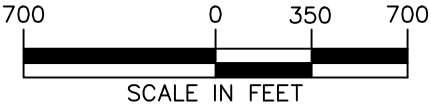
LAND USE LEGEND

- 1 & 2 FAMILY RESIDENTIAL
- MULTI-FAMILY RESIDENTIAL
- MIXED USE
- OPEN SPACE & OUTDOOR RECREATION
- COMMERCIAL
- INSTITUTIONS
- INDUSTRIAL
- PARKING
- TRANSPORTATION/UTILITIES
- VACANT LOTS

NOTES

1. BASE MAP TAKEN FROM WWW.OASISNYC.NET

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BROOKLYN

NEW YORK

Drawing Title

**AREA LAND
USAGE**

Project No.
140080104

Date
01/30/2015

Scale
1" = 700'

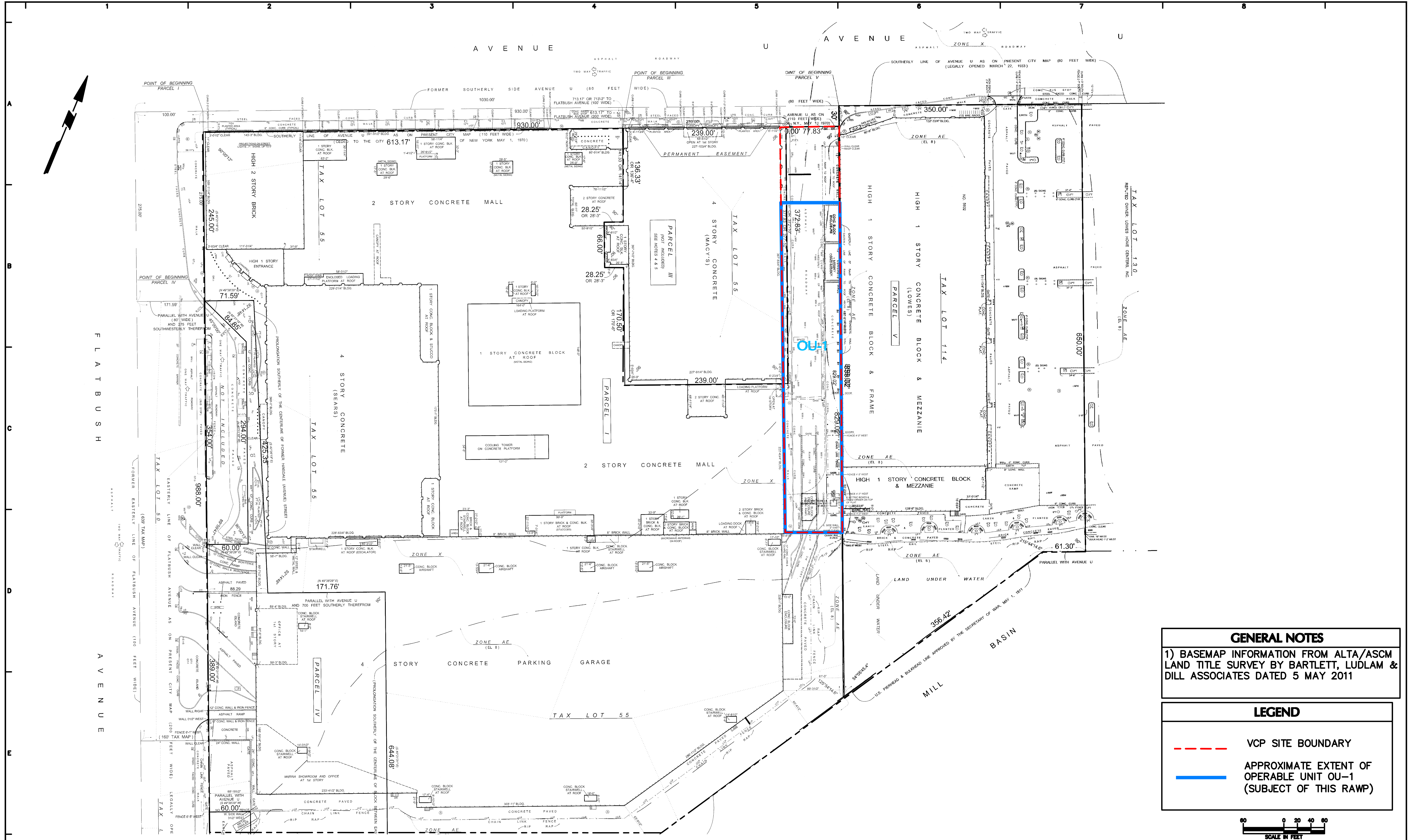
Drawn By
EB

Submission Date
07/18/2016

Drawing No.

2

Sheet 2 of 5

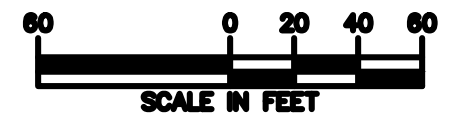


GENERAL NOTES

1) BASEMAP INFORMATION FROM ALTA/ASCM LAND TITLE SURVEY BY BARTLETT, LUDLAM & DILL ASSOCIATES DATED 5 MAY 2011

LEGEND

- VCP SITE BOUNDARY
- APPROXIMATE EXTENT OF OPERABLE UNIT OU-1 (SUBJECT OF THIS RAWP)



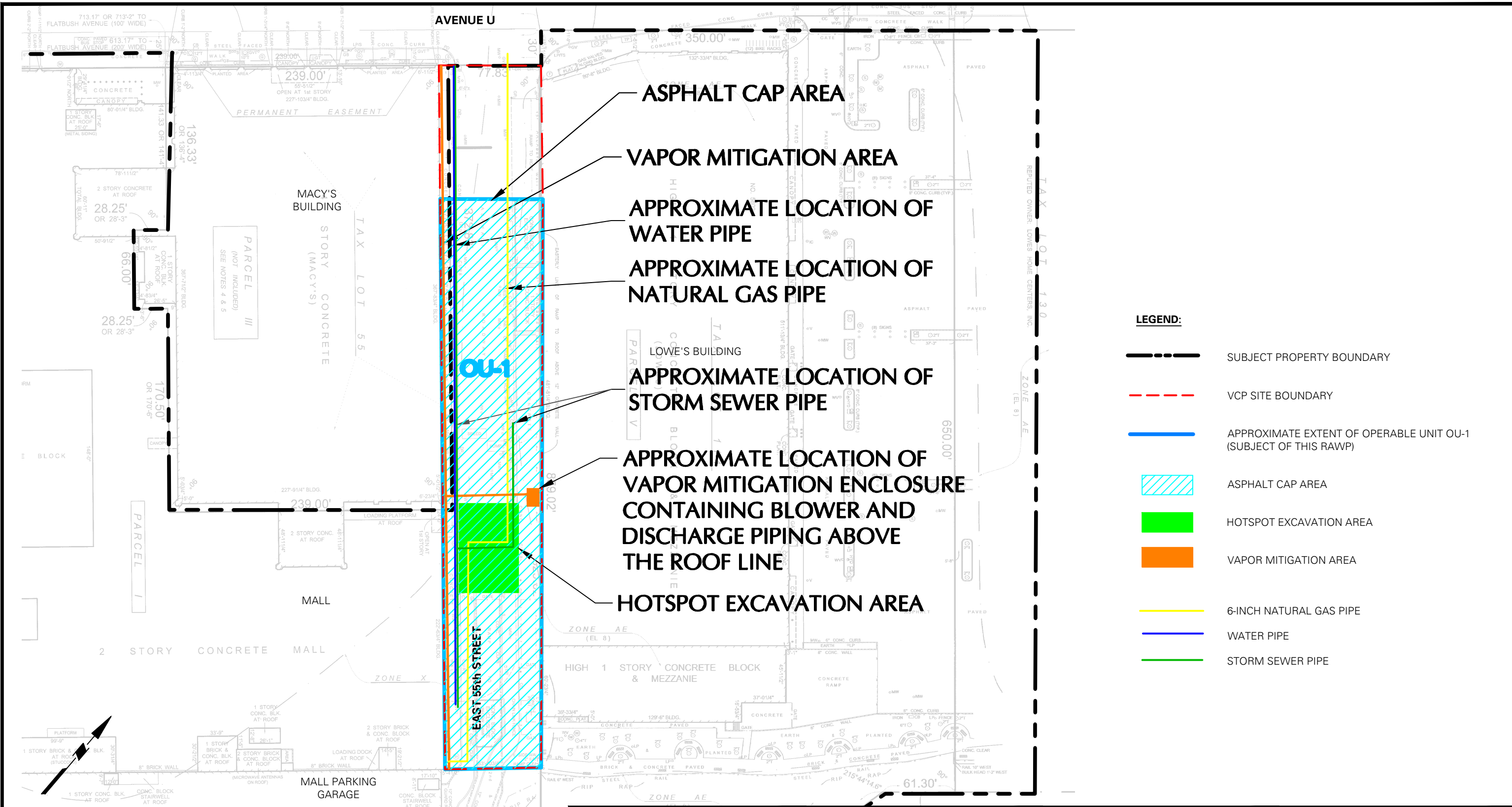
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Project
KINGS PLAZA
BLOCK No. 8470, LOT Nos. 50, 55, AND 114
BROOKLYN NEW YORK

Drawing Title
SITE PLAN

Project No. 140080104	Drawing No. 3
Date 01/30/2015	
Scale 1"=60'	
Drawn By HHG	
Submission Date 07/18/2016	Sheet 3 of 5



NOTES:

1. BASEMAP INFORMATION FROM ALTA/ASCM LAND TITLE SURVEY BY BARTLETT, LUDLAM & DILL ASSOCIATES DATED MAY 5, 2011.

80 0 40 80
SCALE IN FEET

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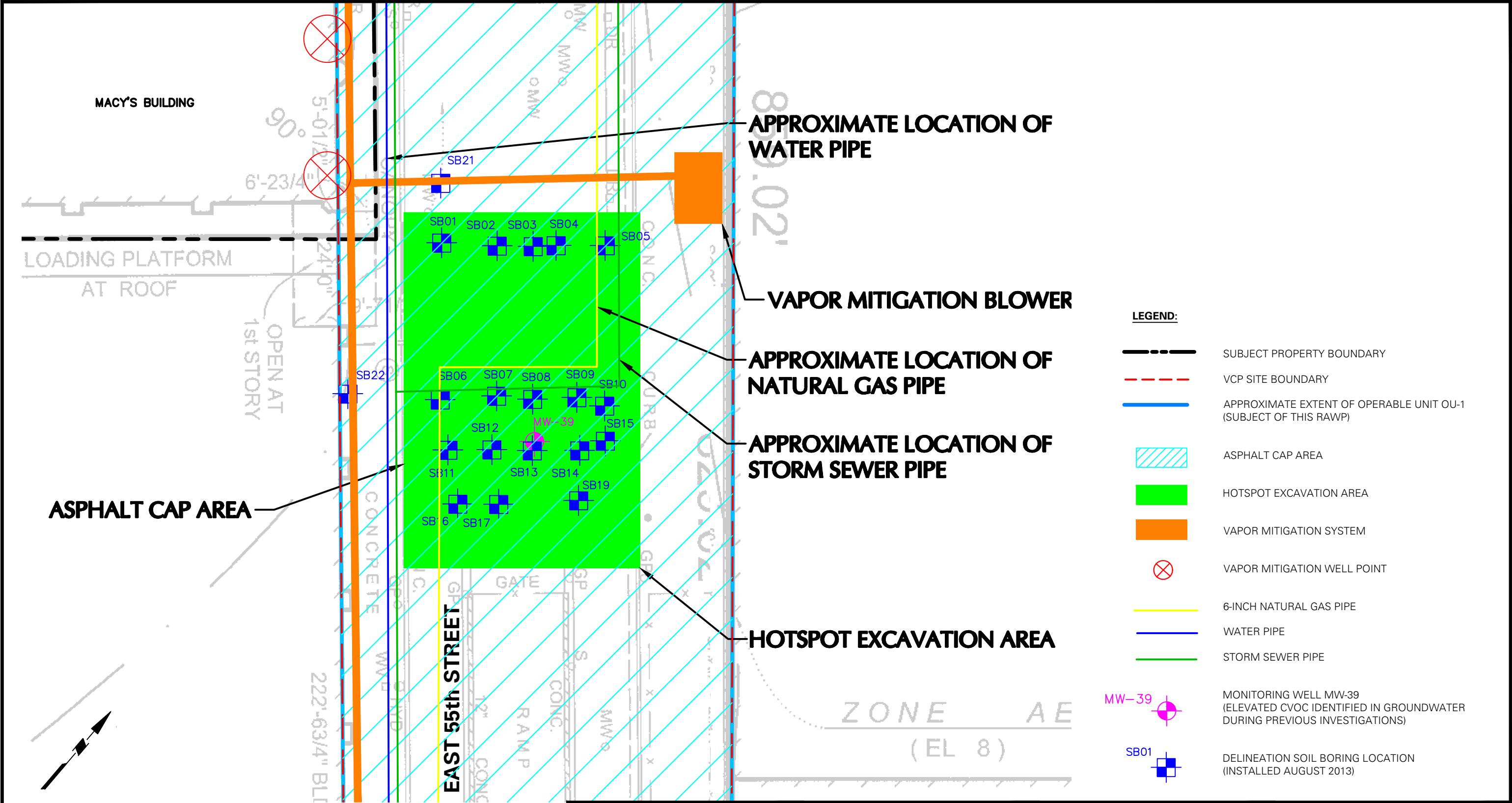
BLOCK No. 8470, LOT Nos. 50, 55, and 114

BROOKLYN NEW YORK

Drawing Title

ENGINEERING CONTROLS AND HOTSPOT REMEDIATION

Project No. 140080104	Drawing No.
Date 01/30/2015	4A
Scale 1" = 80'	
Drawn By HHG	
Submission Date 07/18/2016	Sheet 4 of 5



NOTES:

1. BASEMAP INFORMATION FROM ALTA/ASCM LAND TITLE SURVEY BY BARTLETT, LUDLAM & DILL ASSOCIATES DATED MAY 5, 2011.

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20 0 5 10 20

SCALE IN FEET

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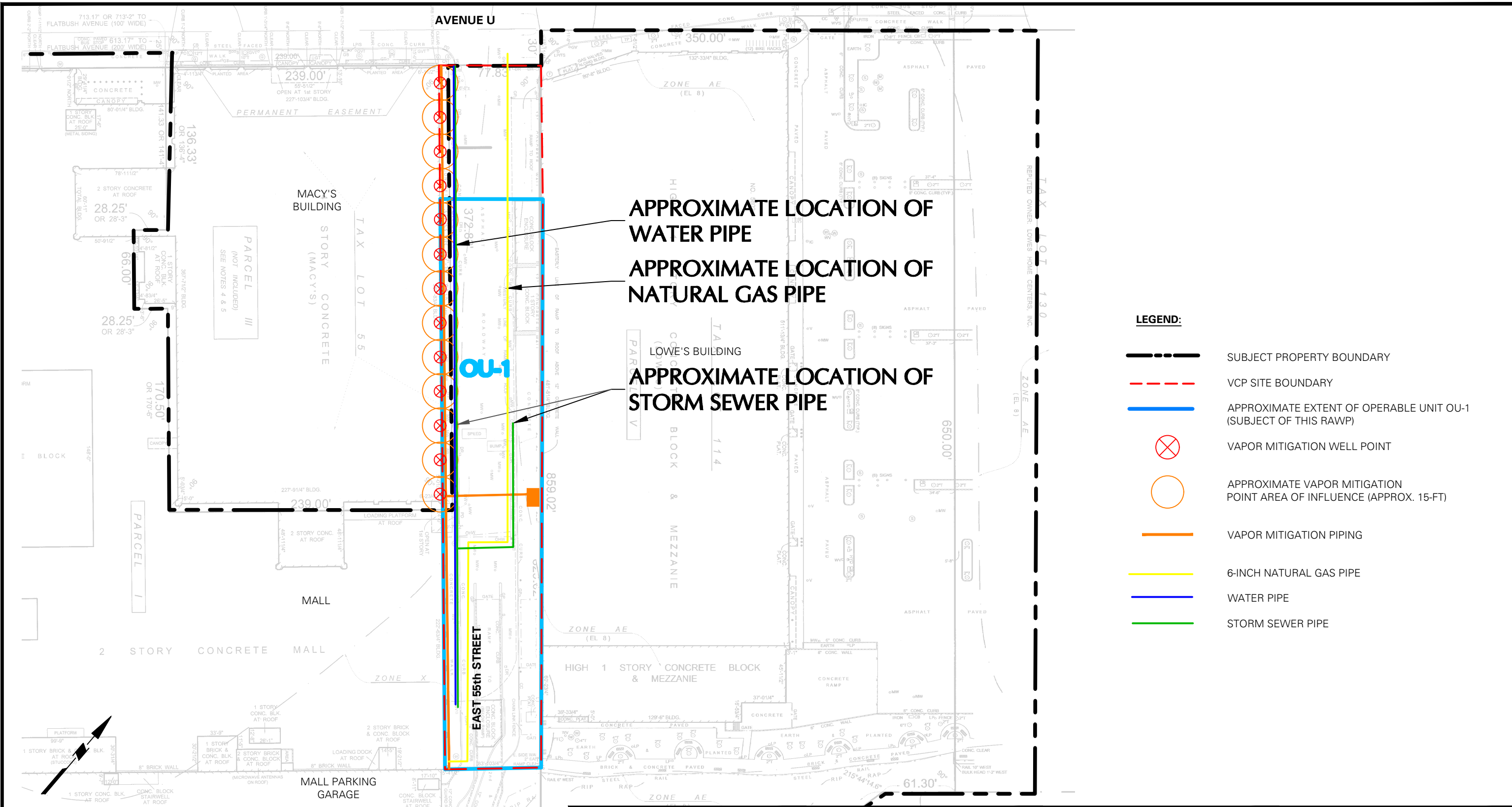
BLOCK No. 8470, LOT Nos. 50, 55, and 114

BROOKLYN NEW YORK

Drawing Title

HOTSPOT EXCAVATION PLAN

Project No. 140080104	Drawing No.
Date 12/1/2015	4B
Scale 1" = 20'	
Drawn By KTZ	
Submission Date 07/18/2016	Sheet 4 of 5



- LEGEND:**
- SUBJECT PROPERTY BOUNDARY
 - VCP SITE BOUNDARY
 - APPROXIMATE EXTENT OF OPERABLE UNIT OU-1 (SUBJECT OF THIS RAWP)
 - VAPOR MITIGATION WELL POINT
 - APPROXIMATE VAPOR MITIGATION POINT AREA OF INFLUENCE (APPROX. 15-FT)
 - VAPOR MITIGATION PIPING
 - 6-INCH NATURAL GAS PIPE
 - WATER PIPE
 - STORM SEWER PIPE

NOTES:

1. BASEMAP INFORMATION FROM ALTA/ASCM LAND TITLE SURVEY BY BARTLETT, LUDLAM & DILL ASSOCIATES DATED MAY 5, 2011.

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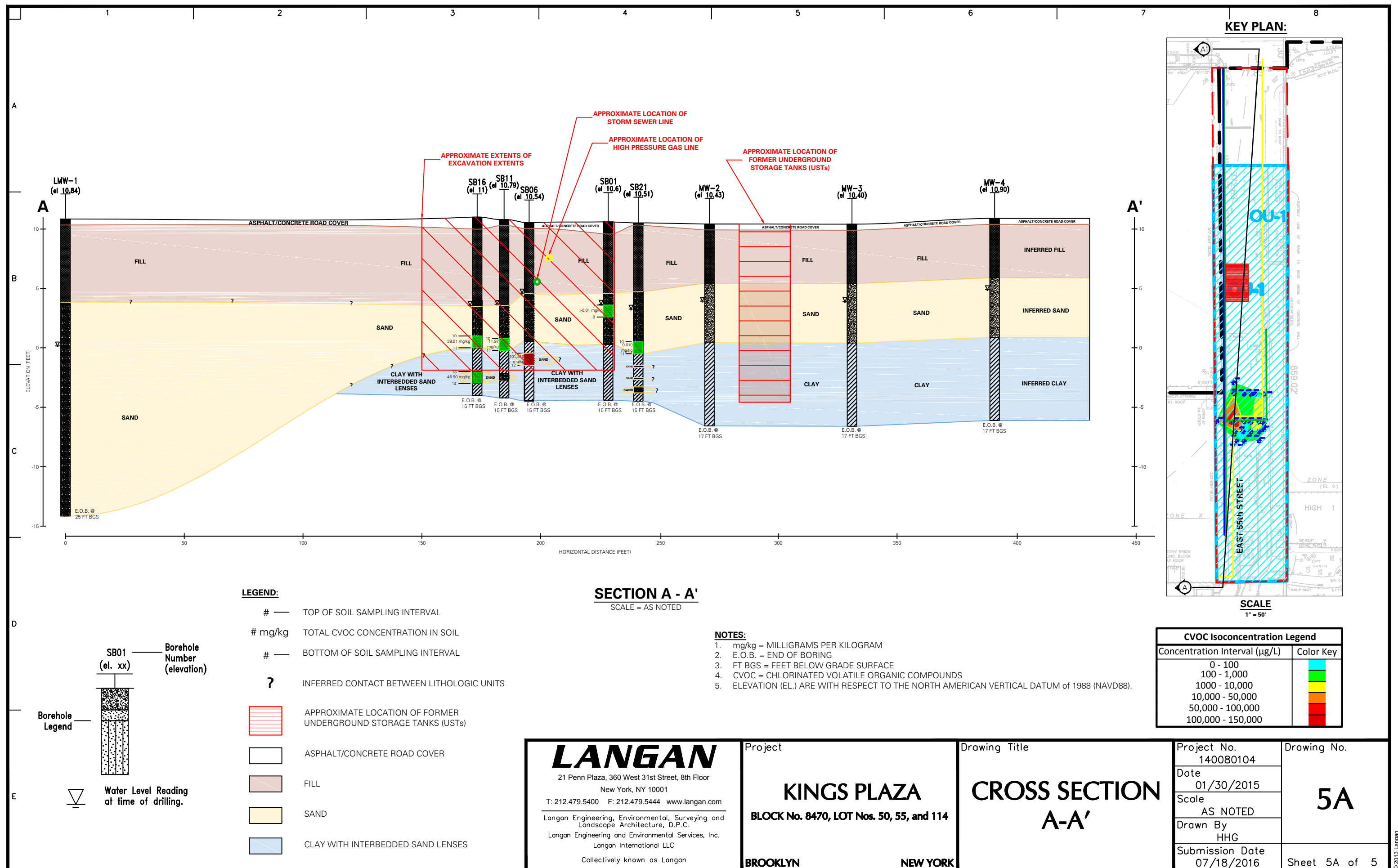
BLOCK No. 8470, LOT Nos. 50, 55, and 114

BROOKLYN **NEW YORK**

Drawing Title

PROPOSED VAPOR MITIGATION PLAN

Project No. 140080104	4C
Date 12/1/2015	
Scale 1" = 80'	
Drawn By KTZ	Sheet 4 of 5
Submission Date 07/18/2016	

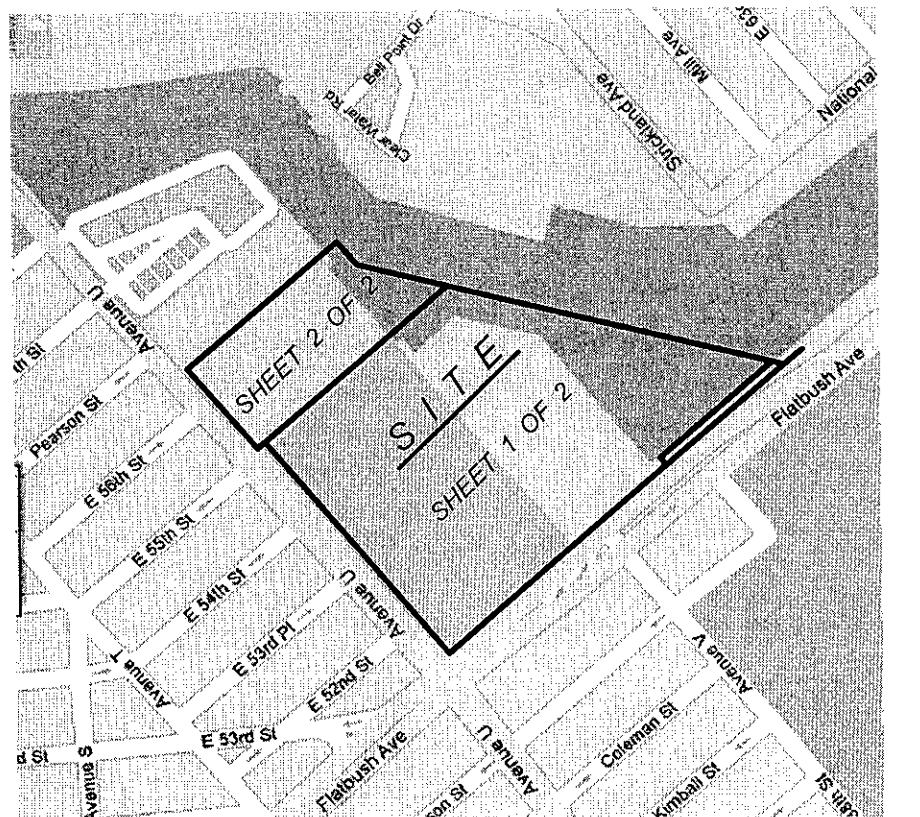


APPENDIX A

Site Survey

IN THE
BOROUGH OF BROOKLYN, COUNTY OF KINGS
CITY AND STATE OF NEW YORK

VICINITY _____ MAP _____
NOT TO SCALE



LEGEND:

- BUMPER GUARD
- G GAS VENT
- GB GAS BOX
- CC CURB CUT
- DR DRAIN
- LPL LIGHT POLE BASE
- SC STEEL COVER
- TS TRAFFIC SIGN
- GT GAS TEST
- GS GAS VALVE
- HV HYDRANT
- IC IRON COVER
- L LIGHT POLE
- LPL LIGHT POLE SIGN
- LPB MAIL BOX
- MP METAL POST
- MW MOUNTING WELL
- LPTS LIGHT POLE/TRAFFIC SIGNAL
- LPB CATCH BASIN
- CH OVERHEAD WIRE(S)
- PD PEDESTRIAN DROP
- PT PUBLIC TELEPHONE
- S SIGN
- L LIGHT
- WM WATER METER
- FF NYC TRAFFIC COVER
- FC FLAG POLE
- GP GATE POST
- 10" TREE AND DIAMETER OF TRUNK
- UT UTILITY POLE
- B BIKE RACK
- EB ELECTRIC BOX
- V WATER VALVE (TYPE UNKNOWN)
- W WATER VALVE

(E)	(E)	ELECTRIC MANHOLE
(G)		GAS MANHOLE
(M)		MANHOLE (TYPE UNKNOWN)
(S)		SEWER MANHOLE
(T)		TELEPHONE MANHOLE
(W)		WATER MANHOLE
		BENCH
(S 40°21'31"E)		BEARING AS PER MODIFIED LEASE PARCEL (PARCEL IV)

TO: STEWART TITLE INSURANCE COMPANY
ALEXANDER'S OF KINGS LLC
KINGS PARKING LLC
ALEXANDER'S KINGS PLAZA, LLC

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2011 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/ACSM LAND TITLE SURVEYS, JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS.
THE FIELD WORK WAS COMPLETED ON MAY 5, 2011.
BROUGHT TO DATE: JULY 20, 2012.

Date: MAY 5, 2011
Brought to date: JULY 20, 2012

John Bernardini (NYSLS No. 049541)

BARTLETT, LUDLAM & DILL ASSOCIATES

LAND AND CITY SURVEYORS SINCE 1809

72-41 COOPER AVENUE
PHONE: 718-366-4832

GLENDAL, NY 11385
FAX: 718-366-4835

60 0 60 120
SCALE = 1" = 40'

SEE SHEET 2 OF 2 FOR DESCRIPTIONS AND NOTES

ALL RIGHTS RESERVED 2012

BLOCK NO: 8470
ORDER NO.: 88442-P SHEET 1 OF 2

OF PROPERTY KNOWN AS

IN THE

NOTES:

- TOTAL AREA OF PARCELS I, IV AND V
EXCLUDING PORTIONS IN THE BED OF AVENUE U
FEET WIDE) AND FLATBUSH AVENUE (200 FEET WIDE) =
1,201,841 SQUARE FEET OR 27.59047 ACRES

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2011 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/ACSM LAND TITLE SURVEYS, JOINTLY ESTABLISHED BY ALTA AND NSPS.
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Date: MAY 5, 2011
Brought to date: JULY 20, 2012

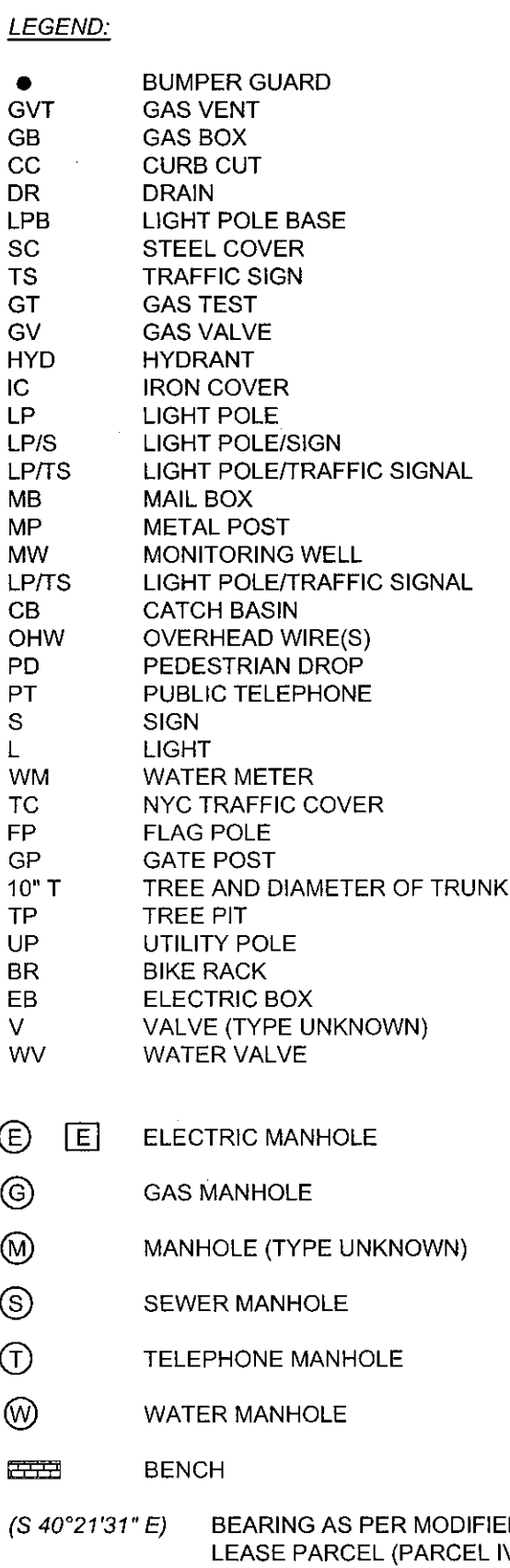
PLETT, LUDLAM & DILL ASSOCIATES
LAND AND CITY SURVEYORS SINCE 1809

72-41 COOPER AVENUE
PHONE: 718-366-4832

GLENDALE, NY 1138
FAX: 718-366-4835

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SCALE = 1" = 40'

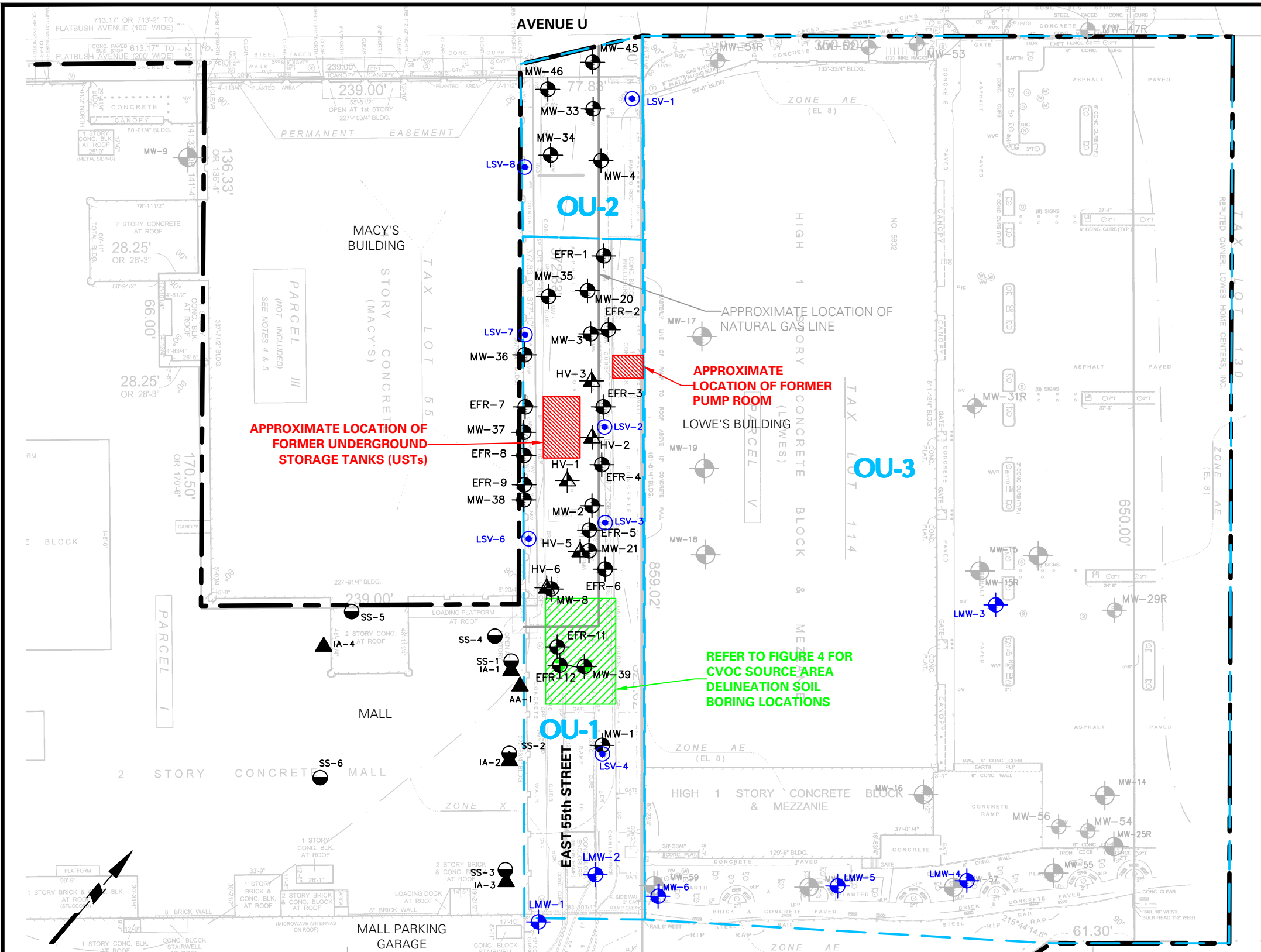
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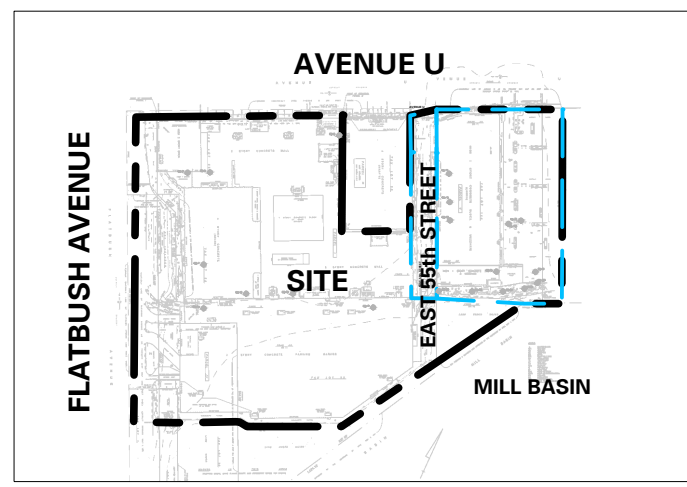
BLOCK NO.: 8470
ORDER NO.: 88442-P SHEET 2 OF 2

APPENDIX B

Selected Remedial Investigation Summary Tables and Figures



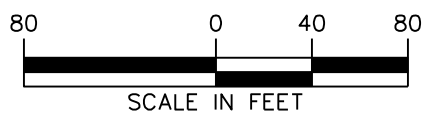
KEY MAP:



LEGEND:

- SUBJECT PROPERTY BOUNDARY
- EXISTING MONITORING WELLS IN OU-1 AND OU-2 (INSTALLED BY OTHERS)
- EXISTING MONITORING WELLS IN OU-3 (INSTALLED BY OTHERS)
- EXISTING HVDPE RECOVERY WELL (INSTALLED BY OTHERS)
- REMOVED OR DESTROYED WELL
- LANGAN SOIL VAPOR POINT (INSTALLED AUGUST 2013)
- LANGAN MONITORING WELL (INSTALLED AUGUST 2013)
- LANGAN SUB-SLAB SOIL VAPOR POINT (INSTALLED MARCH 2014)
- LANGAN INDOOR AND AMBIENT AIR SAMPLE LOCATION (MARCH 2014)
- APPROXIMATE EXTENT OF OPERABLE UNITS (OU)
- APPROXIMATE AREA OF CVOC SOIL INVESTIGATION (REFER TO FIGURE 4 FOR CVOC SOURCE AREA DELINEATION SOIL BORING LOCATIONS)

- NOTES:
- BASEMAP INFORMATION FROM ALTA/ASCM LAND TITLE SURVEY BY BARTLETT, LUDLAM & DILL ASSOCIATES DATED MAY 5, 2011.
 - MONITORING WELL EFR-2 WAS DECOMMISSIONED IN SEPTEMBER 2013.
 - CVOC = CHLORINATED VOLATILE ORGANIC COMPOUNDS

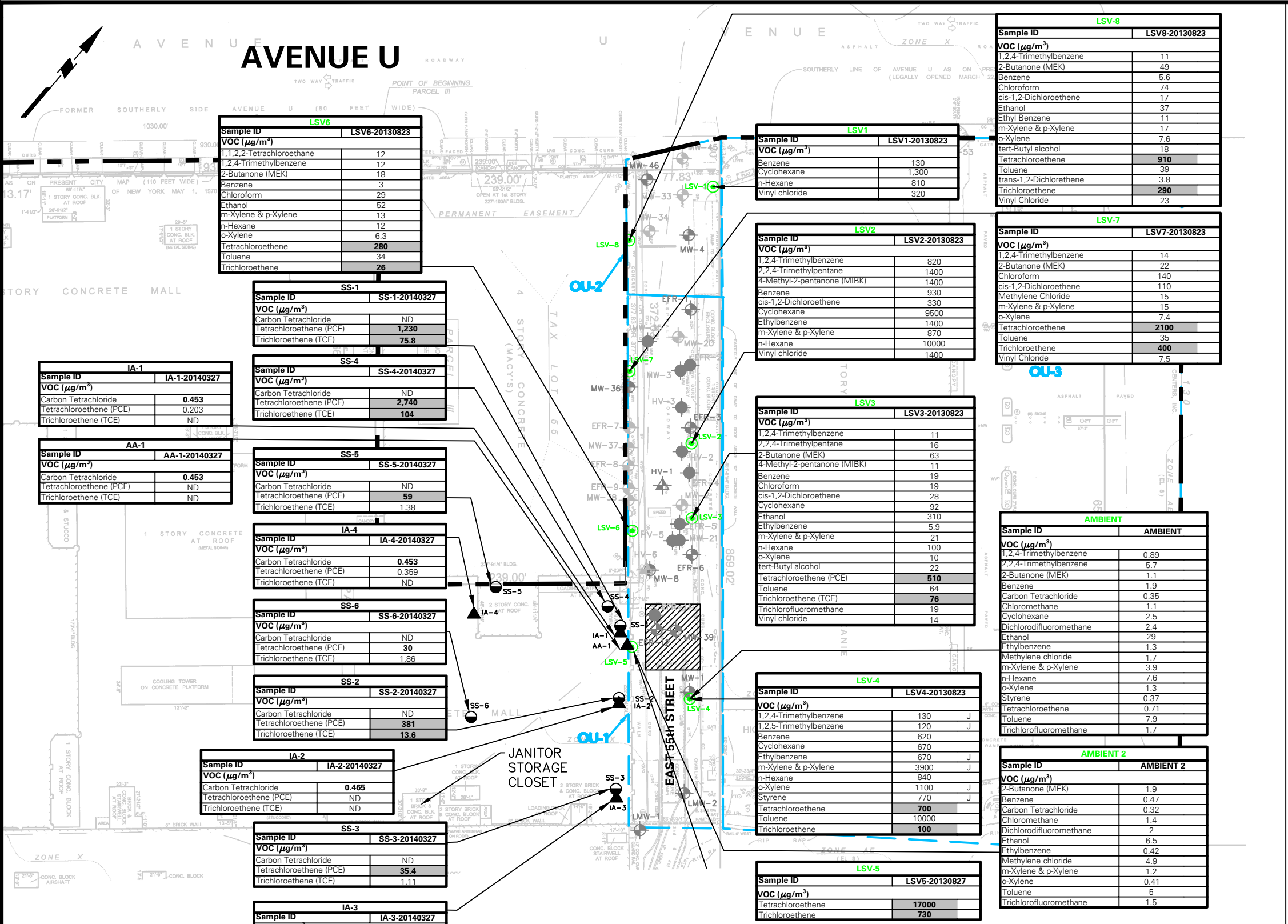


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Langan Engineering and Environmental Services, Inc.
Langan International LLC
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Project
KINGS PLAZA
SRIR - OU-1
BLOCK No. 8470, LOT Nos. 50, 55, and 114
BROOKLYN NEW YORK

Drawing Title
INVESTIGATION PLAN

Project No. 140080105	Drawing No.



LEGEND:

- SUBJECT PROPERTY BOUNDARY
- EXISTING MONITORING WELLS
- EXISTING HVDPE RECOVERY WELL
- DECOMMISSIONED WELL
- LANGAN SOIL VAPOR POINT (INSTALLED AUGUST 2013)
- LANGAN SUB-SLAB SOIL VAPOR POINT (INSTALLED MARCH 2014)
- LANGAN INDOOR AND AMBIENT AIR SAMPLE LOCATION (MARCH 2014)
- APPROXIMATE EXTENT OF OPERABLE UNITS (OU)
- THIS SYMBOL DENOTES THAT FREE PRODUCT WAS OBSERVED IN THE MONITORING WELL DURING THE AUGUST 19, 2013, GAUGING EVENT
- APPROXIMATE AREA OF CVOC SOIL INVESTIGATION (REFER TO FIGURE 4 FOR cVOC SOURCE AREA DELINEATION SOIL BORING LOCATIONS)

NOTES:

- BASEMAP INFORMATION FROM ALTA/ASCM LAND TITLE SURVEY BY BARTLETT, LUDLAM & DILL ASSOCIATES DATED MAY 5, 2011.
- SAMPLE RESULTS WERE COMPARED TO THE NEW YORK STATE DEPARTMENT OF HEALTH (NYSDOH) AIR GUIDELINE VALUES (AGV).
- ONLY DETECTED COMPOUNDS ARE SHOWN.
- CONCENTRATIONS EXCEEDING NYSDOH AGV ARE HIGHLIGHTED AND IN BOLD.
- INDOOR AIR CONCENTRATIONS EXCEEDING NYSDOH INDOOR AIR ACTION LEVELS ARE BOLD.
- VOC = VOLATILE ORGANIC COMPOUND
- CVOC = CHLORINATED VOLATILE ORGANIC COMPOUND
- $\mu\text{g}/\text{m}^3$ = MICROGRAM PER CUBIC METER
- J = ANALYTE DETECTED ABOVE THE METHOD DETECTION LIMIT BUT BELOW THE REPORTING LIMIT; THEREFORE, RESULT IS AN ESTIMATED CONCENTRATION

STANDARDS	NYSDOH AGV
VOC ($\mu\text{g}/\text{m}^3$)	
Carbon Tetrachloride	—
Methylene Chloride	60
Tetrachloroethene	30
Trichloroethene	5

LANGAN

21 Penn Plaza, 360 West 31st Street, 8th Floor
New York, NY 10001
T: 212.479.5400 F: 212.479.5444 www.langan.com
Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C.
Langan Engineering and Environmental Services, Inc.
Langan International LLC
Collectively known as Langan

Project

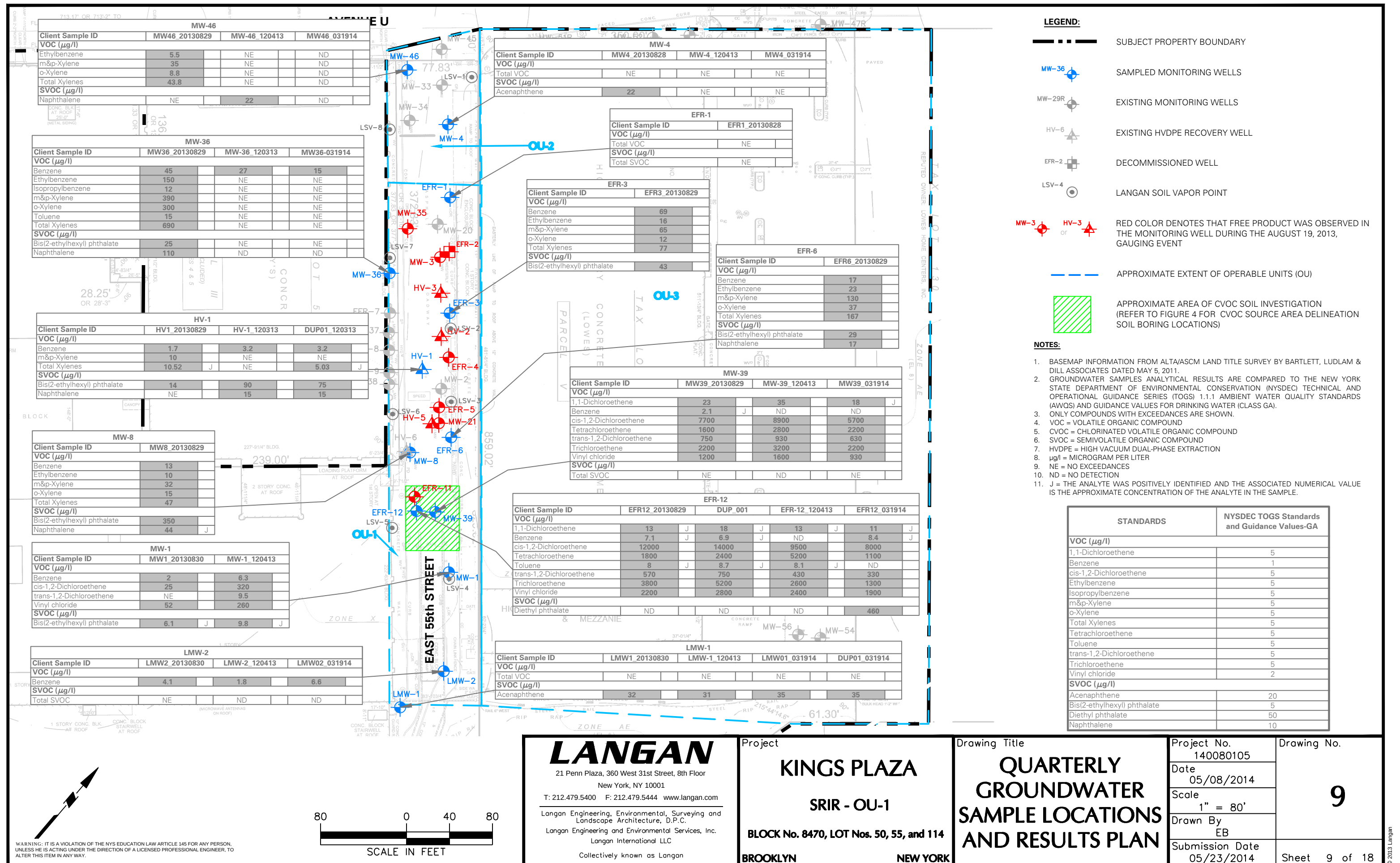
KINGS PLAZA
SRIR - OU-1
BLOCK No. 8470, LOT Nos. 50, 55, and 114
BROOKLYN NEW YORK

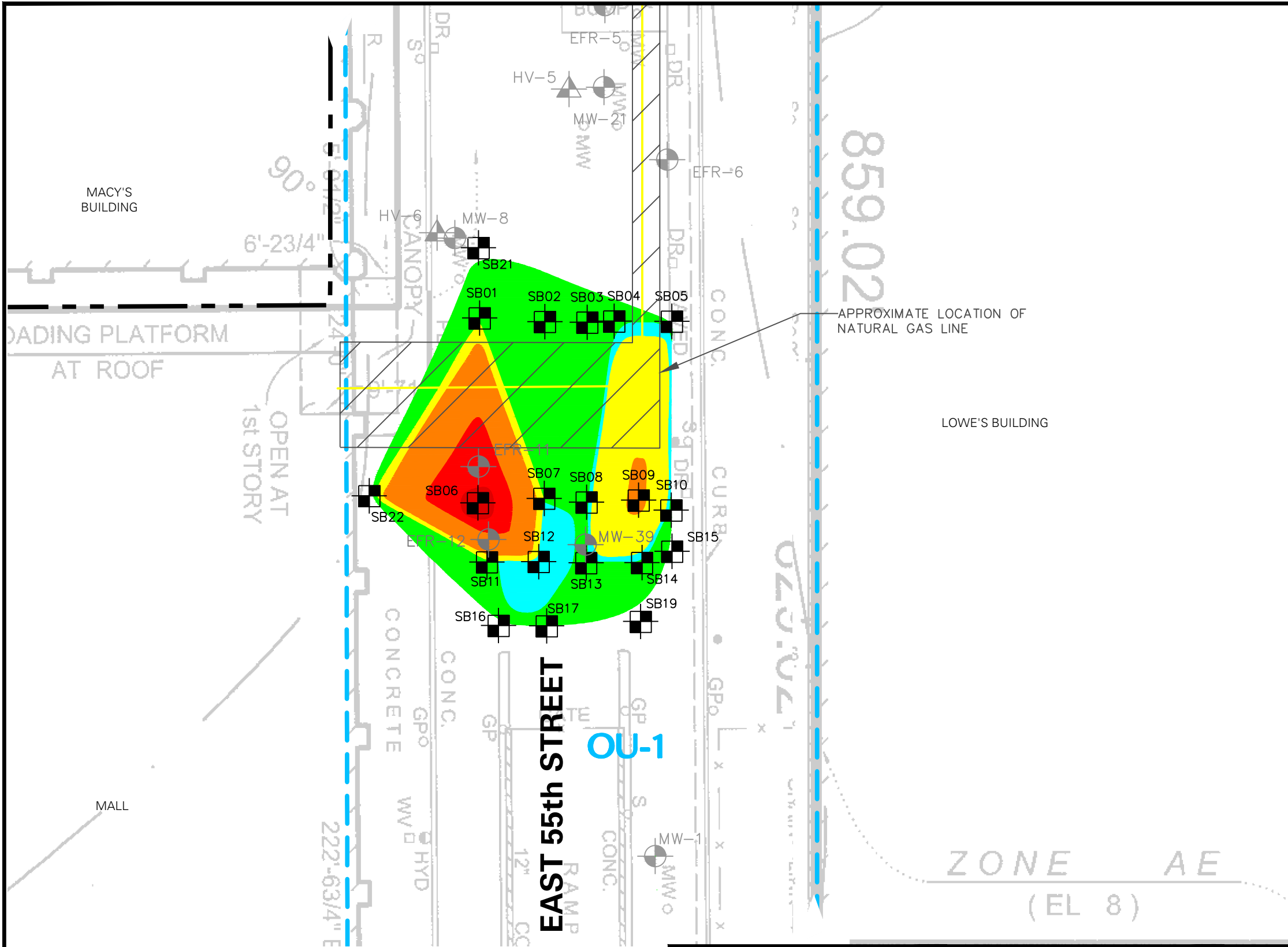
Drawing Title

SOIL VAPOR AND INDOOR AIR SAMPLE LOCATIONS AND RESULTS PLAN

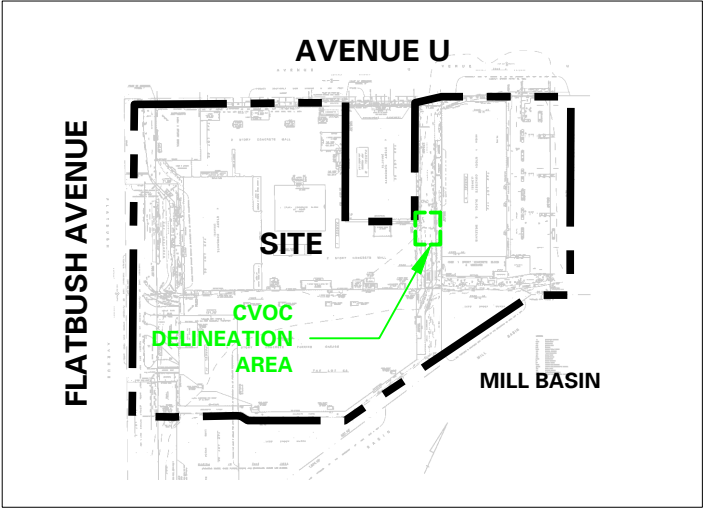
Project No. 140080105	Drawing No. 10
Date 05/08/2014	
Scale 1" = 100'	
Drawn By EB	
Submission Date 05/23/2014	Sheet 10 of 18

WARNING: IT IS A VIOLATION OF THE NYS EDUCATION LAW ARTICLE 145 FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS ITEM IN ANY WAY.





KEY MAP:



LEGEND:

- SUBJECT PROPERTY BOUNDARY
- OU-1 BOUNDARY
- EXISTING MONITORING WELL
- EXISTING HVDPE RECOVERY WELL
- CVOC DELINEATION SOIL BORING

NOTES:

- BASEMAP INFORMATION FROM ALTA/ASCM LAND TITLE SURVEY BY BARTLETT, LUDLAM & DILL ASSOCIATES DATED MAY 5, 2011.
- CVOC = CHLORINATED VOLATILE ORGANIC COMPOUNDS
- mg/kg = MILLIGRAMS PER KILOGRAM

Soil CVOC Isoconcentration Legend	
Concentration Interval (mg/kg)	Color Key
0 - 100	Green
100 - 1,000	Yellow
1,000 - 10,000	Orange
10,000 - 50,000	Red
50,000 - 100,000	Dark Red
100,000 - 150,000	Black

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Project

KINGS PLAZA

SRIR - OU-1

BLOCK No. 8470, LOT Nos. 50, 55, and 114

BROOKLYN

NEW YORK

Drawing Title

**SOIL CVOC
ISOCONCENTRATION
MAP**

Project No.

140080105

Date

05/05/2014

Scale

1" = 20'

Drawn By

AT

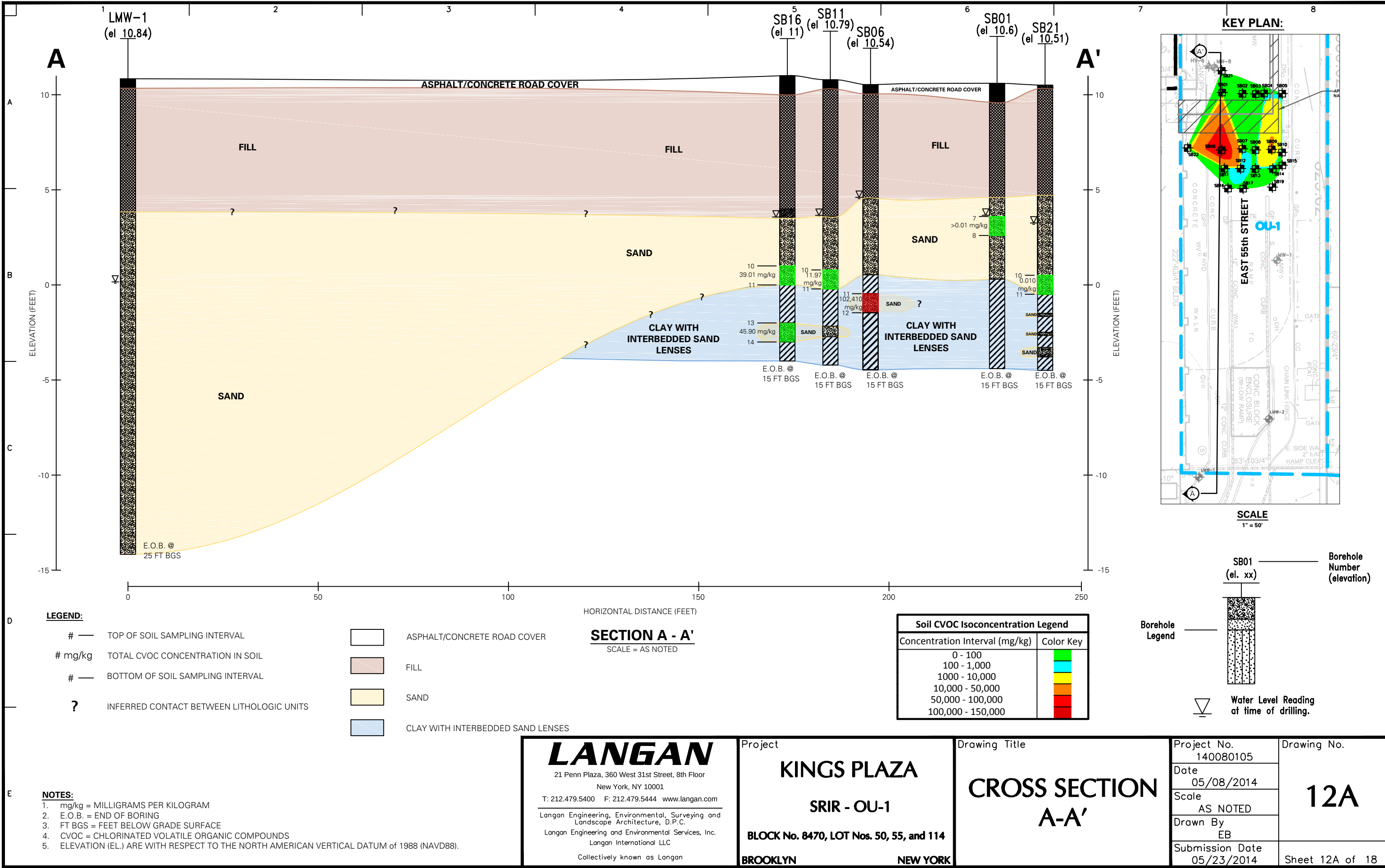
Submission Date

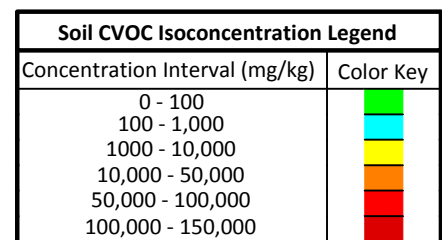
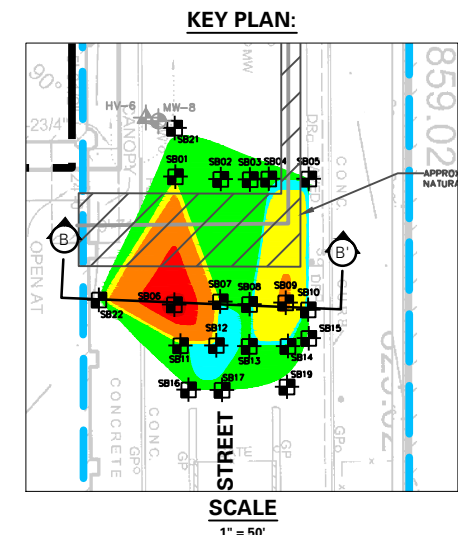
05/23/2014

Drawing No.

11

Sheet 11 of 18





	ASPHALT/CONCRETE ROAD COVER
	FILL
	SAND
	CLAY WITH INTERBEDDED SAND LENSES

Project No. 140080105	Drawing No. 12B
Date 05/05/2014	
Scale AS NOTED	
Drawn By AT	
Submission Date 05/23/2014	Sheet 12B of 18

LANGAN

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Langan Engineering, Environmental, Surveying and
Landscape Architecture, D.P.C.

Langan Engineering and Environmental Services, Inc.
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Table 1
Sample Summary
Supplemental Remedial Investigation Report
Kings Plaza Mall
Brooklyn, New York
NYSDEC VCA No. A2-0403-9911
Langan Project Nos. 140080104 and 140080105

Boring/Monitoring Well/Soil Gas Location	Sample ID	Sample Type	Sample Date	Sample Matrix	Sample Interval (feet bgs)	Parent Sample (for duplicate samples only)
Soil Samples						
SB01	SB01_5-6	N	08/27/13	Soil	5-6	-
	SB01_7-8	N	08/27/13	Soil	7-8	-
SB02	SB02_6-7	N	08/27/13	Soil	6-7	-
	SB02_10-11	N	08/27/13	Soil	10-11	-
	DUP003	Duplicate	08/27/13	Soil	10-11	SB02_10-11
SB03	SB03_6-7	N	08/26/13	Soil	6-7	-
	SB03_8-9	N	08/26/13	Soil	8-9	-
	SB03_10-11	N	08/26/13	Soil	10-11	-
SB04	SB04_6-7	N	08/26/13	Soil	6-7	-
	SB04_7-8	N	08/26/13	Soil	7-8	-
	SB04_10-11	N	08/26/13	Soil	10-11	-
SB05	SB05_5-6	N	08/26/13	Soil	5-6	-
	SB05_7-8	N	08/26/13	Soil	7-8	-
	SB05_10-10.5	N	08/26/13	Soil	10-10.5	-
SB06	SB06_5-6	N	08/27/13	Soil	5-6	-
	SB06_7-8	N	08/27/13	Soil	7-8	-
	SB06_11-12	N	08/27/13	Soil	11-12	-
SB07	SB07_6-7	N	08/27/13	Soil	6-7	-
	SB07_10-11	N	08/27/13	Soil	10-11	-
	SB07_12-13	N	08/27/13	Soil	12-13	-
SB08	SB08_5-6	N	08/26/13	Soil	5-6	-
	SB08_10-11	N	08/26/13	Soil	10-11	-
	SB08_10-11-MS	MS/MSD	08/26/13	Soil	10-11	-
	SB08_10-11-SD	MS/MSD	08/26/13	Soil	10-11	-
SB09	SB09_7-8	N	08/26/13	Soil	7-8	-
	SB09_10-11	N	08/26/13	Soil	10-11	-
SB10	SB10_5-6	N	08/26/13	Soil	5-6	-
	SB10_10-11	N	08/26/13	Soil	10-11	-
	SB10_10-11-MS	MS/MSD	08/26/13	Soil	10-11	-
	SB10_10-11-SD	MS/MSD	08/26/13	Soil	10-11	-
	SB10_13-14	N	08/26/13	Soil	13-14	-
	Dup-001	Duplicate	08/26/13	Soil	13-14	SB10_13-14
SB11	SB11_6-7	N	08/27/13	Soil	6-7	-
	SB11_10-11	N	08/27/13	Soil	10-11	-
SB12	SB12_6-7	N	08/27/13	Soil	6-7	-
	SB12_10-11	N	08/27/13	Soil	10-11	-
	SB12_12-13	N	08/27/13	Soil	12-13	-
SB13	SB13_6-7	N	08/26/13	Soil	6-7	-
	SB13_10-11	N	08/26/13	Soil	10-11	-
SB14	SB14_7-8	N	08/26/13	Soil	7-8	-
	SB14_10-11	N	08/26/13	Soil	10-11	-
SB15	SB15_6-7	N	08/26/13	Soil	6-7	-
	SB15_11-12	N	08/26/13	Soil	11-12	-
SB16	SB16_6-7	N	08/27/13	Soil	6-7	-
	SB16_10-11	N	08/27/13	Soil	10-11	-
	SB16_13-14	N	08/27/13	Soil	13-14	-
SB17	SB17_7-8	N	08/27/13	Soil	7-8	-
	SB17_10-11	N	08/27/13	Soil	10-11	-
SB19	SB19_8-9	N	08/26/13	Soil	8-9	-
	Dup_002	Duplicate	08/26/13	Soil	8-9	SB19_8-9
	SB19_13-14	N	08/26/13	Soil	13-14	-
SB21	SB21_5-6	N	08/27/13	Soil	5-6	-
	SB21_10-11	N	08/27/13	Soil	10-11	-
SB22	SB22_6-7	N	08/27/13	Soil	6-7	-
	SB22_7-8	N	08/27/13	Soil	7-8	-
	SB22_10-11	N	08/27/13	Soil	10-11	-
Groundwater Samples						
EFR1	EFR1_20130828	N	08/28/13	Groundwater	NA	-
EFR3	EFR3_20130829	N	08/29/13	Groundwater	NA	-
EFR6	EFR6_20130829	N	08/29/13	Groundwater	NA	-
EFR12	EFR12_20130829	N	08/29/13	Groundwater	NA	-
	EFR12_20130829-MS	MS/MSD	08/29/13	Groundwater	NA	-
	EFR12_20130829-MSD	MS/MSD	08/29/13	Groundwater	NA	-
	DUP001_20130829	Duplicate	08/29/13	Groundwater	NA	EFR12_20130829
	EFR-12_120413	N	12/04/13	Groundwater	NA	-
	EFR12_031914	N	03/19/14	Groundwater	NA	-
LMW1	LMW1_20130830	N	08/30/13	Groundwater	NA	-
	LMW-1_120413	N	12/04/13	Groundwater	NA	-
	LMW01_031914	N	03/19/14	Groundwater	NA	-
	DUP01_031914	Duplicate	03/19/14	Groundwater	NA	LMW01_031914
LMW2	LMW2_20130830	N	08/30/13	Groundwater	NA	-
	LMW-2_120413	N	12/04/13	Groundwater	NA	-
	LMW02_031914	N	03/19/14	Groundwater	NA	-

Notes:

- N = Normal Environmental Sample
TCL = Target compound list
VOC = Volatile organic compounds
SVOC = Semi volatile organic compounds
EPA = Environmental Protection Agency
NYSDEC = New York State Department of Environmental Conservation
feet bgs= feet below grade surface
MS/MSD = Matrix spike/Matrix spike duplicate
1) All soil samples were analyzed for NYSDEC Part 375 VOCs
2) All groundwater samples were analyzed for TCL VOCs and SVOCs.
3) All soil gas and ambient air samples were analyzed for VOCs via EPA method TO-15.

Table 1
Sample Summary
Supplemental Remedial Investigation Report
Kings Plaza Mall
Brooklyn, New York
NYSDEC VCA No. A2-0403-9911
Langan Project Nos. 140080104 and 140080105

Boring/Monitoring Well/Soil Gas Location	Sample ID	Sample Type	Sample Date	Sample Matrix	Sample Interval (feet bgs)	Parent Sample (for duplicate samples only)
HV1	HV1_20130829	N	08/29/13	Groundwater	NA	-
	HV1_120313	N	12/03/13	Groundwater	NA	-
	DUP01_120313	Duplicate	12/03/13	Groundwater	NA	HV1_120313
MW1	MW1_20130830	N	08/30/13	Groundwater	NA	-
	MW-1_120413	N	12/04/13	Groundwater	NA	-
MW4	MW4_20130828	N	08/28/13	Groundwater	NA	-
	MW-4_120413	N	12/04/13	Groundwater	NA	-
	MW4_031914	N	03/19/14	Groundwater	NA	-
MW8	MW8_20130829	N	08/29/13	Groundwater	NA	-
MW36	MW36_20130829	N	08/29/13	Groundwater	NA	-
	MW-36_120313	N	12/03/13	Groundwater	NA	-
	MW36-031914	N	03/19/14	Groundwater	NA	-
MW39	MW39_20130829	N	08/29/13	Groundwater	NA	-
	MW-39_120413	N	12/04/13	Groundwater	NA	-
	MW39_031914	N	03/19/14	Groundwater	NA	-
MW46	MW46_20130829	N	08/29/13	Groundwater	NA	-
	MW-46_120413	N	12/04/13	Groundwater	NA	-
	MW46_031914	N	03/19/14	Groundwater	NA	-
Soil Gas/Ambient Air Samples						
LSV1	LSV1-20130823	N	08/23/13	Soil Gas	NA	-
LSV2	LSV2-20130823	N	08/23/13	Soil Gas	NA	-
LSV3	LSV3-20130823	N	08/23/13	Soil Gas	NA	-
LSV4	LSV4-20130823	N	08/23/13	Soil Gas	NA	-
	DUP001	Duplicate	08/23/13	Soil Gas	NA	LSV4-20130823
LSV5	LSV5-20130827	N	08/27/13	Soil Gas	NA	-
LSV6	LSV6-20130823	N	08/23/13	Soil Gas	NA	-
LSV7	LSV7-20130823	N	08/23/13	Soil Gas	NA	-
LSV8	LSV8-20130823	N	08/23/13	Soil Gas	NA	-
AMBIENT	AMBIENT	Ambient Air	08/23/13	Ambient Air	NA	-
AMBIENT 2	AMBIENT 2	Ambient Air	08/27/13	Ambient Air	NA	-
SS1	SS1_20140314	N	03/27/14	Soil Gas	NA	-
SS2	SS2_20140314	N	03/27/14	Soil Gas	NA	-
SS3	SS3_20140314	N	03/27/14	Soil Gas	NA	-
SS4	SS4_20140314	N	03/27/14	Soil Gas	NA	-
SS5	SS5_20140314	N	03/27/14	Soil Gas	NA	-
SS6	SS6_20140314	N	03/27/14	Soil Gas	NA	-
IA1	IA1_20140314	Ambient Air	03/27/14	Ambient Air	NA	-
IA2	IA2_20140314	Ambient Air	03/27/14	Ambient Air	NA	-
IA3	IA3_20140314	Ambient Air	03/27/14	Ambient Air	NA	-
IA4	IA4_20140314	Ambient Air	03/27/14	Ambient Air	NA	-
AA1	AA1_20140314	Ambient Air	03/27/14	Ambient Air	NA	-
QA/QC Samples						
FB01	FB01	Field Blank	08/27/13	Water	NA	-
TB01	TB01	Trip Blank	08/27/13	Water	NA	-
FB	FB_0319214	Field Blank	03/19/14	Groundwater	NA	-
TB	TB_031914	Trip Blank	03/19/14	Groundwater	NA	-
FB01	FB01_12013	Field Blank	12/03/13	Water	NA	-
TB01	TB01_12013	Trip Blank	12/03/13	Water	NA	-
TB02	TB02_120413	Trip Blank	12/04/13	Water	NA	-
TB01	TB01_20130829	Trip Blank	08/29/13	Water	NA	-
FB001	FB001_20130829	Field Blank	08/29/13	Water	NA	-

Notes:

- N = Normal Environmental Sample
TCL = Target compound list
VOC = Volatile organic compounds
SVOC = Semi volatile organic compounds
EPA = Environmental Protection Agency
NYSDEC = New York State Department of Environmental Conservation
feet bgs= feet below grade surface
MS/MSD = Matrix spike/Matrix spike duplicate
- 1) All soil samples were analyzed for NYSDEC Part 375 VOCs
2) All groundwater samples were analyzed for TCL VOCs and SVOCs.
3) All soil gas and ambient air samples were analyzed for VOCs via EPA method TO-15.

Table 2
Groundwater Elevations and Product Thickness
Supplemental Remedial Investigation Report
Kings Plaza Mall
Brooklyn, New York
NYSDEC VCA No. A2-0403-9911
Langan Project Nos. 140080104 and 140080105

Monitoring Well Locations	Latitude ¹	Longitude ¹	Ground Surface Elevation ²	Top of Casing Elevation ²	Well Diameter (inches)	Measured Well Depth (feet bgs)	8/19/2013					10/10/2013				
							PID Reading (ppm)	Depth to Water (feet bgs)	Depth to LNAPL (feet bgs)	LNAPL Thickness (feet)	Groundwater Elevation ²	PID Reading (ppm)	Depth to Water (feet bgs)	Depth to LNAPL (feet bgs)	LNAPL Thickness (feet)	Groundwater Elevation ²
EFR-1	40.611218	-73.919271	10.287	10.077	2	12.71	0.0	7.10	7.08	0.02	2.98	NA		7.12	0.03	2.93
EFR-2	40.611114	-73.919155	10.199	10.135	2	12.25	7.8	7.08	6.85	0.23	3.06	Decommissioned on 09/03/2013				
EFR-3	40.610992	-73.919021	10.45	10.161	2	11.54	2.9	6.60	ND	ND	3.56	NA	7.01	ND	ND	3.15
EFR-4	40.610904	-73.918928	10.465	10.219	2	10.22	15.9	7.23	6.91	0.32	2.99	NA	7.25	6.96	0.29	2.97
EFR-5	40.610791	-73.918844	10.534	10.327	2	12.79	2.1	7.91	7.40	0.51	2.42	NA	7.88	7.38	0.50	2.45
EFR-6	40.610753	-73.918748	10.444	10.141	2	12.78	0.0	7.64	ND	ND	2.50	NA	7.71	ND	ND	2.43
EFR-7	40.610894	-73.919174	11.091	11.091	2	13.12	0.0	7.95	ND	ND	3.14	NA	7.98	ND	ND	3.11
EFR-8	40.610819	-73.919095	11.075	10.735	2	12.82	63.4	8.18	8.11	0.07	2.56	NA	8.16	8.14	0.02	2.58
EFR-9	40.610776	-73.919046	11.06	10.665	2	11.70	0.0	8.17	ND	ND	2.50	NA	8.22	ND	ND	2.45
EFR-11	40.610577	-73.918713	10.485	10.303	2	13.20	4.4	8.67	8.27	0.40	1.63	NA	9.42	9.30	0.12	0.88
EFR-12	40.610552	-73.918677	10.549	10.333	2	13.18	4.5	9.35	ND	ND	0.98	NA	8.55	ND	ND	1.78
HV-1	40.610837	-73.918969	10.418	10.017	4	11.51	1.6	6.94	ND	ND	3.08	NA	6.96	ND	ND	3.06
HV-2	40.610933	-73.918992	10.448	9.937	4	12.43	0.0	6.49	ND	ND	3.45	NA	6.48	ND	ND	3.46
HV-3	40.611016	-73.919087	10.491	9.875	4	15.82	6.0	6.45	6.41	0.04	3.43	NA	6.48	6.46	0.02	3.40
HV-5	40.610748	-73.918826	10.383	9.96	4	14.11	13.4	8.45	7.30	1.15	1.51	NA	9.22	7.50	1.72	0.74
HV-6	40.610652	-73.918831	10.232	10.138	4	11.42	0.9	7.79	ND	ND	2.35	NA	7.84	ND	ND	2.30
LMW1	40.610143	-73.918293	11.715	10.608	2	23.00	LMW-1 and LMW-2 installed in August 2013					NA	10.68	ND	ND	-0.07
LMW2	40.610285	-73.91826	10.844	11.528	2	20.00						NA	9.61	ND	ND	1.92
MW-1	40.610486	-73.918461	10.344	9.918	2	12.83	0.0	8.01	ND	ND	1.91	NA	8.35	ND	ND	1.57
MW-2	40.610831	-73.918879	10.425	10.244	2	13.28	5.0	7.29	7.18	0.11	2.95	NA	7.34	7.20	0.14	2.90
MW-3	40.611085	-73.919167	10.404	10.184	2	14.75	7.5	8.55	6.95	1.60	1.63	NA	8.50	7.31	1.19	1.68
MW-4	40.611356	-73.919435	10.892	10.326	2	15.40	0.0	7.45	ND	ND	2.88	NA	7.46	ND	ND	2.87
MW-8	40.610655	-73.91882	10.307	10.017	2	12.84	0.0	7.88	ND	ND	2.14	NA	7.90	ND	ND	2.12
MW-20	40.611145	-73.919245	10.457	10.09	2	14.50	0.0	7.05	ND	ND	3.04	NA	7.03	ND	ND	3.06
MW-21	40.61076	-73.91881	10.512	9.953	2	16.27	1.1	8.64	7.12	1.52	1.31	NA	8.67	8.02	0.65	1.28
MW-33	40.611423	-73.919536	11.05	10.88	2	12.81	3.2	8.90	ND	ND	1.98	NA	8.93	ND	ND	1.95
MW-34	40.611301	-73.919542	10.328	10.04	2	14.33	0.0	7.17	ND	ND	2.87	NA	7.23	ND	ND	2.81
MW-35	40.611087	-73.919312	10.291	10.15	2	13.54	6.2	7.37	7.13	0.24	2.78	NA	7.40	7.36	0.04	2.75
MW-36	40.610971	-73.919261	11.034	10.732	2	12.16	0.0	7.77	ND	ND	2.96	NA	7.75	ND	ND	2.98
MW-37	40.610854	-73.919135	11.066	10.688	2	14.85	0.1	7.68	7.64	0.04	3.01	NA	7.65	7.64	0.01	3.04
MW-38	40.610754	-73.919022	11.011	10.695	2	14.77	0.0	8.21	8.18	0.03	2.49	NA	8.20	8.19	0.01	2.50
MW-39	40.610581	-73.918627	10.464	10.074	4	13.38	2.2	8.09	sheen (>1")	ND	1.98	NA	8.30	ND	ND	1.77
MW-45	40.611493	-73.919614	10.823	10.41	2	13.56	4.2	8.06	ND	ND	2.35	NA	8.12	ND	ND	2.29
MW-46	40.611395	-73.919657	10.207	9.67	2	15.28	0.0	6.89	ND	ND	2.78	NA	6.91	ND	ND	2.76

Notes:

1. The horizontal datum is referenced to the North American Datum of 1983 (NAD83), New York State Plane Coordinate System, Long Island Zone.
2. The vertical datum is referenced to the North American Vertical Datum of 1988 (NAVD88).
3. bgs = below grade surface
4. Monitoring well EFR-2 was decommissioned in September 2013.

5. PID = photo-ionization detector
6. ppm = parts per million
7. ND = Not Detected
8. NA = PID readings could not be recorded due to inclement weather.

Table 2
Groundwater Elevations and Product Thickness
Supplemental Remedial Investigation Report
Kings Plaza Mall
Brooklyn, New York
NYSDEC VCA No. A2-0403-9911
Langan Project Nos. 140080104 and 140080105

Monitoring Well Locations	Latitude ¹	Longitude ¹	Ground Surface Elevation ²	Top of Casing Elevation ²	Well Diameter (inches)	Measured Well Depth (feet bgs)	11/11/2013					12/3/2013					1/13/2014				
							PID Reading (ppm)	Depth to Water (feet bgs)	Depth to LNAPL (feet bgs)	LNAPL Thickness (feet)	Groundwater Elevation ²	PID Reading (ppm)	Depth to Water (feet bgs)	Depth to LNAPL (feet bgs)	LNAPL Thickness (feet)	Groundwater Elevation ²	PID Reading (ppm)	Depth to Water (feet bgs)	Depth to LNAPL (feet bgs)	LNAPL Thickness (feet)	Groundwater Elevation ²
EFR-1	40.611218	-73.919271	10.287	10.077	2	12.71	3.5	7.47	ND	ND	2.61	1.7	7.45	7.31	0.14	2.63	NA	7.03	ND	ND	3.05
EFR-2	40.611114	-73.919155	10.199	10.135	2	12.25	Decommissioned on 09/03/2013					Decommissioned on 09/03/2013					Decommissioned on 09/03/2013				
EFR-3	40.610992	-73.919021	10.45	10.161	2	11.54	51.1	7.70	7.20	0.50	2.46	42.2	7.42	7.13	0.29	2.74	NA	6.71	6.48	0.23	3.45
EFR-4	40.610904	-73.918928	10.465	10.219	2	10.22	43.2	7.80	7.50	0.30	2.42	34.4	7.62	7.55	0.07	2.60	NA	7.24	ND	ND	2.98
EFR-5	40.610791	-73.918844	10.534	10.327	2	12.79	18.2	9.60	7.90	1.70	0.73	41.2	9.31	7.96	1.35	1.02	NA	8.69	7.89	0.80	1.64
EFR-6	40.610753	-73.918748	10.444	10.141	2	12.78	1.0	8.30	8.15	0.15	1.84	9.5	8.21	7.99	0.22	1.93	NA	8.20	8.07	0.13	1.94
EFR-7	40.610894	-73.919174	11.091	11.091	2	13.12	0.1	7.25	ND	ND	3.84	4.6	8.51	ND	ND	2.58	NA	8.05	ND	ND	3.04
EFR-8	40.610819	-73.919095	11.075	10.735	2	12.82	248	8.42	8.38	0.04	2.32	362.2	8.45	8.42	0.03	2.29	NA	8.38	ND	ND	2.36
EFR-9	40.610776	-73.919046	11.06	10.665	2	11.70	1.7	8.50	8.45	0.05	2.17	5.2	8.71	8.48	0.23	1.96	NA	8.51	ND	ND	2.16
EFR-11	40.610577	-73.918713	10.485	10.303	2	13.20	22.4	9.90	8.56	1.34	0.40	11.0	9.95	8.72	1.23	0.35	NA	9.70	8.66	1.04	0.60
EFR-12	40.610552	-73.918677	10.549	10.333	2	13.18	8.4	8.81	ND	ND	1.52	0.8	8.95	ND	ND	1.38	NA	8.91	ND	ND	1.42
HV-1	40.610837	-73.918969	10.418	10.017	4	11.51	31.5	7.45	ND	ND	2.57	27.2	7.55	ND	ND	2.47	NA	7.45	ND	ND	2.57
HV-2	40.610933	-73.918992	10.448	9.937	4	12.43	36.4	7.15	ND	ND	2.79	41.6	7.06	ND	ND	2.88	NA	6.72	ND	ND	3.22
HV-3	40.611016	-73.919087	10.491	9.875	4	15.82	113	7.10	7.04	0.06	2.78	3.6	6.97	6.95	0.02	2.91	NA	NA	NA	NA	NA
HV-5	40.610748	-73.918826	10.383	9.96	4	14.11	65.0	9.80	7.70	2.10	0.16	38.2	8.75	7.91	0.84	1.21	NA	8.35	7.70	0.65	1.61
HV-6	40.610652	-73.918831	10.232	10.138	4	11.42	1.2	7.78	ND	ND	2.36	2.2	10.09	ND	ND	0.05	NA	6.62	ND	ND	3.52
LMW1	40.610143	-73.918293	11.715	10.608	2	23.00	0.1	10.62	ND	ND	-0.01	0.6	9.62	ND	ND	0.99	NA	10.85	ND	ND	-0.24
LMW2	40.610285	-73.91826	10.844	11.528	2	20.00	0.0	9.85	ND	ND	1.68	3.2	8.71	ND	ND	2.82	NA	9.81	ND	ND	1.72
MW-1	40.610486	-73.918461	10.344	9.918	2	12.83	0.0	8.40	ND	ND	1.52	0.8	8.78	ND	ND	1.14	NA	8.88	ND	ND	1.04
MW-2	40.610831	-73.918879	10.425	10.244	2	13.28	33.1	8.10	7.70	0.40	2.14	21.7	8.15	7.81	0.34	2.09	NA	7.82	7.67	0.15	2.42
MW-3	40.611085	-73.919167	10.404	10.184	2	14.75	30.4	8.75	7.40	1.35	1.43	40.2	7.69	7.37	0.32	2.49	NA	7.24	7.02	0.22	2.94
MW-4	40.611356	-73.919435	10.892	10.326	2	15.40	0.1	7.77	ND	ND	2.56	4.4	7.75	ND	ND	2.58	NA	7.36	ND	ND	2.97
MW-8	40.610655	-73.91882	10.307	10.017	2	12.84	0.1	8.32	ND	ND	1.70	36.8	8.52	8.45	0.07	1.50	NA	8.29	ND	ND	1.73
MW-20	40.611145	-73.919245	10.457	10.09	2	14.50	60.2	7.51	7.45	0.06	2.58	8.9	7.40	7.35	0.05	2.69	NA	6.97	ND	ND	3.12
MW-21	40.61076	-73.91881	10.512	9.953	2	16.27	37.9	8.61	7.71	0.90	1.34	34.6	8.75	7.76	0.99	1.20	NA	7.70	7.55	0.15	2.25
MW-33	40.611423	-73.919536	11.05	10.88	2	12.81	0.5	8.36	ND	ND	2.52	3.7	8.31	ND	ND	2.57	NA	8.00	ND	ND	2.88
MW-34	40.611301	-73.919542	10.328	10.04	2	14.33	0.2	7.73	ND	ND	2.31	0.5	7.45	ND	ND	2.59	NA	9.11	ND	ND	0.93
MW-35	40.611087	-73.919312	10.291	10.15	2	13.54	39.0	7.56	7.47	0.09	2.59	47.2	7.49	ND	ND	2.66	NA	7.15	7.14	0.01	3.00
MW-36	40.610971	-73.919261	11.034	10.732	2	12.16	0.2	8.15	ND	ND	2.58	4.4	8.12	ND	ND	2.61	NA	7.87	ND	ND	2.86
MW-37	40.610854	-73.919135	11.066	10.688	2	14.85	7.1	8.21	8.19	0.02	2.48	4.9	8.31	ND	ND	2.38	NA	8.11	8.07	0.04	2.58
MW-38	40.610754	-73.919022	11.011	10.695	2	14.77	10.6	8.50	8.45	0.05	2.20	7.2	8.51	ND	ND	2.19	NA	8.51	ND	ND	2.19
MW-39	40.610581	-73.918627	10.464	10.074	4	13.38	57.0	8.55	ND	ND	1.52	1.2	8.68	ND	ND	1.39	NA	8.62	ND	ND	1.45
MW-45	40.611493	-73.919614	10.823	10.41	2	13.56	0.1	8.00	ND	ND	2.41	2.7	7.99	ND	ND	2.42	NA	NA	NA	NA	NA
MW-46	40.611395	-73.919657	10.207	9.67	2	15.28	7.8	7.15	ND	ND	2.52	2.8	7.11	ND	ND	2.56	NA	6.77	ND	ND	2.90

Notes:

1. The horizontal datum is referenced to the North American Datum of 1983 (NAD83), New York State Plane Coordinate System, Long Island Zone.

2. The vertical datum is referenced to the North American Vertical Datum of 1988 (NAVD88).

3. bgs = below grade surface

4. Monitoring well EFR-2 was decommissioned in September 2013.

5. PID = photo-ionization detector

6. ppm = parts per million

7. ND = Not Detected

8. NA = PID readings could not be recorded due to inclement weather.

Table 2
Groundwater Elevations and Product Thickness
Supplemental Remedial Investigation Report
Kings Plaza Mall
Brooklyn, New York
NYSDEC VCA No. A2-0403-9911
Langan Project Nos. 140080104 and 140080105

Monitoring Well Locations	Latitude ¹	Longitude ¹	Ground Surface Elevation ²	Top of Casing Elevation ²	Well Diameter (inches)	Measured Well Depth (feet bgs)	2/11/2014					3/18/2014				
							PID Reading (ppm)	Depth to Water (feet bgs)	Depth to LNAPL (feet bgs)	LNAPL Thickness (feet)	Groundwater Elevation ²	PID Reading (ppm)	Depth to Water (feet bgs)	Depth to LNAPL (feet bgs)	LNAPL Thickness (feet)	Groundwater Elevation ²
EFR-1	40.611218	-73.919271	10.287	10.077	2	12.71	NT	Not accessible due to snow and ice				NA	6.74	6.73	0.01	3.34
EFR-2	40.611114	-73.919155	10.199	10.135	2	12.25	Decommissioned on 09/03/2013					Decommissioned on 09/03/2013				
EFR-3	40.610992	-73.919021	10.45	10.161	2	11.54	NT	Not accessible due to snow and ice				NA	6.14	6.11	0.03	4.02
EFR-4	40.610904	-73.918928	10.465	10.219	2	10.22	NT	Not accessible due to snow and ice				NA	7.19	6.49	0.70	3.03
EFR-5	40.610791	-73.918844	10.534	10.327	2	12.79	NT	8.35	7.70	0.65	1.98	NA	7.88	7.14	0.74	2.45
EFR-6	40.610753	-73.918748	10.444	10.141	2	12.78	NT	7.88	7.86	0.02	2.26	NA	7.62	7.60	0.02	2.52
EFR-7	40.610894	-73.919174	11.091	11.091	2	13.12	NT	7.60	ND	ND	3.49	NA	7.41	ND	ND	3.68
EFR-8	40.610819	-73.919095	11.075	10.735	2	12.82	NT	8.25	ND	ND	2.49	NA	8.09	8.00	0.09	2.65
EFR-9	40.610776	-73.919046	11.06	10.665	2	11.70	NT	8.40	ND	ND	2.27	NA	8.11	ND	ND	2.56
EFR-11	40.610577	-73.918713	10.485	10.303	2	13.20	NT	9.55	8.60	0.95	0.75	NA	8.87	8.47	0.40	1.43
EFR-12	40.610552	-73.918677	10.549	10.333	2	13.18	NT	8.81	ND	ND	1.52	NA	8.63	ND	ND	1.70
HV-1	40.610837	-73.918969	10.418	10.017	4	11.51	NT	7.10	ND	ND	2.92	NA	NA	NA	NA	NA
HV-2	40.610933	-73.918992	10.448	9.937	4	12.43	NT	Not accessible due to snow and ice				NA	6.05	ND	ND	3.89
HV-3	40.611016	-73.919087	10.491	9.875	4	15.82	NT	Not accessible due to snow and ice				NA	6.11	6.00	0.11	NA
HV-5	40.610748	-73.918826	10.383	9.96	4	14.11	NT	8.10	7.50	0.60	1.86	NA	7.36	7.14	0.22	2.60
HV-6	40.610652	-73.918831	10.232	10.138	4	11.42	NT	3.38	ND	ND	6.76	NA	7.87	ND	ND	2.27
LMW1	40.610143	-73.918293	11.715	10.608	2	23.00	NT	11.00	ND	ND	-0.39	NA	10.80	ND	ND	-0.19
LMW2	40.610285	-73.91826	10.844	11.528	2	20.00	NT	9.95	ND	ND	1.58	NA	9.52	ND	ND	2.01
MW-1	40.610486	-73.918461	10.344	9.918	2	12.83	NT	8.80	ND	ND	1.12	NA	6.92	ND	ND	3.00
MW-2	40.610831	-73.918879	10.425	10.244	2	13.28	NT	7.55	7.46	0.09	2.69	NA	7.01	6.98	0.03	3.23
MW-3	40.611085	-73.919167	10.404	10.184	2	14.75	NT	Not accessible due to snow and ice				NA	7.10	6.67	0.43	3.08
MW-4	40.611356	-73.919435	10.892	10.326	2	15.40	NT	Not accessible due to snow and ice				NA	7.14	ND	ND	3.19
MW-8	40.610655	-73.91882	10.307	10.017	2	12.84	NT	6.70	ND	ND	3.32	NA	8.11	ND	ND	1.91
MW-20	40.611145	-73.919245	10.457	10.09	2	14.50	NT	Not accessible				NA	6.67	6.66	0.01	3.42
MW-21	40.61076	-73.91881	10.512	9.953	2	16.27	NT	9.10	7.45	0.09	0.85	NA	7.68	7.05	0.63	2.27
MW-33	40.611423	-73.919536	11.05	10.88	2	12.81	NT	Not accessible due to snow and ice				NA	7.77	ND	ND	3.11
MW-34	40.611301	-73.919542	10.328	10.04	2	14.33	NT	Not accessible due to snow and ice				NA	6.87	ND	ND	3.17
MW-35	40.611087	-73.919312	10.291	10.15	2	13.54	NT	Not accessible due to snow and ice				NA	6.86	6.85	0.01	3.29
MW-36	40.610971	-73.919261	11.034	10.732	2	12.16	NT	7.70	ND	ND	3.03	NA	7.46	ND	ND	3.27
MW-37	40.610854	-73.919135	11.066	10.688	2	14.85	NT	7.70	ND	ND	2.99	NA	7.26	ND	ND	3.43
MW-38	40.610754	-73.919022	11.011	10.695	2	14.77	NT	9.42	9.40	0.02	1.28	NA	8.10	8.08	0.02	2.60
MW-39	40.610581	-73.918627	10.464	10.074	4	13.38	NT	8.50	ND	ND	1.57	NA	8.35	ND	ND	1.72
MW-45	40.611493	-73.919614	10.823	10.41	2	13.56	NT	Not accessible due to snow and ice				NA	7.55	ND	ND	NA
MW-46	40.611395	-73.919657	10.207	9.67	2	15.28	NT	Not accessible due to snow and ice				NA	6.60	ND	ND	3.07

Notes:

1. The horizontal datum is referenced to the North American Datum of 1983 (NAD83), New York State Plane Coordinate System, Long Island Zone.
2. The vertical datum is referenced to the North American Vertical Datum of 1988 (NAVD88).
3. bgs = below grade surface
4. Monitoring well EFR-2 was decommissioned in September 2013.

5. PID = photo-ionization detector
6. ppm = parts per million
7. ND = Not Detected
8. NA = PID readings could not be recorded due to inclement weather.

Table 3
LNAPL Extraction Summary
Supplemental Remedial Investigation Report
Kings Plaza Mall
Brooklyn, New York
NYSDEC VCA No. A2-0403-9911
Langan Project Nos. 140080104 and 140080105

LNAPL Extraction Event	First Event				Second Event		Third Event	
Date	8/28/2013		9/10/2013		10/10/2013		11/12/2013	
	Volume Removed (gallons)	Contents	Volume Removed (gallons)	Contents	Volume Removed (gallons)	Contents	Volume Removed (gallons)	Contents
Well ID								
EFR-1	-	-	0.5	LNAPL	-	-	-	-
EFR-2	0.5	LNAPL	0.5	LNAPL	Decommissioned on 09/03/2013			
EFR-3	-	-	-	-	-	-	0.5	oily-water
EFR-4	-	-	Obstruction in Well*		Obstruction in Well*		0.5	oily-water
EFR-5	-	-	0.13	oily-water	0.33	oily-water	0.3	oily-water
EFR-6	-	-	-	-	-	-	Obstruction in Well	
EFR-8	-	-	0.33	oily-water	0.125	oily-water	0.25	oily-water
EFR-9	-	-	-	-	-	-	0.125	oily-water
EFR-11	-	-	0.33	oily-water	0.75	LNAPL	0.5	LNAPL
HV-3	-	-	0.25	LNAPL	0.125	LNAPL	0.125	LNAPL
HV-5	1	LNAPL	1	LNAPL	0.33	LNAPL	1.75	LNAPL
MW-2	-	-	1.13	oily-water	0.125	oily-water	0.25	oily-water
MW-3	-	-	0.5	LNAPL	0.5	LNAPL	0.125	LNAPL
MW-8	-	-	-	-	-	-	-	-
MW-20	-	-	-	-	-	-	0.25	oily-water
MW-21	-	-	1	LNAPL	0.33	LNAPL	0.75	LNAPL
MW-35	-	-	0.5	LNAPL	0.125	LNAPL	0.25	oily-water
MW-37	-	-	0.25	oily-water	0.125	oily-water	0.125	oily-water
MW-38	-	-	0.5	LNAPL	0.125	LNAPL	0.125	oily-water
Total LNAPL Removed (gallons)	1.5		4.75		2.285		3.250	
Total Oily-Water Removed (gallons)	0		2.17		0.705		2.675	
TOTAL REMOVED	1.5		6.92		2.99		5.925	

Notes:

1. LNAPL = Light non-aqueous phase liquid
2. "-" = LNAPL was not detected in the well during this event.
3. * = A submersible pump was unable to fit into the wellhead during the first two sampling events due to an obstruction. However, a peristaltic pump was later used.

Table 3
LNAPL Extraction Summary
Supplemental Remedial Investigation Report
Kings Plaza Mall
Brooklyn, New York
NYSDEC VCA No. A2-0403-9911
Langan Project Nos. 140080104 and 140080105

LNAPL Extraction Event	Fourth Event		Fifth Event		Sixth Event		Seventh Event		Cumulative Volume Removed (gallons)
Date	12/12/2013		1/13/2014		2/11/2014		3/18/2014		
	Volume Removed (gallons)	Contents	Volume Removed (gallons)	Contents	Volume Removed (gallons)	Contents	Volume Removed (gallons)	Contents	
Well ID									
EFR-1	-	-	-	-	-	-	0.25	oily-water	0.75
EFR-2	Decommissioned on 09/03/2013								1
EFR-3	0.1	oily-water	1.25	oily-water	-	-	0.5	oily-water	2.35
EFR-4	0.05	oily-water	-	-	-	-	0.8	oily-water	1.35
EFR-5	0.9	LNAPL	3.5	LNAPL	1.25	oily-water	1	LNAPL	7.41
EFR-6	0.05	oily-water	1	oily-water	0.25	oily-water	0.25	oily-water	1.55
EFR-8	0.05	oily-water	-	-	-	-	0.25	oily-water	1.005
EFR-9	0.05	oily-water	-	-	-	-	-	-	0.175
EFR-11	0.3	LNAPL	1.5	oily-water	0.5	oily-water	1	oily-water	4.88
HV-3	0.1	LNAPL	-	-	-	-	0.2	LNAPL	0.8
HV-5	0.95	LNAPL	1.3	LNAPL	1.5	LNAPL	1.25	LNAPL	9.08
MW-2	0.1	oily-water	1.25	oily-water	1	oily-water	0.25	oily-water	4.105
MW-3	0.3	LNAPL	1.5	oily-water	-	-	0.25	LNAPL	3.175
MW-8	0.05	oily-water	-	-	-	-	-	-	0.05
MW-20	0.05	oily-water	-	-	-	-	0.5	oily-water	0.8
MW-21	0.75	LNAPL	0.8	LNAPL	1.25	LNAPL	0.6	LNAPL	5.48
MW-35	-	-	0.1	oily-water	-	-	0.25	oily-water	1.225
MW-37	-	-	0.1	oily-water	-	-	-	-	0.6
MW-38	-	-	-	-	0.25	oily-water	0.25	oily-water	1.25
Total LNAPL Removed (gallons)	3.30		5.6		2.75		3.3		26.735
Total Oily-Water Removed (gallons)	0.50		6.7		3.25		4.3		20.3
TOTAL REMOVED	3.80		12.3		6		7.6		47.04

Notes:

1. LNAPL = Light non-aqueous phase liquid
2. "-" = LNAPL was not detected in the well during this event.
3. * = A submersible pump was unable to fit into the wellhead during the first two sampling events due to an obstruction. However, a peristaltic pump was later used.

Table 4
Soil Sample Analytical Results Summary
Supplemental Remedial Investigation Report
Kings Plaza Mall
Brooklyn, New York
NYSDEC VCA No. A2-0403-9911
Langan Project Nos. 140080104 and 140080105

Sample Location Client Sample ID Lab Sample ID Sampling Date Sampling Depth (feet bgs) Dilution Factor	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Use Commercial SCO	SB01		SB02			SB03			SB04		
			SB01_5-6	SB01_7-8	SB02_6-7	SB02_10-11	DUP_003	SB03_6-7	SB03_8-9	SB03_10-11	SB04_6-7	SB04_7-8	SB04_10-11
			460-61972-15	460-61972-16	460-61972-12	460-61972-13	460-61972-14	460-61880-7	460-61880-8	460-61880-9	460-61880-4	460-61880-5	460-61880-6
			8/27/2013	8/27/2013	8/27/2013	8/27/2013	8/27/2013	8/26/2013	8/26/2013	8/26/2013	8/26/2013	8/26/2013	8/26/2013
			5 to 6	7 to 8	6 to 7	10 to 11	10 to 11	6 to 7	8 to 9	10 to 11	6 to 7	7 to 8	10 to 11
			1	200	50	1	1	50	50	1	1	1	1
Volatile Organic Compounds (mg/kg)													
1,1-Dichloroethene	0.33	500	0.0013 U	0.41 U	0.12 U	0.0011 U	0.0011 U	0.13 U	0.11 U	0.0015 U	0.0012 U	0.0011 U	0.0013 U
1,2-Dichlorobenzene	1.1	500	0.0013 U	0.41 U	0.12 U	0.0011 U	0.0011 U	0.13 U	0.11 U	0.0015 U	0.0012 U	0.0011 U	0.0013 U
1,2-Dichloropropane	~	~	0.0013 U	0.41 U	0.12 U	0.0011 U	0.0011 U	0.13 U	0.11 U	0.0015 U	0.0012 U	0.0011 U	0.0013 U
1,4-Dichlorobenzene	1.8	130	0.0013 U	0.41 U	0.12 U	0.0011 U	0.0011 U	0.13 U	0.11 U	0.0015 U	0.0012 U	0.0011 U	0.0013 U
2-Butanone	0.12	500	0.013 U	2.1 U	0.58 U	0.0038 J	0.011 U	0.66 U	0.54 U	0.015 U	0.012 U	0.011 U	0.013 U
2-Hexanone	~	~	0.013 UJ	2.1 U	0.58 U	0.011 U	0.011 UJ	0.66 U	0.54 U	0.015 U	0.012 U	0.011 U	0.013 U
4-Methyl-2-pentanone	~	~	0.013 UJ	2.1 U	0.58 U	0.011 U	0.011 UJ	0.66 U	0.54 U	0.015 U	0.012 U	0.011 U	0.013 U
Acetone	0.05	500	0.0043 J	2.1 U	0.58 U	0.027	0.01 J	0.66 U	0.54 U	0.025	0.019	0.027	0.018
Benzene	0.06	44	0.0013 U	0.17 J	0.12 U	0.0003 J	0.0011 U	0.13 U	0.11 U	0.0048	0.0012 U	0.0011 U	0.00099 J
Bromodichloromethane	~	~	0.0013 U	0.41 U	0.12 U	0.0011 U	0.0011 U	0.13 U	0.11 U	0.0015 U	0.0012 U	0.0011 U	0.0013 U
Carbon disulfide	~	~	0.00043 J	0.41 U	0.12 U	0.0016	0.0011	0.13 U	0.11 U	0.004	0.0012 U	0.0037	0.0034
Chloroform	0.37	350	0.0013 U	0.41 U	0.12 U	0.0011 U	0.0011 U	0.13 U	0.11 U	0.0015 U	0.0012 U	0.0011 U	0.0013 U
cis-1,2-Dichloroethene	0.25	500	0.0025	0.41 U	0.12 U	0.0011 U	0.00039 J	0.028 J	0.11 U *	0.00042 J	0.00063 J	0.0011 U	0.00063 J
Ethylbenzene	1	390	0.0013 U	5.2	0.84	0.00092 J	0.0011 U	0.53	0.11 U	0.0015 U	0.0012 U	0.0011 U	0.0013 U
Methylene Chloride	0.05	500	0.0013 U	0.41 U	0.12 U	0.0011 U	0.00096 J	0.13 U	0.11 U	0.0015 U	0.0015 U	0.0011 U	0.0023 U
Tetrachloroethene (PCE)	1.3	150	0.012	0.41 U	0.12 U	0.034 J	0.00095 J	0.34	0.11 U	0.0015 U	0.0012	0.0011 U	0.0013 U
Toluene	0.7	500	0.0013 U	0.16 J	0.12 U	0.00056 J	0.0002 J	0.13 U	0.11 U	0.0015 U	0.0012 U	0.0011 U	0.0013 U
trans-1,2-Dichloroethene	0.19	500	0.0013 U	0.41 U	0.12 U	0.0011 U	0.0011 U	0.13 U	0.11 U	0.00022 J	0.0012 U	0.0011 U	0.0013 U
Trichloroethene (TCE)	0.47	200	0.0014	0.41 U	0.12 U	0.00039 J	0.0011 U	0.052 J	0.11 U	0.0015 U	0.0012 U	0.0011 U	0.0013 U
Vinyl chloride	0.02	13	0.0013 U	0.41 U	0.12 U	0.0011 U	0.0011 U	0.13 U	0.11 U	0.0015 U	0.0012 U	0.0011 U	0.0013 U
Xylenes, Total	0.26	500	0.0039 U	15	1.7	0.0021 J	0.0033 U	0.94	0.32 U	0.0015 J	0.0035 U	0.0034 U	0.0038 U
Total VOC Concentration	100	500	0.02063	20.53	2.54	0.07067	0.0136	1.89	0	0.03641	0.02233	0.0307	0.02532

- Notes:**
- Grab soil sample analytical results are compared to the New York State Department of Environmental Conservation (NYSDEC) title 6 of the official compilation of New York Codes, Rules, and Regulations (NYCRR) Part 375 Unrestricted Use and Commercial Use Soil Cleanup Objectives (SCOs).
 - Only compounds with detections are shown in table.
 - NYSDEC Part 375 Unrestricted Use SCO exceedances are highlighted and bolded.
 - NYSDEC Part 375 Restricted Use Commercial SCO exceedances are in red.
 - mg/kg = milligrams per kilogram
 - ~ = No regulatory limit has been established for this analyte.
 - Sample DUP_003 is a duplicate sample of SB02_10-11.
 - Sample DUP_001 is a duplicate sample of SB10_13-14.
 - Sample DUP_002 is a duplicate sample of SB19_8-9.

- Qualifiers:**
- J =The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
- U =The analyte was analyzed, but was not detected at a level greater than or equal to the level of the Reporting Limit (RL) or the sample concentration for results impacted by blank contamination.
- UJ= The analyte was not detected at a level greater than or equal to the RL; however, the reported RL is approximate and may be inaccurate or imprecise.
- B= The analyte was found in an associated blank, as well as in the sample.
- D^x= Sample was diluted for this analyte; x= dilution factor
- * = Relative Percent Difference (RPD) of the Lab Control Sample (LCS) and the Lab Control Sample Duplicate (LCSD) exceeds the control limits.

Table 4
Soil Sample Analytical Results Summary
Supplemental Remedial Investigation Report
Kings Plaza Mall
Brooklyn, New York
NYSDEC VCA No. A2-0403-9911
Langan Project Nos. 140080104 and 140080105

Sample Location Client Sample ID Lab Sample ID Sampling Date Sampling Depth (feet bgs) Dilution Factor	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Use Commercial SCO	SB05			SB06			SB07			SB08		
			SB05_5-6	SB05_7-8	SB05_10-10.5	SB06_5-6	SB06_7-8	SB06_11-12	SB07_6-7	SB07_10-11	SB07_12-13	SB08_5-6	SB08_10-11	
			460-61880-1	460-61880-2	460-61880-3	460-61972-9	460-61972-10	460-61972-11	460-61972-4	460-61972-5	460-61972-6	460-61880-10	460-61880-11	
			8/26/2013	8/26/2013	8/26/2013	8/27/2013	8/27/2013	8/27/2013	8/27/2013	8/27/2013	8/27/2013	8/26/2013	8/26/2013	
			5 to 6	7 to 8	10 to 10.5	5 to 6	7 to 8	11 to 12	6 to 7	10 to 11	12 to 13	5 to 6	10 to 11	
			1	1	1	1	50	250000	1	50	50	1	50	
Volatile Organic Compounds (mg/kg)														
1,1-Dichloroethene	0.33	500	0.0014 U	0.0011 U	0.0012 U	0.0023 U	0.13 U	540 U	0.0023 U	0.14 U	0.045 J	0.0012 U	0.11 U	
1,2-Dichlorobenzene	1.1	500	0.0014 U	0.0011 U	0.0012 U	0.0023 U	0.13 U	540 U	0.0023 U	0.14 U	0.13 U	0.0012 U	0.11 U	
1,2-Dichloropropane	~	~	0.0014 U	0.0011 U	0.0012 U	0.0023 U	0.13 U	540 U	0.0023 U	0.14 U	0.13 U	0.0012 U	0.11 U	
1,4-Dichlorobenzene	1.8	130	0.0014 U	0.0011 U	0.0012 U	0.0023 U	0.13 U	540 U	0.0023 U	0.14 U	0.13 U	0.0012 U	0.11 U	
2-Butanone	0.12	500	0.014 U	0.011 U	0.012 U	0.023 U	0.67 U	2700 U	0.023 U	0.69 U	0.64 U	0.012 U	0.57 U	
2-Hexanone	~	~	0.014 U	0.011 U	0.012 U	0.023 UJ	0.67 U	2700 U	0.023 UJ	0.69 U	0.64 U	0.012 U	0.57 U	
4-Methyl-2-pentanone	~	~	0.014 U	0.011 U	0.012 U	0.023 UJ	0.67 U	2700 U	0.023 U	0.69 U	0.64 U	0.012 U	0.57 U	
Acetone	0.05	500	0.0074 J	0.011 U	0.029	0.023 U	0.67 U	2700 UJ	0.023 U	0.69 UJ	0.64 U	0.012	0.57 U	
Benzene	0.06	44	0.0014 U	0.0011 U	0.0012 U	0.0023 U	0.032 J	540 U	0.0023 U	0.14 U	0.026 J	0.0012 U	0.28	
Bromodichloromethane	~	~	0.0014 U	0.0011 U	0.0012 U	0.0023 U	0.13 U	540 U	0.0023 U	0.14 U	0.13 U	0.0012 U	0.11 U	
Carbon disulfide	~	~	0.0014 U	0.0011 U	0.0068	0.0023 U	0.13 UJ	540 U	0.0023 U	0.14 U	0.13 U	0.0012 U	0.11 UJ	
Chloroform	0.37	350	0.0014 U	0.0011 U	0.0012 U	0.0023 U	0.13 U	540 U	0.0023 U	0.14 U	0.13 U	0.0012 U	0.11 U	
cis-1,2-Dichloroethene	0.25	500	0.0051	0.0011 U	0.00057 J	0.0097	0.031 J	610	0.022	0.7	40	0.0011 J	5.4	
Ethylbenzene	1	390	0.0014 U	0.0011 U	0.0012 U	0.0023 U	1.6	540 U	0.0023 U	0.14 U	0.13 U	0.0012 U	0.022 J	
Methylene Chloride	0.05	500	0.0091	0.0011 U	0.0012 U	0.0023 U	0.13 U	540 U	0.0023 U	0.14 U	0.13 U	0.0012 U	0.11 U	
Tetrachloroethene (PCE)	1.3	150	0.0083	0.012	0.00079 J	0.069	1.2	100000	0.28	3	19	0.0036	6.6	
Toluene	0.7	500	0.0014 U	0.0011 U	0.0012 U	0.0017 J	0.08 J	540 U	0.0023 U	0.14 U	0.12 J	0.0012 U	0.42	
trans-1,2-Dichloroethene	0.19	500	0.0014 U	0.0011 U	0.0012 U	0.0023 U	0.13 U	540 U	0.0005 J	0.14 U	0.69	0.0012 U	0.13	
Trichloroethene (TCE)	0.47	200	0.0019	0.00033 J	0.0012 U	0.0075	0.035 J	1800	0.024	0.44	19	0.00047 J	1.8	
Vinyl chloride	0.02	13	0.0014 U	0.0011 U	0.0012 U	0.0023 U	0.13 U	540 U	0.0023 U	0.14 U	2.1	0.0012 U	0.11 U	
Xylenes, Total	0.26	500	0.0041 U	0.0034 U	0.0037 U	0.0068 U	9.9	1600 U	0.0068 U	0.41 U	0.38 U	0.0037 U	0.13 J	
Total VOC Concentration	100	500	0.0318	0.01233	0.03716	0.0879	12.878	102410	0.3265	4.14	80.981	0.01857	14.782	

- Notes:**
- Grab soil sample analytical results are compared to the New York State Department of Environmental Conservation (NYSDEC) title 6 of the official compilation of New York Codes, Rules, and Regulations (NYCRR) Part 375 Unrestricted Use and Commercial Use Soil Cleanup Objectives (SCOs).
 - Only compounds with detections are shown in table.
 - NYSDEC Part 375 Unrestricted Use SCO exceedances are highlighted and bolded.
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 - mg/kg = milligrams per kilogram
 - ~ = No regulatory limit has been established for this analyte.
 - Sample DUP_003 is a duplicate sample of SB02_10-11.
 - Sample DUP_001 is a duplicate sample of SB10_13-14.
 - Sample DUP_002 is a duplicate sample of SB19_8-9.

- Qualifiers:**
- J =The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
- U =The analyte was analyzed, but was not detected at a level greater than or equal to the level of the Reporting Limit (RL) or the sample concentration for results impacted by blank contamination.
- UJ= The analyte was not detected at a level greater than or equal to the RL; however, the reported RL is approximate and may be inaccurate or imprecise.
- B= The analyte was found in an associated blank, as well as in the sample.
- D^x= Sample was diluted for this analyte; x= dilution factor
- * = Relative Percent Difference (RPD) of the Lab Control Sample (LCS) and the Lab Control Sample Duplicate (LCSD) exceeds the control limits.

Table 4
Soil Sample Analytical Results Summary
Supplemental Remedial Investigation Report
Kings Plaza Mall
Brooklyn, New York
NYSDEC VCA No. A2-0403-9911
Langan Project Nos. 140080104 and 140080105

Sample Location	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Use Commercial SCO	SB09		SB10				SB11		SB12	
Client Sample ID			SB09_7-8	SB09_10-11	SB10_5-6	SB10_10-11	SB10_13-14	Dup_001	SB11_6-7	SB11_10-11	SB12_6-7	SB12_10-11
Lab Sample ID			460-61880-12	460-61880-13	460-61880-14	460-61880-15	460-61880-16	460-61880-17	460-61972-7	460-61972-8	460-61972-1	460-61972-2
Sampling Date			8/26/2013	8/26/2013	8/26/2013	8/26/2013	8/26/2013	8/26/2013	8/27/2013	8/27/2013	8/27/2013	8/27/2013
Sampling Depth (feet bgs)			7 to 8	10 to 11	5 to 6	10 to 11	13 to 14	13 to 14	6 to 7	10 to 11	6 to 7	10 to 11
Dilution Factor			1	25000	1	50	1	1	50	50	1	1
Volatile Organic Compounds (mg/kg)												
1,1-Dichloroethene	0.33	500	0.0014 U	62 U	0.0013 U	0.16 U	0.0015 U	0.0012 U	0.15 U	0.16 U	0.0011 U	0.0068
1,2-Dichlorobenzene	1.1	500	0.0014 U	62 U	0.0013 U	0.16 U	0.0015 U	0.0012 U	0.15 U	0.16 U	0.0011 U	0.00058 J
1,2-Dichloropropane	~	~	0.0014 U	62 U	0.0013 U	0.16 U	0.0015 U	0.0012 U	0.15 U	0.16 U	0.0011 U	0.0011 U
1,4-Dichlorobenzene	1.8	130	0.0014 U	62 U	0.0013 U	0.16 U	0.0015 U	0.0012 U	0.15 U	0.16 U	0.0011 U	0.00017 J
2-Butanone	0.12	500	0.014 U	310 U	0.013 U	0.79 U	0.015 U	0.012 U	0.73 U	0.8 U	0.011 U	0.011 U
2-Hexanone	~	~	0.014 U	310 U	0.013 U	0.79 U	0.015 U *	0.012 U *	0.73 U	0.8 U	0.011 UJ	0.011 UJ
4-Methyl-2-pentanone	~	~	0.014 U	310 U	0.013 U	0.79 U	0.015 U *	0.012 U *	0.73 U	0.8 U	0.011 U	0.011 U
Acetone	0.05	500	0.0098 J	310 U	0.013 U	0.79 U	0.011 J *	0.015 *	0.73 UJ	0.8 UJ	0.011 U	0.036
Benzene	0.06	44	0.0014 U	62 U	0.0013 U	0.16 U	0.0015 UJ	0.012 J	0.15 U	0.16 U	0.0011 U	0.0021
Bromodichloromethane	~	~	0.0014 U	62 U	0.0013 U	0.16 U	0.0015 U	0.0012 U	0.15 U	0.16 U	0.0011 U	0.0011 U
Carbon disulfide	~	~	0.0014 U	62 UJ	0.0013 U	0.16 U	0.0073 J	0.0041 J	0.15 U	0.16 U	0.0011 U	0.0082
Chloroform	0.37	350	0.0014 U	62 U	0.0013 U	0.16 U	0.0015 U	0.0012 U	0.15 U	0.16 U	0.0011 U	0.0011 U
cis-1,2-Dichloroethene	0.25	500	0.0071	21 J	0.0013 U	3.7 J	0.024	0.11	0.49	10	0.013	0.056 JD ⁵⁰
Ethylbenzene	1	390	0.0014 U	62 U	0.0013 U	0.16 U	0.0015 U	0.00022 J	0.15 U	0.16 U	0.0011 U	0.0016
Methylene Chloride	0.05	500	0.0032	62 U	0.0013 U	0.16 U	0.0027	0.0013	0.15 U	0.16 U	0.0035	0.0011 U
Tetrachloroethene (PCE)	1.3	150	0.026	13000	0.0008 J	38	0.1	0.23	3.8	0.11 J	0.11	0.045 JD ⁵⁰
Toluene	0.7	500	0.0014 U	62 U	0.0013 U	0.16 U	0.0015 U	0.0019 B	0.15 U	0.093 J	0.00085 J	0.013
trans-1,2-Dichloroethene	0.19	500	0.0014 U	62 U	0.0013 U	0.16 U	0.0015 U	0.0034	0.15 U	0.92	0.0004 J	0.48
Trichloroethene (TCE)	0.47	200	0.0031	170	0.0013 U	3.2	0.0084	0.034	0.42	0.16 U	0.017	0.031 JD ⁵⁰
Vinyl chloride	0.02	13	0.0014 U	62 U	0.0013 U	0.21	0.0016 J	0.034 J	0.15 U	0.94	0.0011 U	0.13
Xylenes, Total	0.26	500	0.0041 U	190 U	0.0039 U	0.47 U	0.0044 U	0.00097 J	0.44 U	0.48 U	0.0034 U	0.0045
Total VOC Concentration	100	500	0.0492	13191	0.0008	45.11	0.155	0.44689	4.71	12.063	0.14475	32.18295

Notes:
1. Grab soil sample analytical results are compared to the New York State Department of Environmental Conservation (NYSDEC) title 6 of the official compilation of New York Codes, Rules, and Regulations (NYCRR) Part 375 Unrestricted Use and Commercial Use Soil Cleanup Objectives (SCOs).
2. Only compounds with detections are shown in table.
3. NYSDEC Part 375 Unrestricted Use SCO exceedances are highlighted and bolded.
4. NYSDEC Part 375 Restricted Use Commercial SCO exceedances are in red.
6. mg/kg = milligrams per kilogram
7. ~ = No regulatory limit has been established for this analyte.
8. Sample DUP_003 is a duplicate sample of SB02_10-11.
9. Sample DUP_001 is a duplicate sample of SB10_13-14.
10. Sample DUP_002 is a duplicate sample of SB19_8-9.

Qualifiers:
J =The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
U =The analyte was analyzed, but was not detected at a level greater than or equal to the level of the Reporting Limit (RL) or the sample concentration for results impacted by blank contamination.
UJ= The analyte was not detected at a level greater than or equal to the RL; however, the reported RL is approximate and may be inaccurate or imprecise.
B= The analyte was found in an associated blank, as well as in the sample.
D^x= Sample was diluted for this analyte; x= dilution factor
* = Relative Percent Difference (RPD) of the Lab Control Sample (LCS) and the Lab Control Sample Duplicate (LCSD) exceeds the control limits.

Table 4
Soil Sample Analytical Results Summary
Supplemental Remedial Investigation Report
Kings Plaza Mall
Brooklyn, New York
NYSDEC VCA No. A2-0403-9911
Langan Project Nos. 140080104 and 140080105

Sample Location	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Use Commercial SCO	SB12		SB13		SB14		SB15		SB16											
Client Sample ID			SB12_12-13	SB13_6-7	SB13_10-11	SB14_7-8	SB14_10-11	SB15_6-7	SB15_11-12	SB16_6-7	SB16_10-11	SB16_13-14										
Lab Sample ID			460-61972-3	460-61880-18	460-61880-19	460-61880-20	460-61880-21	460-61880-22	460-61880-23	460-61972-17	460-61972-18	460-61972-19										
Sampling Date			8/27/2013	8/26/2013	8/26/2013	8/26/2013	8/26/2013	8/26/2013	8/26/2013	8/27/2013	8/27/2013	8/27/2013										
Sampling Depth (feet bgs)			12 to 13	6 to 7	10 to 11	7 to 8	10 to 11	6 to 7	11 to 12	6 to 7	10 to 11	13 to 14										
Dilution Factor	500	1	1	1	50	1	1	1	1	50	50											
Volatile Organic Compounds (mg/kg)																						
1,1-Dichloroethene	0.33	500	1.8	U	0.0016	U	0.0063		0.0013	U	0.0013	U	0.0011	U	0.0012	U	0.028	J	0.23	U		
1,2-Dichlorobenzene	1.1	500	1.8	U	0.0016	U	0.00012	J	0.0013	U	0.11	U	0.0013	U	0.0011	U	0.0012	U	0.18	U	0.23	U
1,2-Dichloropropane	~	~	1.8	U	0.0016	U	0.0011	U	0.0013	U	0.11	U	0.0013	U	0.0011	U	0.0012	U	0.18	U	0.23	U
1,4-Dichlorobenzene	1.8	130	1.8	U	0.0016	U	0.0011	U	0.0013	U	0.11	U	0.0013	U	0.0011	U	0.0012	U	0.18	U	0.23	U
2-Butanone	0.12	500	8.9	U	0.016	U	0.011	U	0.013	U	0.56	U	0.013	U	0.011	U	0.012	U	0.91	U	1.2	U
2-Hexanone	~	~	8.9	U	0.016	U *	0.011	U *	0.013	U	0.56	U	0.013	U	0.011	U	0.012	UJ	0.91	U	1.2	U
4-Methyl-2-pentanone	~	~	8.9	U	0.016	U *	0.011	U *	0.013	U	0.56	U	0.013	U	0.011	U	0.012	U	0.91	U	1.2	U
Acetone	0.05	500	8.9	U	0.016	U *	0.019	*	0.008	J	0.56	U	0.013	U	0.012		0.012	U	0.91	U	1.2	UJ
Benzene	0.06	44	1.8	U	0.0011	J	0.00068	J	0.0013	U	0.11	U	0.0013	U	0.0011	U	0.0012	U	0.038	J	0.11	J
Bromodichloromethane	~	~	1.8	U	0.0016	U	0.0011	U	0.0013	U	0.11	U	0.0013	U	0.0011	U	0.0012	U	0.18	U	0.23	U
Carbon disulfide	~	~	1.8	U	0.0016	U	0.02		0.0013	U	0.11	UJ	0.0013	U	0.018		0.0012	U	0.048	J	0.23	U
Chloroform	0.37	350	1.8	U	0.0016	U	0.0011	U	0.0013	U	0.11	U	0.00033	J	0.0011	U	0.0012	U	0.18	U	0.23	U
cis-1,2-Dichloroethene	0.25	500	30		0.019		0.13	JD ⁵⁰	0.0052		2.9		0.0075		0.44		0.0018		25		43	
Ethylbenzene	1	390	1.8	U	0.0016	U	0.0011	U	0.0013	U	0.11	U	0.0013	U	0.00028	J	0.0012	U	0.18	U	0.11	J
Methylene Chloride	0.05	500	1.8	U	0.0016	U	0.0011	U	0.0026		0.11	U	0.0023		0.0026		0.0012	U	0.18	U	0.23	U
Tetrachloroethene (PCE)	1.3	150	340		0.02		0.0067		0.016		3		0.22		0.028		0.074		0.15	J	0.23	U
Toluene	0.7	500	0.33	J	0.0015	J B	0.00078	J B	0.0013	U	0.11	U	0.0013	U	0.00093	J B	0.0012	U	0.1	J	0.22	J
trans-1,2-Dichloroethene	0.19	500	1.8	U	0.0013	J	0.15		0.0013	U	0.11	U	0.0013	U	0.0027		0.0012	U	3.5		1.9	
Trichloroethene (TCE)	0.47	200	46		0.0065		0.0055		0.0036		0.81		0.022		0.041		0.011		0.33		0.23	U
Vinyl chloride	0.02	13	1.4	J	0.0044		0.36		0.0013	U	0.11	U	0.0013	U	0.0032		0.0012	U	10		1	
Xylenes, Total	0.26	500	5.3	U	0.0047	U	0.001	J	0.004	U	0.34	U	0.0038	U	0.0012	J	0.0035	U	0.097	J	0.25	J
Total VOC Concentration	100	500	417.73		0.0538		1.46008		0.0354		6.71		0.25213		0.54991		0.0868		39.291		46.59	

- Notes:**
- Grab soil sample analytical results are compared to the New York State Department of Environmental Conservation (NYSDEC) title 6 of the official compilation of New York Codes, Rules, and Regulations (NYCRR) Part 375 Unrestricted Use and Commercial Use Soil Cleanup Objectives (SCOs).
 - Only compounds with detections are shown in table.
 - NYSDEC Part 375 Unrestricted Use SCO exceedances are highlighted and bolded.
 - NYSDEC Part 375 Restricted Use Commercial SCO exceedances are in red.
 - mg/kg = milligrams per kilogram
 - ~ = No regulatory limit has been established for this analyte.
 - Sample DUP_003 is a duplicate sample of SB02_10-11.
 - Sample DUP_001 is a duplicate sample of SB10_13-14.
 - Sample DUP_002 is a duplicate sample of SB19_8-9.

- Qualifiers:**
- J=The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
- U=The analyte was analyzed, but was not detected at a level greater than or equal to the level of the Reporting Limit (RL) or the sample concentration for results impacted by blank contamination.
- UJ= The analyte was not detected at a level greater than or equal to the RL; however, the reported RL is approximate and may be inaccurate or imprecise.
- B= The analyte was found in an associated blank, as well as in the sample.
- D^x= Sample was diluted for this analyte; x= dilution factor
- * = Relative Percent Difference (RPD) of the Lab Control Sample (LCS) and the Lab Control Sample Duplicate (LCSD) exceeds the control limits.

Table 4
Soil Sample Analytical Results Summary
Supplemental Remedial Investigation Report
Kings Plaza Mall
Brooklyn, New York
NYSDEC VCA No. A2-0403-9911
Langan Project Nos. 140080104 and 140080105

Sample Location Client Sample ID Lab Sample ID Sampling Date Sampling Depth (feet bgs) Dilution Factor	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Use Commercial SCO	SB17		SB19			SB21		SB22				
			SB17 7-8	SB17 10-11	SB19 8-9	Dup_002	SB19 13-14	SB21 5-6	SB21 10-11	SB22 6-7	SB22 7-8	SB22 10-11		
			460-61972-25	460-61972-26	460-61880-24	460-61880-25	460-61880-26	460-61972-23	460-61972-24	460-61972-20	460-61972-21	460-61972-22		
			8/27/2013	8/27/2013	8/26/2013	8/26/2013	8/26/2013	8/27/2013	8/27/2013	8/27/2013	8/27/2013	8/27/2013		
			7 to 8	10 to 11	8 to 9	8 to 9	13 to 14	5 to 6	10 to 11	6 to 7	7 to 8	10 to 11		
			1	1	1	1	50	50	1	50	50	1		
Volatile Organic Compounds (mg/kg)														
1,1-Dichloroethene	0.33	500	0.001 U	0.0019 U	0.0013 U	0.0012 U	0.13 U	0.12 U	0.0015 U	0.11 U	0.11 U	0.0014 U		
1,2-Dichlorobenzene	1.1	500	0.001 U	0.0019 U	0.0013 U	0.0012 U	0.13 U	0.12 U	0.0015 U	0.11 U	0.11 U	0.0014 U		
1,2-Dichloropropane	~	~	0.001 U	0.0019 U	0.0013 U	0.0012 U	0.13 U	0.12 U	0.0015 U	0.11 U	0.11 U	0.0014 UJ		
1,4-Dichlorobenzene	1.8	130	0.001 U	0.0019 U	0.0013 U	0.0012 U	0.13 U	0.12 U	0.0015 U	0.11 U	0.11 U	0.0014 U		
2-Butanone	0.12	500	0.01 U	0.028 U	0.013 U	0.012 U	0.63 U	0.58 U	0.015 U	0.56 U	0.53 U	0.014 U		
2-Hexanone	~	~	0.01 UJ	0.019 U	0.013 U	0.012 U *	0.63 U	0.58 U	0.015 UJ	0.56 U	0.53 U	0.014 U		
4-Methyl-2-pentanone	~	~	0.01 U	0.019 U	0.013 U	0.012 U *	0.63 U	0.58 U	0.015 UJ	0.56 U	0.53 U	0.014 U		
Acetone	0.05	500	0.019	0.12	0.019	0.021 *	0.63 U	0.58 U	0.022	0.56 U	0.53 U	0.014 U		
Benzene	0.06	44	0.001 U	0.00032 J	0.0013 U	0.0012 U	0.014 J	0.12 U	0.00057 J	0.11 U	0.15	0.31 J		
Bromodichloromethane	~	~	0.0031	0.0019 U	0.0013 U	0.0012 U	0.13 U	0.12 U	0.0015 U	0.11 U	0.11 U	0.0014 U		
Carbon disulfide	~	~	0.0096	0.00078 J	0.011	0.0095	0.13 U	0.12 UJ	0.0099	0.11 U	0.11 UJ	0.0036 J		
Chloroform	0.37	350	0.001 U	0.0019 U	0.0013 U	0.0012 U	0.13 U	0.12 U	0.0015 U	0.11 U	0.11 U	0.0014 U		
cis-1,2-Dichloroethene	0.25	500	0.013	0.00045 J	0.0013 U	0.0014	1.3	0.12 U	0.0045	0.11 U	0.11 U	0.00053 J		
Ethylbenzene	1	390	0.001 U	0.0019 U	0.0013 U	0.0012 U	0.13 U	0.033 J	0.0015 U	0.11 U	2.5	0.039 JD ⁵⁰		
Methylene Chloride	0.05	500	0.0027	0.0019 U	0.0013	0.0012 U	0.13 U	0.12 U	0.002	0.11 U	0.11 U	0.0014 U		
Tetrachloroethene (PCE)	1.3	150	0.0021	0.00096 J	0.0013 U	0.0032	12	0.34	0.00089 J	0.11 U	0.11 U	0.0021 J		
Toluene	0.7	500	0.001 U	0.00085 J	0.0013 U	0.00088 J B	0.13 U	0.12 U	0.0015 U	0.11 U	0.053 J	0.075 J		
trans-1,2-Dichloroethene	0.19	500	0.023	0.0019 U	0.0013 U	0.00033 J	0.13 U	0.12 U	0.0043	0.11 U	0.11 U	0.00021 J		
Trichloroethene (TCE)	0.47	200	0.0013	0.00051 J	0.00026 J	0.0012 U	1.7	0.12 U	0.00078 J	0.11 U	0.11 U	0.0014 U		
Vinyl chloride	0.02	13	0.0068	0.0019 U	0.0013 U	0.0012 U	0.025 J	0.12 U	0.0015 U	0.11 U	0.11 U	0.0014 U		
Xylenes, Total	0.26	500	0.0031 U	0.0056 U	0.0038 U	0.0036 U	0.38 U	0.45	0.0044 U	0.29 J	5.2	0.086 JD ⁵⁰		
Total VOC Concentration	100	500	0.0806	0.15187	0.03156	0.03631	15.039	0.823	0.04494	0.29	7.903	3.37144		

Notes:
1. Grab soil sample analytical results are compared to the New York State Department of Environmental Conservation (NYSDEC) title 6 of the official compilation of New York Codes, Rules, and Regulations (NYCRR) Part 375 Unrestricted Use and Commercial Use Soil Cleanup Objectives (SCOs).
2. Only compounds with detections are shown in table.
3. NYSDCE Part 375 Unrestricted Use SCO exceedances are highlighted and bolded.
4. NYSDCE Part 375 Restricted Use Commercial SCO exceedances are in red.
6. mg/kg = milligrams per kilogram
7. ~ = No regulatory limit has been established for this analyte.
8. Sample DUP_003 is a duplicate sample of SB02_10-11.
9. Sample DUP_001 is a duplicate sample of SB10_13-14.
10. Sample DUP_002 is a duplicate sample of SB19_8-9.

Qualifiers:
J =The analyte was positively identified and the associated numerical value is the approximate concentr
U =The analyte was analyzed, but was not detected at a level greater than or equal to the level of the Reporting Limit (RL) or the sample concentration for results impacted by blank contamination.
UJ= The analyte was not detected at a level greater than or equal to the RL; however, the reported RL is approximate and may be inaccurate or imprecise.
B= The analyte was found in an associated blank, as well as in the sample.
D^x= Sample was diluted for this analyte; x= dilution factor
* = Relative Percent Difference (RPD) of the Lab Control Sample (LCS) and the Lab Control Sample Duplicate (LCSD) exceeds the control limits.

Table 5
Groundwater Sample Analytical Results Summary
Supplemental Remedial Investigation Report
Kings Plaza Mall
Brooklyn, New York
NYSDEC VCA No. A2-0403-9911
Langan Project Nos. 140080104 and 140080105

Sample Location Client Sample ID Lab Sample ID Sampling Date	NYSDEC TOGS Standards and Guidance Values	MW1 MW1_20130830 460-62235-3 8/30/2013	MW4 MW4_20130828 460-62066-1 8/28/2013	MW8 MW8_20130829 460-62149-9 8/29/2013	MW36 MW36_20130829 460-62149-1 8/29/2013	MW39 MW39_20130829 460-62149-7 8/29/2013	MW46 MW46_20130829 460-62149-3 8/29/2013	EFR1 EFR1_20130828 460-62066-2 8/28/2013	EFR3 EFR3_20130829 460-62149-4 8/29/2013	EFR6 EFR6_20130829 460-62149-2 8/29/2013
Volatile Organic Compounds (µg/l)										
1,1-Dichloroethene	5	1 U	1 U	1 U	1 U	23 D ²⁰	1 U	1 U	1 U	1 U
Acetone	50	10 J	5 U	5 U	13	100 UD ²⁰	5 U	5 U	5 U	5 U
Benzene	1	2	1 U	13	45	2.1 JD ²⁰	0.19 J	1 U	69	17
Carbon disulfide	60	0.66 J	1 U	0.32 J	1 U	20 UD ²⁰	1 U	1 U	1 U	1 U
Chloroethane	5	1 U *	1 U	1 U	1 U	20 UD ²⁰	1 U	1 U	1 U	1 U
Chloroform	7	1 U	1 U	1 U	1 U	20 UD ²⁰	1 U	1 U	1 U	1 U
cis-1,2-Dichloroethene	5	25	0.52 J	4.3	1 U	7700 D ²⁰	1.2	0.9 J	0.26 J	1 U
Cyclohexane	~	4.1	1 U	2.4	6.5	20 UD ²⁰	1	1 U	4.5	4.8
Ethylbenzene	5	1 U	1 U	10	150	20 UD ²⁰	5.5	1 U	16	23
Isopropylbenzene	5	1 U	1 U	1.8	12	20 UD ²⁰	0.45 J	1 U	1.3	4.9
m&p-Xylene	5	2 U	2 U	32	390	40 UD ²⁰	35	2 U	65	130
Methylcyclohexane	~	1 U	1 U	3.4	3.2	20 UD ²⁰	0.85 J	1 U	5	4.2
Methylene Chloride	5	1 U	1 U	1 U	1 U	20 UD ²⁰	1 U	1 U	1 U	1 U
Methyl tert-butyl ether (MTBE)	10	1 U	1 U	1.2	4.4	20 UD ²⁰	1 U	1 U	6.7	0.58 J
o-Xylene	5	1 U	1 U	15	300	20 UD ²⁰	8.8	1 U	12	37
Tetrachloroethene (PCE)	5	1 U	1 U	1.6	1	1600 D ²⁰	1 U	1 U	1 U	1 U
Toluene	5	0.64 J	1 U	1.3	15	3.3 JD ²⁰	1 J	1 U	2	2.2
trans-1,2-Dichloroethene	5	0.48 J	0.41 J	0.5 J	1 U	750 D ²⁰	1 U	0.21 J	1 U	1 U
Trichloroethene (TCE)	5	1 U	1 U	2.2	1 U	2200 D ²⁰	1 U	1 U	1 U	1 U
Vinyl chloride	2	52	1 U	0.62 J	0.34 J	1200 D ²⁰	0.64 J	1.7	0.55 J	0.35 J
Total Xylenes	5	ND	ND	47	690	ND	43.8	ND	77	167
Total VOC Concentration	~	94.88	0.93	89.64	939.44	13478.4	53.98	2.81	182.31	224.03
Semivolatile Organic Compounds (µg/l)										
2-Methylnaphthalene	~	10 U *	10 U	87 D ⁵	260 D ²	10 U	15	10 U	19	27
4-Methylphenol	~	10 U	10 U	6.1 JD ⁵	25 UD ²	10 U	10 U	10 U	10 U	11 U
Acenaphthene	20	10 U	22	10 JD ⁵	18 JD ²	10 U	10 U	2.9 J	5.1 J	4.7 J
Acetophenone	~	10 U	U	50 UD ⁵	25 UD ²	10 U	10 U	10 U	10 U	11 U
Anthracene	50	10 U	10 U	5.4 JD ⁵	4.2 JD ²	10 U	10 U	10 U	10 U	11 U
Bis(2-ethylhexyl) phthalate	5	6.1 J	10 U	350 D ⁵	25 D ²	1.2 J	3.7 J	10 U	43	29
Carbazole	~	10 U *	10 U	50 UD ⁵	6.6 JD ²	10 U	10 U	10 U	3.8 J	11 U
Dibenzofuran	~	10 U	10 U	50 UD ⁵	8.3 JD ²	10 U	10 U	10 U	1.8 J	2.1 J
Diethyl phthalate	50	8 J	10 U	50 UD ⁵	25 UD ²	10 U	10 U	10 U	10 U	11 U
Di-n-butyl phthalate	50	10 U	10 U	50 UD ⁵	25 UD ²	10 U	10 U	10 U	10 J	11 U
Di-n-octyl phthalate	50	10 U	10 U	7.3 JD ⁵	25 UD ²	10 U	10 U	10 U	10 U	11 U
Diphenyl	~	10 U	10 U	50 UD ⁵	7.1 JD ²	10 U	10 U	10 U	10 U	11 U
Fluorene	50	10 U	10 U	10 JD ⁵	16 JD ²	10 U	10 U	10 U	4.5 J	3.3 J
Naphthalene	10	10 U *	10 U	44 JD ⁵	110 D ²	10 U	8.3 J	10 U	6.5 J	17
Phenanthrene	50	10 U	10 U	25 JD ⁵	37 D ²	10 U	2.4 J	10 U	4.5 U*J	5.1 J
Pyrene	50	10 U	10 U	6.2 JD ⁵	4.6 JD ²	10 U	10 U	10 U	10 U	11 U
Total SVOC Concentration	~	14.1	22	1411	729.3	1.2	29.4	2.9	196.2	146.4

Notes:

- Groundwater samples analytical results are compared to the New York State Department of Environmental Conservation (NYSDEC) Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards (AWQS) and guidance values for drinking water (class GA) .
- Only compounds with detections are shown in the table.
- Results exceeding NYSDEC TOGS are highlighted and in bold.
- µg/l = micrograms per liter
- ~ = No regulatory limit has been established for this analyte.
- Sample DUP_001 is a duplicate sample of EFR12.
- TB = Trip Blank
- FB = Field Blank

Qualifiers:

- J =The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
U =The analyte was analyzed, but was not detected at a level greater than or equal to the level of the Reporting Limit (RL) or the sample concentration for results impacted by blank contamination.
D^x= Sample was diluted for this analyte; x= dilution factor
* = Relative Percent Difference (RPD) of the Lab Control Sample (LCS) and the Lab Control Sample Duplicate (LCSD) exceeds the control limits.

Table 5
Groundwater Sample Analytical Results Summary
Supplemental Remedial Investigation Report
Kings Plaza Mall
Brooklyn, New York
NYSDEC VCA No. A2-0403-9911
Langan Project Nos. 140080104 and 140080105

Sample Location Client Sample ID Lab Sample ID Sampling Date	NYSDEC TOGS Standards and Guidance Values	EFR12				HV1		LMW1		LMW2		TB01		TB03		FB001	
		EFR12_20130829 460-62149-5 8/29/2013		DUP_001 460-62149-6 8/29/2013		HV1_20130829 460-62149-8 8/29/2013		LMW1_20130830 460-62235-1 8/30/2013		LMW2_20130830 460-62235-2 8/30/2013		TB01 460-62149-10 8/29/2013		TB03 460-62235-4 8/30/2013		FB001 460-62149-11 8/29/2013	
Volatile Organic Compounds (µg/l)																	
1,1-Dichloroethene	5	13	JD ⁵⁰	18	JD ⁵⁰	1	U	1	U	1	U	1	U	1	U	1	U
Acetone	50	250	UD ⁵⁰	250	UD ⁵⁰	5	U	5	U	5	U	5	U	5	U	5	U
Benzene	1	7.1	JD ⁵⁰	6.9	JD ⁵⁰	1.7		1	U	4.1		1	U	1	U	1	U
Carbon disulfide	60	50	UD ⁵⁰	50	UD ⁵⁰	1	U	1	U	1	U	1	U	1	U	1	U
Chloroethane	5	50	UD ⁵⁰	50	UD ⁵⁰	1	U	1	U *	1	U *	1	U	1	U *	1	U
Chloroform	7	50	UD ⁵⁰	50	UD ⁵⁰	1	U	1	U	1	U	1	U	0.23	J	1	U
cis-1,2-Dichloroethene	5	12000	D ⁵⁰	14000	D ⁵⁰	3.5		0.19	J	0.24	J	1	U	1	U	1	U
Cyclohexane	~	50	UD ⁵⁰	50	UD ⁵⁰	2.9		1	U	8.1		1	U	1	U	1	U
Ethylbenzene	5	50	UD ⁵⁰	50	UD ⁵⁰	3.5		1	U	1	U	1	U	1	U	1	U
Isopropylbenzene	5	50	UD ⁵⁰	50	UD ⁵⁰	1.2		0.12	J	0.66	J	1	U	1	U	1	U
m&p-Xylene	5	100	UD ⁵⁰	100	UD ⁵⁰	10		2	U	2	U	2	U	2	U	2	U
Methylcyclohexane	~	50	UD ⁵⁰	50	UD ⁵⁰	4.7		1	U	4.2		1	U	1	U	1	U
Methylene Chloride	5	50	UD ⁵⁰	50	UD ⁵⁰	1	U	1	U	1	U	1	U	1	U	1.6	
Methyl tert-butyl ether (MTBE)	10	50	UD ⁵⁰	50	UD ⁵⁰	0.61	J	0.72	J	0.41	J	1	U	1	U	1	U
o-Xylene	5	50	UD ⁵⁰	50	UD ⁵⁰	0.52	J	1	U	1	U	1	U	1	U	1	U
Tetrachloroethene (PCE)	5	1800	D ⁵⁰	2400	D ⁵⁰	2.1		1	U	1	U	1	U	1	U	1	U
Toluene	5	8	JD ⁵⁰	8.7	JD ⁵⁰	1	U	1	U	1	U	1	U	1	U	0.26	J
trans-1,2-Dichloroethene	5	570	D ⁵⁰	750	D ⁵⁰	0.53	J	1	U	1	U	1	U	1	U	1	U
Trichloroethene (TCE)	5	3800	D ⁵⁰	5200	D ⁵⁰	2.4		1	U	1	U	1	U	1	U	1	U
Vinyl chloride	2	2200	D ⁵⁰	2800	D ⁵⁰	0.59	J	0.24	J	1	U	1	U	1	U	1	U
Total Xylenes	5	ND		ND		10.52		ND		ND		ND		ND		ND	
Total VOC Concentration	~	20398.1		25183.6		34.49		1.27		17.71		0		0.23		1.86	
Semivolatile Organic Compounds (µg/l)																	
2-Methylnaphthalene	~	10	U	10	U	5.3	J	10	U *	10	U *	NA		NA		10	U
4-Methylphenol	~	10	U	10	U	10	U	10	U	10	U	NA		NA		10	U
Acenaphthene	20	10	U	10	U	2.4	J	32		10	U	NA		NA		10	U
Acetophenone	~	10	U	10	U	10	U	10	U	10	U	NA		NA		1.8	J
Anthracene	50	10	U	10	U	10	U	10	U	10	U	NA		NA		10	U
Bis(2-ethylhexyl) phthalate	5	10	U	10	U	14		10	U	10	U	NA		NA		10	U
Carbazole	~	10	U	10	U	10	U	10	U	10	U *	NA		NA		10	U
Dibenzofuran	~	10	U	10	U	10	U	10	U	10	U	NA		NA		10	U
Diethyl phthalate	50	10	U	10	U	10	U	10	U	1.5	J	NA		NA		10	U
Di-n-butyl phthalate	50	10	U	10	U	10	U	10	U	10	U	NA		NA		1.4	J
Di-n-octyl phthalate	50	10	U	10	U	10	U	10	U	10	U	NA		NA		10	U
Diphenyl	~	10	U	10	U	10	U	10	U	10	U	NA		NA		10	U
Fluorene	50	10	U	10	U	2.6	J	4.5	J	10	U	NA		NA		10	U
Naphthalene	10	10	U	10	U	3.5	J	10	U	10	U *	NA		NA		10	U
Phenanthrene	50	10	U	10	U	1.6	J	10	U	10	U	NA		NA		10	U
Pyrene	50	10	U	10	U	10	U	10	U	10	U	NA		NA		10	U
Total SVOC Concentration	~	ND		ND		97.5		36.5		1.5		NA		NA		3.2	

Notes:

- Groundwater samples analytical results are compared to the New York State Department of Environmental Conservation (NYSDEC) Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards (AWQS) and guidance values for drinking water (class GA) .
- Only compounds with detections are shown in the table.
- Results exceeding NYSDEC TOGS are highlighted and in bold.
- µg/l = micrograms per liter
- ~ = No regulatory limit has been established for this analyte.
- Sample DUP_001 is a duplicate sample of EFR12.
- TB = Trip Blank
- FB = Field Blank

Qualifiers:

- J =The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
U =The analyte was analyzed, but was not detected at a level greater than or equal to the level of the Reporting Limit (RL) or the sample concentration for results impacted by blank contamination.
D^x= Sample was diluted for this analyte; x= dilution factor
* = Relative Percent Difference (RPD) of the Lab Control Sample (LCS) and the Lab Control Sample Duplicate (LCSD) exceeds the control limits.

Table 6A
Soil Vapor Sample Analytical Results Summary
Supplemental Remedial Investigation Report
Kings Plaza Mall
Brooklyn, New York
NYSDEC VCA No. A2-0403-9911
Langan Project Nos. 140080104 and 140080105

Sample Location Client Sample ID Lab Sample ID Sampling Date Dilution Factor	NYSDOH AGV	LSV1	LSV2	LSV3	LSV4		LSV5	LSV6	LSV7	LSV8	AMBIENT		
		LSV1-20130823 H3H270411009 8/23/2013 320.25	LSV2-20130823 H3H270411004 8/23/2013 774.5	LSV3-20130823 H3H270411002 8/23/2013 10	LSV4-20130823 H3H270411001 8/23/2013 226.2	DUP_001 H3H270411007 8/23/2013 224.85	LSV5-20130827 H3H290419001 8/27/2013 210.05	LSV6-20130823 H3H270411006 8/23/2013 10	LSV7-20130823 H3H270411005 8/23/2013 20	LSV8-20130823 H3H270411008 8/23/2013 10	AMBIENT H3H270411003 8/23/2013 1	AMBIENT 2 H3H290419002 8/27/2013 1	
Volatile Organic Compounds (µg/m³)													
1,1,2,2-Tetrachloroethane	~	53 U	130 U	1.6 U	37 U	37 U	35 U	12	3.3 U	1.6 U	0.16 U	0.16 U	
1,2,4-Trimethylbenzene	~	39 U	820	11	130 J	320 J	26 U	12	14	11	0.89	0.12 U	
1,3,5-Trimethylbenzene	~	41 U	99 U	1.3 U	120 J	320 J	27 U	1.3 U	2.6 U	1.3 U	0.13 U	0.13 U	
2,2,4-Trimethylpentane	~	24 U	1400	16	17 U	17 U	16 U	0.75 U	1.5 U	0.75 U	5.7	0.075 U	
2-Butanone (MEK)	~	76 U	180 U	63	53 U	53 U	50 U	18	22	49	1.1	1.9	
4-Methyl-2-pentanone (MIBK)	~	24 U	1400	11	17 U	17 U	15 U	0.74 U	1.5 U	0.74 U	0.074 U	0.074 U	
Benzene	~	130	930	19	620	540	15 U	3	1.5 U	5.6	1.9	0.47	
Carbon tetrachloride	~	30 U	73 U	0.94 U	21 U	21 U	20 U	0.94 U	1.9 U	0.94 U	0.35	0.32	
Chloroform	~	23 U	57 U	19	17 U	16 U	15 U	29	140	74	0.073 U	0.073 U	
Chloromethane	~	42 U	100 U	1.3 U	30 U	30 U	28 U	1.3 U	2.6 U	1.3 U	1.1	1.4	
cis-1,2-Dichloroethene	~	30 U	330	28	22 U	21 U	20 U	0.95 U	110	17	0.095 U	0.095 U	
Cyclohexane	~	1300	9500	92	670	580	12 U	0.55 U	1.1 U	0.55 U	2.5	0.055 U	
Dichlorodifluoromethane	~	43 U	100 U	1.3 U	30 U	30 U	28 U	1.3 U	2.7 U	1.3 U	2.4	2	
Ethanol	~	480 U	1200 U	310	340 U	340 U	320 U	52	30 U	37	29	6.5	
Ethylbenzene	~	38 U	1400	5.9	670 J	1300 J	25 U	1.2 U	2.3 U	11	1.3	0.42	
Methylene chloride	60	140 U	350 U	4.5 U	100 U	100 U	95 U	4.5 U	15	4.5 U	1.7	4.9	
m-Xylene & p-Xylene	~	74 U	870	21	3900 J	8000 J	48 U	13	15	17	3.9	1.2	
n-Hexane	~	810	10000	100	840	720	9.6 U	12	0.92 U	0.46 U	7.6	0.046 U	
o-Xylene	~	33 U	81 U	10	1100 J	2400 J	22 U	6.3	7.4	7.6	1.3	0.41	
Styrene	~	31 U	76 U	0.98 U	770 J	1900 J	21 U	0.98 U	2 U	0.98 U	0.37	0.098 U	
tert-Butyl alcohol	~	15 U	35 U	22	10 U	10 U	9.6 U	0.45 U	0.91 U	18	0.045 U	0.045 U	
Tetrachloroethene (PCE)	30	35 U	84 U	510	700	920	17000	280	2100	910	0.71	0.11 U	
Toluene	~	25 U	61 U	64	10000	14000	17 U	34	35	39	7.9	5	
trans-1,2-Dichloroethene	~	25 U	61 U	0.79 U	18 U	18 U	17 U	0.79 U	1.6 U	3.8	0.079 U	0.079 U	
Trichloroethene (TCE)	5	24 U	58 U	76	100	100	730	26	400	290	0.075 U	0.075 U	
Trichlorofluoromethane	~	18 U	43 U	19	12 U	12 U	12 U	0.55 U	1.1 U	0.55 U	1.7	1.5	
Vinyl chloride	~	320	1400	14	17 U	17 U	16 U	0.74 U	7.5	23	0.074 U	0.074 U	
Total VOC Concentration	~	2560	28050	1410.9	19620	31100	17730	497.3	2865.9	1513	71.42	26.02	

Notes:
1. Soil vapor samples analytical results are compared to the New York State Department of Health (NYSDOH) Air Guideline Value (AGV).
2. Only compounds with detections are shown in table.
3. NYSDOH AGV exceedances are highlightd and bolded.
4. Reporting Limits (RL) above NYSDOH AGV are italicized.
5. µg/m³ = micrograms per cubic meter
6. ~ = This indicates that no regulatory limit has been established for this analyte.
7. Sample DUP_001 is a duplicate sample of LSV4-20130823.

Qualifiers:
J =The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
U =The analyte was analyzed, but was not detected at a level greater than or equal to the level of the Reporting Limit (RL) or the sample concentration for results impacted by blank contamination.

Table 6B
Sub-Slab Soil Vapor, Indoor and Outdoor Ambient Air Sample Detection Summary
Kings Plaza Shopping Center
5102-5508 Avenue U, New York
Langan Project Number: 140080105

Type of Sample Sample Location Client Sample ID Lab Sample ID Sampling Date	NYSDOH AGV	NYSDOH Action Levels		Sub-Slab Vapor SS-1	Indoor Air IA-1	Sub-Slab Vapor SS-2	Indoor Air IA-2	Sub-Slab Vapor SS-3	Indoor Air IA-3	Sub-Slab Vapor SS-4	Indoor Air IA-4	Sub-Slab Vapor SS-5	Sub-Slab Vapor SS-6	Ambient Air AA-1
				SS-1-20140327 L1406477-01 3/27/14	IA-1-20140327 L1406477-02 3/27/14	SS-2-20140327 L1406477-03 3/27/14	IA-2-201403127 L1406477-04 3/27/14	SS-3-20140327 L1406477-05 3/27/14	IA-3-201403127 L1406477-06 3/27/14	SS-4-20140327 L1406477-07 3/27/14	IA-4-20140327 L1406477-08 3/27/14	SS-5-20140327 L1406477-09 3/27/14	SS-6-20140327 L1406477-10 3/27/14	AA-1-20140327 L1406477-11 3/27/14
		Sub-Slab Vapor	Indoor Air											
Volatile Organic Compounds (µg/m³)														
1,2,4-Trimethylbenzene				5.11	0.983 U	7.87	0.983 U	5.21	0.983 U	7.33	0.983 U	4.39	2.35	0.983 U
1,2-Dichloroethane				1.64 U	0.809 U	0.809 U	0.809 U	0.809 U	0.809 U	2.7 U	1.01	0.809 U	0.809 U	0.809 U
1,2-Dichloropropane				1.88 U	0.924 U	0.924 U	0.924 U	0.924 U	0.924 U	3.08 U	2.18	0.924 U	0.924 U	0.924 U
1,3,5-Trimethylbenzene				8.26	0.983 U	12	0.983 U	2.58	0.983 U	3.88	0.983 U	1.89	0.983 U	0.983 U
2-Butanone				8.26	0.669	11	0.77	1.99	0.672	53.4	6.55	16	12.8	0.699
2-Hexanone				2.7	0.82 U	1.16	0.82 U	0.82 U	0.82 U	2.73 U	0.82 U	0.82 U	0.82 U	0.82 U
4-Ethyltoluene				2 U	0.983 U	0.983 U	0.983 U	1.03	0.983 U	3.28 U	0.983 U	1.65	0.983 U	0.983 U
4-Methyl-2-pentanone				1.66 U	0.82 U	1.12	0.82 U	0.82 U	0.82 U	20.2	0.82 U	1.19	0.967	0.82 U
Acetone				190	4.06	108	4.44	57	8.69	361	19.9	273	404	2.99
Benzene				1.3 U	0.639 U	0.639 U	0.639 U	0.639 U	0.639 U	11.4	0.639 U	9.2	0.783	0.639 U
Carbon disulfide				1.26 U	0.623 U	11.6	0.623 U	0.8	0.623 U	2.08 U	0.623 U	2.63	0.623 U	0.623 U
Carbon tetrachloride**†	–	5	–	2.55 U	-	1.26 U	-	1.26 U	-	4.2 U	-	1.26 U	1.26 U	-
Chloroform				3.49	0.977 U	1.38	0.977 U	2.49	0.977 U	25.2	0.977 U	1.65	0.977 U	0.977 U
Chloromethane				0.838 U	1.13	0.413 U	1.01	0.413 U	1.1	1.38 U	1.12	0.413 U	1.03	1.09
cis-1,2-Dichloroethene*				7.3	-	0.805	-	0.793 U	-	7.61	-	0.793 U	0.793 U	-
Cyclohexane				1.4 U	0.688 U	0.688 U	0.688 U	0.688 U	0.688 U	4.51	0.688 U	1.29	1.29	0.688 U
Dichlorodifluoromethane				2.01 U	1.42	1.55	1.32	2.1	1.37	3.3 U	1.95	1.27	1.48	1.27
Ethanol				24.3	12.9	47.3	21.7	12.2	58.8	15.7 U	92.1	97.4	141	4.71 U
Ethyl Acetate				3.64 U	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U	6.02 U	3.86	1.8 U	1.8 U	1.8 U
Ethylbenzene				2.55	0.869 U	1.67	0.869 U	0.869 U	0.869 U	9.08	1.17	2.59	1.79	0.869 U
Heptane				1.81	0.82 U	0.82 U	0.82 U	0.82 U	0.82 U	3.66	1.62	5	2.51	0.82 U
Isopropanol				8.85	7.1	37.9	22.6	32	198	8.11	72.5	34.7	47.2	1.23 U
n-Hexane				1.43 U	0.705 U	0.705 U	0.705 U	0.705 U	0.705 U	3.98	0.705 U	3.84	2.2	0.705 U
o-Xylene				5.04	0.869 U	4.15	0.869 U	5	0.869 U	10.4	0.869 U	3.16	2.26	0.869 U
p/m-Xylene				8.21	1.74 U	6.86	1.74 U	4.6	1.74 U	29.8	1.74 U	7.77	5.21	1.74 U
Styrene				1.73 U	0.852 U	0.852 U	0.852 U	0.852 U	0.852 U	2.84 U	0.852 U	1.37	1.91	0.852 U
Tertiary butyl Alcohol				3.06 U	1.52 U	1.52 U	1.52 U	1.52 U	1.52 U	5.06 U	1.52 U	8.49	2.13	1.52 U
Tetrachloroethene*	30	30	–	1230 [†]	-	381 ^M	-	35.4 [‡]	-	2740 [†]	-	59.1 [‡]	30 [‡]	-
Tetrahydrofuran				1.2 U	0.59 U	6.69	0.59 U	0.59	0.59 U	9.05	0.59 U	12.7	0.59 U	0.59 U
Toluene				124	1.64	10.9	1.38	3.73	1.98	54.3	71.2	43	34.1	0.754 U
Trichloroethene*	5	5	–	75.8 ^M	-	13.6 [‡]	-	1.11	-	104 ^M	-	1.38	1.86	-
Trichlorofluoromethane				2.28 U	1.12 U	1.21	1.17	1.18	1.19	3.75 U	1.12 U	1.13	1.18	1.12 U
Volatile Organic Compounds (µg/m³) SIM														
Carbon tetrachloride [‡]	–	–	0.25	-	0.453	-	0.465	-	0.459	-	0.453	-	-	0.453
cis-1,2-Dichloroethene				-	0.0793 U	-	0.0793 U	-	0.0793 U	-	0.0793 U	-	-	0.0793 U
Tetrachloroethene	30	–	3	-	0.203	-	0.136 U	-	0.136 U	-	0.359	-	-	0.136 U
Trichloroethene	5	–	0.25	-	0.107 U	-	0.107 U	-	0.107 U	-	0.107 U	-	-	0.107 U

Notes:

Shading indicates exceedance of NSYDOH AGV

Bold indicates exceedance of NYSDOH sub-slab vapor concentrations

Underline indiactes exceedance of NYSDOH target indoor air concentrations

Only compounds with detections are shown in table.

Sample results were compared to criteria listed in the New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006 - the Air Guideline Values (AGV)

Values with red text exceed the NYSDOH AGV

µg/m³ = micrograms per cubic meter

CAS No. = Chemical Abstracts Service number

-' = Compound not measured in NYSDOH background study or without corresponding NYSDOH AGV

* = For those compounds not reported in standard analysis, compound is reported by SIM analysis.

≠ = No further action required

‡ = Correlating indoor air concentration requires taking reasonable and parctical action to identify source(s) of compound of reduce exposure

M = Continued monitoring, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, is needed to determine whether concentrations in the sub-slab vapor have changed

† = Mitigation is needed to minimize the current or potential exposures associated with soil vapor intrusion

Qualifiers:

U = Analyte included in the analysis, but not detected

APPENDIX C

Previous Environmental Reports (On CD)

APPENDIX D

Health and Safety Plan

APPENDIX D HEALTH AND SAFETY PLAN

for

**OU-1 and OU-2 at the Kings Plaza Shopping Center
5102, 5120 & 5502 Avenue U
Brooklyn, New York**

NYSDEC VCP No. A2-0403-9911

NYSDEC Site No. V00323

Prepared For:

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Prepared By:

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LANGAN

**July 6, 2015
140080104, 140080105 & 140080106**

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HEALTH AND SAFETY PLAN (HASP) SUMMARY

Emergency Contacts

Emergency contacts are listed on Table 0.1.

Emergency Procedures

Emergency procedures are described in Section 6.

Site-Specific Hazards and Training

Site-Specific Hazards are described in Section 2.

The Field Safety Officer (FSO) will be responsible for providing site-specific training to all personnel that work at the Site. This training will cover the following topics:

- Names of personnel responsible for site safety and health;
- Hazards potentially present at the Site;
- Proper use of personal protective equipment (PPE);
- Work practices by which the employee can minimize risk from hazard;
- Acute effects of compounds at the Site; and,
- Decontamination procedures.

Personnel will be required to sign and date the Site-Specific Training Form provided in Attachment B prior to working on-site.

General Health and Safety Requirements

Personnel will be required to sign and date the HASP and Work Plan Acceptance Form provided in Attachment B prior to working on-site.

Personnel Protective Equipment

Level D protection will be worn for initial entry on-site and for all activities except as noted in Section 3. Level D protection will consist of:

- Standard work clothes;
- Steel-toe safety boots;
- Safety glasses or goggles must be worn when splash hazard is present;
- Nitrile outer gloves and polyvinyl chloride (PVC) or nitrile inner gloves must be worn during all sampling activities; and,
- Hard hat (must be worn during all sampling activities).

Modified Level D protection may be required under conditions where potential contact of the skin or clothes with significant contamination occurs. Modified Level D is the same as Level D but includes Tyvek coveralls and disposable polyethylene (PE) overboots.

Level C protection, unless otherwise specified in Section 3, will consist of Level D equipment and the following additional equipment:

- Full-face or half-mask air-purifying respirator (APR);
- Combination dust/organic vapor cartridges;
- Tyvek coveralls if particulate hazards are present;
- PE-coated Tyvek coverall if liquid contamination is present;
- PVC or nitrile inner and nitrile outer gloves; and,
- 5-minute escape self-contained breathing apparatus (SCBA).

Level B protection, unless otherwise specified in Section 3, will consist of Level D equipment and the following additional equipment:

- Hard hat;
- Positive pressure SCBA or positive pressure airline and respirator with escape SCBA;
- PE-coated Tyvek coverall;
- Nitrile outer and PVC or nitrile inner gloves; and,
- Nitrile boot covers.

Air Monitoring

A summary of the action levels and restrictions is presented on Table 0.2.

FIGURE 1
HOSPITAL ROUTE PLAN (University Hospital of Brooklyn)

Site Location: 5102, 5120 and 5502 Avenue U, Brooklyn, NY
Hospital Location: 450 Clarkson Avenue, Brooklyn, NY
Emergency Room (718) 758-8920



Directions to University Hospital of Brooklyn
450 Clarkson Ave, Brooklyn, NY 11203
4.6 mi – about 15 mins

A Kings Plaza Shopping Center
5100 Kings Plaza, Brooklyn, NY 11234

1. Head northeast on Avenue U toward E 55th St go 0.5 mi
About 1 min total 0.5 mi
2. Turn left onto Mill Ave go 0.3 mi
About 1 min total 0.8 mi
3. Slight right onto Ralph Ave go 2.4 mi
About 7 mins total 3.2 mi
4. Slight left onto Remsen Ave go 0.3 mi
About 2 mins total 3.5 mi
5. Turn left onto Clarkson Ave go 1.1 mi
Destination will be on the left
About 4 mins total 4.6 mi

B University Hospital of Brooklyn
450 Clarkson Ave, Brooklyn, NY 11203

TABLE 0.1
EMERGENCY CONTACTS

In the event of any situation or unplanned occurrence requiring assistance, the appropriate contact(s) should be made from the list below. For emergency situations, contact should first be made with the Field Team Leader (or designee) and the FSO, who will notify emergency personnel who will then contact the appropriate response teams. This emergency contacts list must be in an easily accessible location at the Site.

Emergency Contacts

Phone Number

Fire Department:	911
Police:	911
Dig Safely – New York: (three day notice required for utility markouts)	(800)-272-4480
Poison Control Center:	(800) 222-1222
Pollution Toxic Chemical Oil Spills:	(800) 424-8802

Medical Emergency

Ambulance Service:	911
Hospital Name:	University Hospital of Brooklyn
Hospital Phone Number:	(718) 758-8920
Hospital Address:	450 Clarkson Avenue, Brooklyn, NY
Route to Hospital:	See Figure 1
Travel Time From Site:	15 minutes

Langan Contacts

Project Director:	Jamie P. Barr, L.E.P.	(917) 882-5428
Program/Project Manager:	Ryan Wohlstrom	(203) 464-2731
Remediation Engineer:	Joel B. Landes, P.E.	(917) 940-3015
Program Quality Assurance Monitor:	Ryan Wohlstrom	(203) 464-2731
Langan Health & Safety Officer:	Tony Moffa	(215) 756-2523
Field Safety Officer/Field Team Leader:	David Granucci	(203) 710-4448

TABLE 0.2

SUMMARY OF ACTION LEVELS AND RESTRICTIONS

Conditions for Level D:

All areas:

- Photoionization detector (PID) readings < 25 ppm and benzene < 1 ppm; and/or,
- No visible fugitive dust emissions from site activities (< 150 $\mu\text{g}/\text{m}^3$).

Conditions for Level C:

All areas:

- Where PID readings > 25 ppm (sustained for 15 minutes in the breathing zone) to 200 ppm and benzene < 5ppm; and/or,
- Sustained visible fugitive dust emissions from site activities in excess of 150 $\mu\text{g}/\text{m}^3$ (not anticipated).

Conditions for Level B (or retreat):

All areas:

- Where PID readings > 500 ppm or benzene > 25 ppm; and/or,
- Visible fugitive dust emissions from site activities cloud the surrounding air and are in excess of 150 $\mu\text{g}/\text{m}^3$ (not anticipated).

1.0 INTRODUCTION

1.1 Purpose and Policy

The purpose of this Health and Safety Plan (HASP) is to establish personnel protection standards and mandatory safety practices and procedures for the implementation the Remedial Action Work Plan (RAWP) at the Kings Plaza Shopping Center (Kings Plaza) located at 5102, 5120 and 5502 Avenue U (the "Site") in Brooklyn, New York. The RAWP will include excavation and off-site disposal of soils exhibiting visual and olfactory indications of gross impacts within the previously delineated cVOC area. The existing asphalt surface cover will be demolished to facilitate excavation

This HASP assigns responsibilities, establishes standard operating procedures, and provides for contingencies that may arise while operations are being conducted during the completion of the referenced tasks. The provisions of the HASP are mandatory for all on-site personnel. Any supplemental plans used by subcontractors shall conform to this plan at a minimum. All personnel who engage in project activities must be familiar with this plan, comply with its requirements, and sign the Plan Acceptance Form (Attachment B), page number B-5, prior to working on the Site. The Plan Acceptance Form must be submitted to the Langan Field Safety Officer (FSO). In addition to this plan, all work shall be performed in accordance with all applicable federal, state and local regulations.

1.2 Site Description

The Site is located at 5102, 5120 and 5502 Avenue U in the Borough of Brooklyn, Kings County, New York. The lot at 5102 Avenue U (Map 23B, Block 8470, Lot 50) is improved with a parking garage, a mall office, and a marina store. The lot at 5120 Avenue U (Map 23B, Block 8470, Lot 55) is improved with a two- to four-story mall building, a parking garage, a power plant, a water treatment facility, and concrete walkways. The lot at 5502 Avenue U (Map 23B, Block 8470, Lot 114) is improved with a one-story Lowe's building and associated asphalt parking lot. The Site has approximately 900-feet of frontage along Avenue U and 1,000-feet of frontage along Flatbush Avenue.

1.3 Scope of Work

The RAWP recommends a Track 4 cleanup for addressing impacted soil, groundwater and soil vapor within the Site boundaries. The remedy described is consistent with the procedures defined by the Division of Environmental Remediation's Technical Guidance for Site Investigation and Remediation (DER-10) and complies with all applicable Federal, State and local laws, regulations and requirements. A Track 4 remedy would be executed by accomplishing the following tasks:

- Excavation and off-site disposal of soils exceeding Track 4 site-specific SCOs (Restricted-Commercial Restricted Use SCOs) and grossly-impacted soil, if encountered. The existing asphalt surface cover will be demolished to facilitate excavation;
- Localized dewatering, if required, will be treated as necessary prior to discharge to the municipal sewer system;
- Collection and analysis of soil samples to document residual soil conditions;
- Importing of soil to be used for backfill in compliance with this plan and in accordance with applicable laws and regulations. Imported soil will be sampled and analyzed in accordance with NYSDEC DER-10 Section 5.4 prior to import to the Site, and will meet Restricted Commercial Use SCOs. Recycled concrete aggregate (RCA) and imported virgin stone will not be sampled.
- Development and implementation of plans for the protection of on-site workers, community, and environment during remediation and construction activities;
- Replacement of the site cover system consisting of asphalt pavement and concrete sidewalks; and,
- Implementation of long-term Institutional Controls in the form of an Environmental Easement and Site Management Plan (SMP).

The remedial excavation extent is shown on Figure 4 of the RAWP. The remedial extent is based on previous data collected at the Site.

1.4 Langan Project Team Organization

Table 1.1 describes the responsibilities of Langan on-site personnel associated with this project. The names of principal personnel associated with this project are:

Project Director:	Jamie P. Barr, L.E.P.	(917) 882-5428
Program/Project Manager:	Ryan Wohlstrom	(203) 464-2731
Remediation Engineer:	Joel B. Landes, P.E.	(917) 940-3015
Program Quality Assurance Monitor:	Ryan Wohlstrom.	(203) 464-2731
Langan Health & Safety Officer:	Tony Moffa	(215) 756-2523
Field Safety Officer/ Team Leader:	David Granucci	(203) 710-4448

Langan personnel have been appropriately trained in first aid and hazardous waste safety procedures, including the operating and fitting of personal protective equipment (PPE), and are experienced with the field operations planned for this Site.

TABLE 1.1

ON-SITE PERSONNEL AND RESPONSIBILITIES

PROJECT MANAGER – Assumes control over site activities. Reports to upper-level management and has authority to direct response operations.

Responsibilities:

- Prepares and organizes the background review of the situation, the RAWP, the site HASP, and the field team;
- Obtains permission for site access and coordinates activities with appropriate officials;
- Ensures that the RAWP is executed and on schedule;
- Briefs the field team on their specific assignments;
- Coordinates with the site Health and Safety Officer (HSO) to ensure that health and safety requirements are met;
- Prepares the final report and support files on the response activities; and,
- Serves as the liaison with public officials.

FIELD SAFETY OFFICER (FSO) – Advises the HSO and project manager on aspects of health and safety on-site. Stops work if operations threaten worker or public health or safety.

Responsibilities:

- Ensures that all necessary health and safety equipment is available on-site. Ensures that all equipment is functional;
- Periodically inspects protective clothing and equipment;
- Ensures that protective clothing and equipment are properly stored and maintained;
- Controls entry and exit at the Access Control Points;
- Coordinates health and safety program activities with the site HSO;
- Confirms each team member's suitability for work based on a physician's recommendation;
- Monitors the work parties for signs of stress, such as cold exposure, heat stress, and fatigue;
- Implements the site HASP;
- Conducts periodic inspections to determine if the site HASP is being followed;
- Enforces the "buddy" system;

- Knows emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department;
- Notifies, when necessary, local public emergency officials;
- Coordinates emergency medical care;
- Sets up decontamination lines and the decontamination solutions appropriate for the type of chemical contamination on the Site;
- Controls the decontamination of all equipment, personnel, and samples from the contaminated areas;
- Assures proper disposal of contaminated clothing and materials;
- Ensures that all required equipment is available;
- Advises medical personnel of potential exposures and consequences; and,
- Notifies emergency response personnel by telephone or radio in the event of an emergency.

FIELD TEAM LEADER – Advises on all aspects of health and safety on-site. Stops work if any operation threatens worker or public health or safety and is directly responsible for the field team and the safety of site operations.

Responsibilities:

- Manages field operations;
- Executes the RAWP and schedule;
- Enforces safety procedures;
- Coordinates with the FSO in determining protection level;
- Enforces site control;
- Documents field activities and sample collection; and,
- Serves as a liaison with public officials.

WORK TEAM – Operators, laborers, samplers. The work party must consist of at least two people.

Responsibilities:

- Safely completes the on-site tasks required to fulfill the RAWP;
- Complies with site HASP; and,
- Notifies FSO or supervisor of suspected unsafe condition.

2.0 RISK ANALYSIS

2.1 Chemical Hazards

The primary potential chemical hazard is exposure to aromatic and halogenated volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and petroleum products (specifically #2 fuel oil). Other compounds that may be encountered are site equipment fuels (gasoline, diesel, etc.) that also contain volatile components. Although not confirmed, heavy metals such as arsenic, lead, and mercury may be present in soils within OU-1 and OU-2 under East 55th Street, potentially due to the presence of urban fill. Relevant properties of these compounds are outlined in Table 2.1.

Dust with chemical constituents may be generated during implementation of the RAWP. Therefore, air will be monitored for particulates and organic vapors continuously within the work zone and periodically at the Site perimeter.

Material Safety Data Sheets (MSDS) for substances that will be used on-site are included in Attachment C.

TABLE 2.1
RELEVANT PROPERTIES OF VOLATILES, SEMI-VOLATILES, METALS, PCBS, AND PESTICIDES KNOWN OR SUSPECTED AT THE SITE

Compound (Synonym)	OSHA PEL ⁽¹⁾ (ppm)	IDLH (ppm)	LEL (%)	Odor Threshold ⁽²⁾ (ppm)	Odor Character	Vapor Pressure (mm Hg)	Physical State	Detectable w/ 10.6 eV lamp PID (I.P. eV)
Arsenic (As)	0.01	5	NA	NA	NA	0 (approx)	Noncombustible Solid ⁽³⁾	NA
Benzene	1	500	1.2	1.5	Sweet aromatic	75	Combustible Liquid	Yes
Benzo(a)anthracene	0.2	NA	NA	NA	Faint aromatic	5.49×10^{-9}	Noncombustible	NA
Benzo(a)pyrene	0.2	NA	NA	NA	Faint aromatic	5.49×10^{-9}	Noncombustible	NA
Beryllium (Be)	0.002	4	NA	NA	NA	0 (approx)	Noncombustible	NA
Chloroform	50	500	NA	NA	NA	160	Noncombustible	NA
Chromium (Cr)	0.1	250	NA	NA	NA	0 (approx)	Noncombustible Solid	NA
Chrysene	0.2	NA	NA	NA	NA	NA	Noncombustible	NA
Copper (Cu)	1	100	NA	NA	NA	1	Noncombustible	NA
DDE	1	500	NA	NA	Faint aromatic	6.5×10^{-6}	Noncombustible	NA
DDT	1	500	NA	NA	Faint aromatic	1.87×10^{-7}	Noncombustible	NA
1,1-Dichloroethylene (1,1-DCE)	NA	NA	6.5	190	Sweet, chloroform-like	500	Colorless Liquid/Gas	NA

Compound (Synonym)	OSHA PEL⁽¹⁾ (ppm)	IDLH (ppm)	LEL (%)	Odor Threshold⁽²⁾ (ppm)	Odor Character	Vapor Pressure (mm Hg)	Physical State	Detectable w/ 10.6 eV lamp PID (I.P. eV)
cis-1,2-Dichloroethylene (cis-1,2-DCE)	NA	NA	9.7	NA	Pleasant	201	Colorless Liquid	NA
trans-1,2-Dichloroethylene (trans-1,2-DCE)	200	NA	6.7	NA	Pleasant	400	Colorless Liquid	NA
Dieldrin	0.25	450	NA	NA	Mild chemical	1.8×10^{-7}	Noncombustible	NA
Ethylbenzene	100	800	0.8	2.3	Sweet aromatic	7	Combustible Liquid	Yes
Heptachlor Epoxide	0.5	35	NA	0.02	Camphor-like	3.0×10^{-4}	Noncombustible	NA
Iron (Fe)	5	NA	NA	NA	NA	NA	Noncombustible	NA
Lead (Pb)	0.05	11	NA	NA	NA	0 (approx)	Noncombustible Solid	NA
Magnesium (Mg)	5	500	NA	NA	NA	0 (approx)	Combustible Solid	NA
2-mercaptobenzothiazole	NA	NA	15	NA	NA	0 (approx)	Noncombustible	NA
Mercury (Hg)	0.1	10	NA	NA	NA	0 (approx)	Noncombustible	NA
Methyl Tert Butyl Ether (MTBE)	NA	NA	1	NA	Ether-like	75	Colorless Liquid	NA
N-nitrosodiphenylamine	NA	NA	NA	NA	NA	2.7	Combustible Liquid	NA
Nickel (Ni)	1	10	NA	NA	NA	0 (approx)	Combustible Solid ⁽⁴⁾	NA

Polychlorinated biphenyl (PCB)	0.5	5	NA	NA	Mild, hydrocarbon	1.0×10^{-3}	Noncombustible Solid	NA
Compound (Synonym)	OSHA PEL ⁽¹⁾ (ppm)	IDLH (ppm)	LEL (%)	Odor Threshold ⁽²⁾ (ppm)	Odor Character	Vapor Pressure (mm Hg)	Physical State	Detectable w/ 10.6 eV lamp PID (I.P. eV)
Polynuclear Aromatic Hydrocarbons (PAHs)	0.2	80 (CA)	Varies	Varies	Varies	Varies	Combustible solid	No
Tetrachloroethylene (PCE)	100	150	NA	1	Chloroform-like	14	Colorless liquid	NA
Toluene	200	500	1.1	2.9	Sweet aromatic	21	Combustible liquid	Yes
1,2,4-trichlorobenzene	NA	NA	2.5	3	Faint aromatic	1	Combustible liquid	NA
Trichloroethylene (TCE)	100	1,000	8	28	Chloroform-like	58	Colorless liquid	NA
Vinyl Chloride (VC)	1	NA	3.6	3,000	Pleasant	3,660	Colorless gas	NA
Xylenes (total)	100	900	0.9	1	Faint aromatic	7	Combustible liquid	Yes
Zinc (Zn)	5	50	NA	NA	NA	0 (approx.)	Combustible solid ⁽⁵⁾	NA

-
- (1) 29 CFR 1910, June 30, 1993 (8-hour Time weighted average unless otherwise specified.)
(2) ACGIH 1989 Highest reported value of acceptable odor threshold range.
(3) Slight explosive hazard if dust is exposed to flame
(4) Sponge catalyst may ignite spontaneously in the air.
(5) Powder may ignite spontaneously in the air, and can continue burning under water.
(IDLH) Immediately dangerous to life or health
(CA) Suspected carcinogen – minimize all possible exposures

2.3 Biological Hazards

2.3.1 Animals

During site operations, animals such as dogs, pigeons, sea gulls, mice, and rats may be encountered. Workers will use discretion and avoid all contact with animals. Bites and scratches from dogs can be painful and if the animal is rabid, the potential for contracting rabies exists. Contact with rat and mice droppings may lead to contracting hantavirus. Inhalation of dried pigeon droppings may lead to psittacosis; cryptococcosis and histoplasmosis are also diseases associated with exposure to dried bird droppings but these are less likely to occur in this occupational setting.

2.3.2 Insects

Insects, including bees, wasps, hornets, mosquitoes, and spiders, may be present at this Site. Some individuals may have a severe allergic reaction to an insect bite or sting that can result in a life threatening condition. In addition, mosquito bites may lead to St. Louis encephalitis or West Nile encephalitis. Personnel that have been bitten or stung by an insect at the Site should notify the HSO or FSO immediately. The following is a list of preventive measures:

- Apply insect repellent prior to fieldwork and/or as often as needed throughout the shift;
- Wear proper protective clothing (work boots, socks and light colored pants);
- When walking in wooded areas, to the extent possible, avoid contact with bushes, tall grass, or brush; and,
- Field personnel who may have insect allergies (e.g., bee sting) should provide this information to the HSO or FSO prior to commencing work, and will have allergy medication on-site.

The HSO or FSO will instruct the project personnel in the recognition and procedures for encountering potentially hazardous insects at the Site.

Lyme disease is caused by infection from a deer tick that carries a spirochete. During the painless tick bite, the spirochete may be transmitted into the bloodstream, which could lead to the worker contracting Lyme disease. This flu-like illness occurs out of season, commonly happening between May and October when ticks are more active. Symptoms can include a stiff neck, chills, fever, sore throat, headache, fatigue and joint pain. Early signs may include an expanding skin rash and joint pain. If left untreated, Lyme disease can cause serious nerve or heart problems as well as a disabling type of arthritis. If personnel feel sick or have signs similar to those above, they should notify the HSO or FSO immediately.

It is recommended that personnel check themselves when in areas that could harbor deer ticks, wear light color clothing and visually check themselves and their buddy when coming

from wooded or vegetated areas. If a tick is found biting an individual, the HSO or FSO should be contacted immediately. The tick can be removed by pulling gently at the head with tweezers. The affected area should then be disinfected with an antiseptic wipe.

2.4 Physical Hazards

2.4.1 Explosion

No explosion hazards are expected for the scope of work at this Site.

2.4.2 Heat Stress

The use of Level C protective equipment, or greater, may create heat stress. Monitoring of personnel wearing personal protective clothing should commence when the ambient temperature is 72°F or above. Table 2.2 presents the suggested frequency for such monitoring. Monitoring frequency should increase as ambient temperature increases or as slow recovery rates are observed. Refer to Table 2.3 below to assist in assessing when the risk for heat related illness is likely. To use this table, the ambient temperature and relative humidity must be obtained (a regional weather report should suffice). Heat stress monitoring should be performed by the FSO, who shall be able to recognize symptoms related to heat stress.

To monitor the workers, be familiar with the following heat-related disorders and their symptoms:

- **Prickly Heat (Heat rash)**
 - Painful, itchy red rash. Occurs during sweating, on skin covered by clothing.
- **Heat Cramps**
 - Painful spasm of arm, leg or abdominal muscles, during or after work.
- **Heat Exhaustion**
 - Headache, nausea, dizziness; cool, clammy, moist skin; heavy sweating; weak, fast pulse; shallow respiration, normal temperature.
- **Heat Fatigue**
 - Weariness, irritability, loss of skill for fine or precision work; decreased ability to concentrate; no loss of temperature control.
- **Heat Syncope (Heat Collapse)**
 - Fainting while standing in a hot environment.

- **Heat Stroke**

- Headache, nausea, weakness, hot dry skin, fever, rapid strong pulse, rapid deep respirations, loss of consciousness, convulsions, coma. This is a life threatening condition.
- Do not permit a worker to wear a semi-permeable or impermeable garment when they are showing signs or symptoms of heat-related illness.

To monitor the worker, measure:

- Heart rate – Count the radial pulse during a 30-second period as early as possible in the rest period.
 - If the heart rate exceeds 100 beats per minute (bpm) at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same.
 - If the heart rate still exceeds 100 bpm at the next rest period, shorten the following work cycle by one-third. A worker cannot return to work after a rest period until their heart rate is below 100 bpm.
- Oral temperature – Use a clinical thermometer (3-minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking).
 - If oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period. A worker cannot return to work after a rest period until their oral temperature is below 99.6°F.
 - If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following cycle by one-third.
 - Do not permit a worker to wear a semi-permeable or impermeable garment when oral temperature exceeds 100.6°F (38.1°C).

Prevention of Heat Stress – Proper training and preventative measures will aid in averting loss of worker productivity and serious illness. Heat stress prevention is particularly important because once a person suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat related illness. To avoid heat stress the following steps should be taken:

- Adjust work schedules;
- Mandate work slowdowns as needed;

- Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided;
- Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods; and,
- Maintain worker's body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat, e.g., 8 fluid ounces (fl oz) (0.23 liters (L)) of water must be ingested for approximately every 8 oz (0.23 kg) of weight lost. The normal thirst mechanism is not sensitive enough to ensure that enough water will be drunk to replace lost sweat. When heavy sweating occurs, encourage the worker to drink more. The following strategies may be useful:
 - Maintain water temperature 50 to 60°F (10 to 16.6°C).
 - Provide small disposal cups that hold about 4 oz (0.1 L).
 - Have workers drink 16 oz (0.5 L) of fluid (preferably water or diluted drinks) before beginning work.
 - Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1- to 1.6-gallons (4- to 6-L) of fluid per day are recommended, but more may be necessary to maintain body weight.
 - Train workers to recognize the symptoms of heat related illness.

2.4.3 Cold-Related Illness

If work on this project begins in the winter months, thermal injury due to cold exposure can become a problem for field personnel. Systemic cold exposure is referred to as hypothermia. Local cold exposure is generally called frostbite.

Hypothermia – Hypothermia is defined as a decrease in the patient core temperature below 96°F. The body temperature is normally maintained by a combination of central (brain and spinal cord) and peripheral (skin and muscle) activity. Interference with any of these mechanisms can result in hypothermia, even in the absence of what normally is considered a "cold" ambient temperature. Symptoms of hypothermia include: shivering, apathy, listlessness, sleepiness, and unconsciousness.

Frostbite – Frostbite is both a general and medical term given to areas of local cold injury. Unlike systemic hypothermia, frostbite rarely occurs unless the ambient temperatures are less than freezing and usually less than 20°F. Symptoms of frostbite are: a sudden blanching or whitening of the skin; the skin has a waxy or white appearance and is firm to the touch; tissues are cold, pale, and solid.

Prevention of Cold-Related Illness – To prevent cold-related illness:

- Educate workers to recognize the symptoms of frostbite and hypothermia;
- Identify and limit known risk factors;
- Assure the availability of enclosed, heated environments on or adjacent to the site;
- Assure the availability of dry changes of clothing;
- Assure the availability of warm drinks; and,
- Start (oral) temperature recording at the job site:
 - At the FSO or Field Team Leader's discretion, when suspicion is based on changes in a worker's performance or mental status.
 - At a worker's request.
 - As a screening measure, two times per shift, under unusually hazardous conditions (e.g., wind-chill less than 20°F, or wind-chill less than 30°F with precipitation).
 - As a screening measure whenever any worker on the site develops hypothermia.

Any person developing moderate hypothermia (a core temperature of 92°F) cannot return to work for 48 hours.

2.4.4 Hand and Power Tools

In order to adjust drilling equipment and sever polyvinyl chloride (PVC) riser, personnel will utilize hand and/or power tools. The use of hand and power tools can present a variety of hazards, including physical harm from being struck by flying objects, being cut or struck by the tool, fire, and electrocution. Ground Fault Circuit Interrupters (GFCIs) are required for power tools.

2.4.5 Working Near Heavy Machinery

Care should be exercised when working near heavy machinery, such as the excavators. Workers should always stay in view of the equipment operator and give equipment wide berth.

Clear communication signals, including hand signals, should be established prior to commencement of work and the equipment should have a back-up alarm.

2.4.6 Lifting

Improper lifting and carrying of equipment and materials and shoveling soil may cause strains. Safe lifting and general material handling techniques should be exercised.

2.4.7 Falling Hazards

Soil material, crushed stone, tools, etc. may fall from power shovels, front-end loaders, etc. Hard hats are to be worn at all times while in work zones.

2.4.8 Vehicle Hazards

Trucks and other work vehicles will be entering and leaving the site during work hours. In addition, the hydraulic excavators, dump trucks, and other construction vehicles will be working throughout the site. Care should be taken when working on-site and be aware of surroundings at all times. When working near vehicular traffic or work zones, attempt to keep eye contact with the machine operators.

2.4.9 Hearing Loss Prevention

Work activities during the remediation and construction activities may be conducted at locations with high noise levels from the operation of equipment. Hearing protection will be used as necessary.

2.4.10 Slips, Trips and Fall Hazards

Care should be exercised when walking at the site, especially when carrying equipment. The presence of surface debris, uneven surfaces, pits, facility equipment, and soil piles contribute to tripping hazards and fall hazards. To the extent possible, all hazards should be identified and marked on the site, with hazards communicated to all workers in the area.

2.4.11 Utilities (Electrocution and Fire Hazards)

The possibility of encountering underground utilities poses fire, explosion, and electrocution hazards. All intrusive work will be preceded by notification of the subsurface work to the Dig Safely – New York. Potential adverse effects of electrical hazards include burns and electrocution, which could result in death.

2.5 Task Hazard Analysis

2.5.1 Excavation, Removal of Soil, Engineering and Institutional Controls

Identified potential issues related to work at this site include: low levels of regulated compounds in soil and/or groundwater (e.g., aromatic and halogenated VOCs, SVOCs, and petroleum products (specifically #2 fuel oil), and drilling/cutting with gas-powered equipment potentially generating CO and CO₂ in the exhaust fumes.

2.5.2 Soil Removal for Site Restoration

The following hazards are associated with the removal and sampling of soil: heavy excavation equipment (impact hazard to on-foot workers), open excavations (fall and cave-in hazard), uneven land surface (slip and trip hazard), and contaminated media (chemical exposure hazard).

2.5.3 Soil Backfill

The backfilling of the excavated areas have similar hazards as those associated with the removal of soil.

Chemical exposure may occur as workers encounter soil and groundwater across the site, or are exposed to products used at the site including gasoline, diesel, and motor oil. Soil and groundwater sampling presents similar potential exposure to hazards. Activities will be conducted initially in Level D but may be upgraded to Modified Level D. Although not anticipated, there will be a Level C and B contingency should pockets of contaminants be brought to the surface and breathing zone air become contaminated.

If evidence of historic or unknown contamination, such as oily materials, high PID readings, etc., is encountered during intrusive work, the FSO will determine the appropriate level of personnel protection.

Table 2.2
Suggested Frequency of Physiological Monitoring
For Fit and Acclimated Workers^a

Adjusted Temperature^b	Normal Work Ensemble^c	Impermeable Ensemble
90°F or above (32.2°C) or above	After each 45 min. of work	After each 15 min. of work
87.5°F (30.8°-32.2°C)	After each 60 min. of work	After each 30 min. of work
82.5°-87.5°F (28.1°-30.8°C)	After each 90 min. of work	After each 60 min. of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 min. of work	After each 90 min. of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 min. of work	After each 120 min. of work

- a. For work levels of 250 kilocalories/hour.
- b. Calculate the adjusted air temperature (ta adj) by using this equation: $ta\ adj\ ^\circ F = ta\ ^\circ F + (13 \times \% \text{ sunshine})$. Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)
- c. A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

Table 2.3 - HEAT INDEX

RELATIVE HUMIDITY	ENVIRONMENTAL TEMPERATURE (Fahrenheit)										
	70	75	80	85	90	95	100	105	110	115	120
	APPARENT TEMPERATURE*										
0%	64	69	73	78	83	87	91	95	99	103	107
10%	65	70	75	80	85	90	95	100	105	111	116
20%	66	72	77	82	87	93	99	105	112	120	130
30%	67	73	78	84	90	96	104	113	123	135	148
40%	68	74	79	86	93	101	110	123	137	151	
50%	69	75	81	88	96	107	120	135	150		
60%	70	76	82	90	100	114	132	149			
70%	70	77	85	93	106	124	144				
80%	71	78	86	97	113	136					
90%	71	79	88	102	122						
100%	72	80	91	108							

*Combined Index of Heat and Humidity...what it "feels like" to the body

Source: National Oceanic and Atmospheric Administration

How to use Heat Index:

1. Across top locate Environmental Temperature
2. Down left side locate Relative Humidity
3. Follow across and down to find Apparent Temperature
4. Determine Heat Stress Risk on chart at right

Note: Exposure to full sunshine can increase Heat Index values by up to 15 degrees F.

Apparent Temperature	Heat Stress Risk with Physical Activity and/or Prolonged Exposure
90-105	Heat Cramps or Heat Exhaustion Possible
105-130	Heat Cramps or Heat Exhaustion Likely, Heat Stroke Possible
>130	Heatstroke Highly Likely

3.0 PERSONNEL PROTECTION AND MONITORING

3.1 Occupation Safety and Health Administration (OSHA) Training

All on-site personnel who will be actively involved in site activities and can potentially encounter hazardous waste must have completed hazardous waste operations-related training, as required by OSHA Regulations 29 CFR 1910.120. Personnel who completed this training more than 12 months prior to the start of the project must have completed an 8-hour refresher course within the past 12 months. Documentation of OSHA training for project personnel must be provided to Langan prior to starting work.

3.2 Site-Specific Training

The FSO will be responsible for developing a site-specific occupational hazard training program and providing training to all personnel that are to work at the Site. This training will be conducted prior to starting field work and will consist of the following topics:

- Names of personnel responsible for site safety and health;
- Hazards potentially present at the Site;
- Proper use of PPE;
- Requirements of this HASP;
- Work practices by which the employee can minimize risk from hazards. This may include a specific review of heavy equipment safety, safety during inclement weather, changes in common escape rendezvous point, site security measures, or other site-specific issues that need to be addressed before work begins;
- Safe use of engineering controls and equipment on the Site;
- Acute effects of compounds present at the Site; and,
- Decontamination procedures.

Upon completion of site-specific training, workers will sign the Site-Specific Training Form provided in Attachment B. A copy of the completed Site-Specific Training Form will be included in the project files for future reference.

3.3 Monitoring Requirements

Worker air monitoring and community air monitoring (as described in Section 6.4) will be conducted at the start of field work.

Fugitive dust generation that could affect site workers, site occupants, or the public may be expected due to excavation and soil disturbance activities. The FSO will visually monitor the perimeter of the work area for evidence of sustained visible emissions. Work activities will be suspended until dust levels diminish to an acceptable level if sustained emissions are observed.

Air monitoring of the breathing zone will be conducted periodically or continuously during boring advancement, test pitting, and sampling activities to assure proper health and safety protection.

VOCs will be monitored with a photoionization detector (PID) in accordance with the HASP with an action level of 25 ppm in the absence of benzene. If the action level is exceeded and adequate ventilation cannot be provided, work will cease and the potential affected portion of the work area will be evacuated until adequate mechanical ventilation can be setup to control the hazard. Level C respiratory protection may be donned in accordance with the HASP if untrained personnel are not present and the action level is exceeded.

If air monitoring during operations identifies the presence of VOCs (not anticipated because of natural ventilation), the action levels, permissible exposure, engineering controls, and PPE specified in this HASP will be implemented. A PID (MiniRAE 2000 or equivalent) will be used to monitor for organic vapors in the breathing zone and to screen soil samples. Air monitoring results will be recorded in the field book during investigation activities and made available for review.

3.4 Summary of Action Levels and Restrictions

A PID, such as the RaeSystems MiniRae 2000 equipped with a 10.6 eV lamp, shall be used to screen for total organic vapors. All readings pertain to sustained readings for 15 minutes in the worker breathing zone. The following conditions shall apply to each level of protection:

Conditions for Level D:

All areas:

- PID readings < 25 ppm and benzene < 1 ppm; and/or,
- No visible fugitive dust emissions from site activities.

Conditions for Level C:

All areas:

- Where PID readings > 25 ppm (sustained for 15 minutes in the breathing zone) to 200 ppm and benzene < 5ppm; and/or,
- Any visible fugitive dust emissions from site activities that disturb contaminated soil.

Conditions for Level B (or retreat):

All areas:

- Where PID readings > 500 ppm or benzene > 25 ppm; and/or,
- Visible fugitive dust emissions from site activities cloud the surrounding air.

3.4.1 Level D and Modified Level D

Level D protection will be worn for initial entry on-site and initially for all activities. Level D protection will consist of:

- Standard work clothes;
- Steel-toe safety boots;
- Safety glasses (goggles must be worn when splash hazard is present);
- Nitrile outer gloves and PVC inner gloves must be worn during all activities requiring contact with soils; and/or,
- Hard hat (must be worn during all site activities).

Modified Level D is the same as Level D but includes Tyvek coveralls and disposable polyethylene (PE) overboots to contact with the skin or clothes if significant contamination is present in subsurface materials.

3.4.2 Level C

The level of personal protection will be upgraded to Level C if the concentration of VOCs, which can be detected with a PID in the breathing zone, equals or exceeds the specified action limits and the contaminants of concern (COCs) have characteristic warning properties appropriate for air purifying respirators (e.g. taste, odor). Level C protection will consist of the following equipment:

- Full-face or half-mask air-purifying respirator (APR) or powered air purifier (PAPR), depending on presence and abundance of airborne toxic COCs;
- Combination high-efficiency particulate absorption (HEPA) filter/organic vapor cartridges;
- Tyvek coveralls must be worn if particulate hazard present;
- PE-coated Tyvek coveralls if liquid contamination present;
- Steel-toe safety boots;
- Nitrile outer gloves and PVC inner gloves must be worn during all activities requiring contact with soils; and/or,
- Hard hat (must be worn during all site activities).

Cartridges will be disposed at the end of each day's use.

3.4.3 Level B (Retreat)

If the concentration of volatile organics, which can be detected with a PID, equals or exceeds the specified action levels, all field personnel associated with the project will immediately retreat to a location upwind of the source of contamination. At this point the FSO must consult with the Langan HSO to discuss appropriate actions.

3.4.4 OSHA Requirements for PPE

All PPE used during the course of this field investigation must meet the following OSHA standards:

Type of Protection	Regulation	Source
Eye and Face	29 CFR 1910.133 29 CFR 1926.102	ANSI Z87.1-1968
Respiratory	29 CFR 1910.134 29 CFR 1926.103	ANSI Z88.1-1980
Head	29 CFR 1910.135 29 CFR 1926.100	ANSI Z89.1-1969
Foot	29 CFR 1910.136 29 CFR 1926.96	ANSI Z41.1-1967

ANSI = American National Standards Institute

Both the respirator and cartridges specified for use in Level C protection must be fit-tested prior to use in accordance with OSHA regulations (29 CFR 1910.1025; 29 CFR 1910.134).

Based on performance criteria, air purifying respirators cannot be worn under the following conditions:

- Oxygen deficiency;
- IDLH concentrations;
- High relative humidity; and,
- If contaminant levels exceed designated use concentrations.

4.0 WORK ZONES AND DECONTAMINATION

4.1 Site Work Zones

Work zones will be established if hazardous materials are encountered.

4.1.1 Hot Zone

Hot zones will be established within a 25-foot radius around excavation areas, where possible. Barriers will be established at the perimeter of the excavation area where the perimeter is shared with an area accessible to the public. Unprotected onlookers should be located 25-feet upwind of the activities. All personnel within the hot zone must don the appropriate levels of personal protection as set forth by the FSO. It is not anticipated that Level C or higher will be required for this site.

All personnel within the hot zone will be required to use the specified level of protection. No food, drink, or smoking will be allowed in the hot or warm zones.

4.1.2 Warm Zone

A warm zone will be established and utilized during the field activities. This zone will be established between the hot zone and the cold zone (discussed below), and will include the personnel and equipment necessary for decontamination of equipment and personnel exiting the hot zone. Personnel and equipment in the hot zone must pass through this zone before entering the cold zone. This zone should always be located upwind of the hot zone.

4.1.3 Cold Zone

The cold zone will include the remaining areas of the job site. Break areas and support facilities (include equipment storage and maintenance areas) will be located in this zone. No equipment or personnel will be permitted to enter the cold zone from the hot zone without passing through the decontamination station in the warm zone. Eating, smoking, and drinking will be allowed only in this area.

4.2 Decontamination

Generally, any water used in decontamination procedures will be placed in containers, temporarily stored on-site, and properly characterized and disposed.

4.2.1 Decontamination of Personnel

Decontamination of personnel will be necessary if Level C or B protection is used, which is not anticipated based on current knowledge of the site history. Decontamination will not be necessary if only Level D protection is used. However, disposable gloves and booties used during sampling activities should be removed and bagged; personnel should be encouraged to

remove clothing and shower as soon as is practicable at the end of the day. All clothing should be machine-washed. All personnel will wash hands and face prior to eating and before and after using the restroom.

4.2.2 Decontamination of Field Equipment

Decontamination of field equipment will be necessary for all equipment in contact with contaminated materials. Decontamination activities shall be performed in a designated area lined with polyethylene sheeting that is designed to collect the decontamination rinsate.

4.3 Remedial Activity-Derived Waste

All PPE-related remedial activity-derived waste materials (PPE, decontamination waste) will be placed in labeled containers and appropriately disposed. Stockpiling of contaminated soil is not anticipated.

5.0 SAMPLE SHIPMENT

5.1 Non-Hazardous Samples

Samples collected in this study will be classified as environmental samples.

5.1.1 Environmental Samples

In general, environmental samples that are collected from soils or wells are not expected to contain high (hazardous) levels of COCs.

Sample containers must have a completed sample identification tag and the outside container must be marked "Environmental Sample". The sample tag will be legibly written and completed with an indelible pencil or waterproof ink. The information will also be recorded in a log book. At a minimum, it will include:

- Exact location of sample;
- Time and date sample was collected;
- Name of sampler witnesses (if necessary);
- Project codes, sample station number, and identifying code (if applicable);
- Type of sample (if known);
- Laboratory number (if applicable); and,
- Any other pertinent information.

Environmental samples will be packaged and shipped according to the following procedure:

1. Place sample container, properly identified and with a sealed lid, in a PE-bag, and seal bag;
2. Place sample in a fiberboard container or metal picnic cooler which has been lined with a large polyethylene bag;
3. Pack cooler with ice to maintain temperature of 4°C;
4. Pack with enough noncombustible, absorbent, cushioning material to minimize the possibility of the container breaking;
5. Seal large bag; and,
6. Seal or close outside container.

The appropriate side of the container must be marked "This End Up" and arrows should be drawn accordingly. No Department of Transportation (DOT) marking labeling is required. No DOT shipping papers are required. There are no DOT restrictions on mode of transportation.

5.2 Hazardous Samples

Hazardous materials are not anticipated at the Site and samples are anticipated to be transported to the analytical laboratory via courier service. However, should hazardous materials be encountered in samples at the Site, the following procedures will be implemented. Personnel who must complete a Hazardous Goods Airway Bill must first be DOT trained and certified every two years. Drummed waste samples, tank samples, sludge samples, and grossly contaminated soil samples will be shipped as DOT Hazardous Materials. The designation "Flammable Liquid" or "Flammable Solid" will be used. The samples will be transported as follows:

1. Collect sample in a 16 oz or smaller glass or polyethylene container with nonmetallic Teflon-lined screw cap. Allow sufficient air space (approximately 10% by volume) so container is not liquid full at 54°C (130°F). If collecting a solid material, the container plus contents should not exceed 1 pound (lb) net weight. If sampling for volatile organic analysis, fill volatile organic analyte (VOA) container to septum but place the VOA container inside a 16 oz or smaller container so the required air space may be provided. Large quantities, up to 3.786 L (1-gallon), may be collected if the sample's flash point is 23°C (75°F) or higher. In this case, the flash point must be marked on the outside container (e.g., carton, cooler), and shipping papers should state that "Flash point is 73°F or higher."
2. Seal sample and place in a 4-millimeter (mil) thick PE-bag, one sample per bag.
3. Place sealed bag inside a metal can with noncombustible, absorbent cushioning material (e.g., vermiculite or earth) to prevent breakage, one bag per can. Pressure-close the can and use clips, tape or other positive means to hold the lid securely.
4. Mark the can with:
 - Name and address of originator;
 - "Flammable Liquid N.O.S. UN 1993";
 - (or "Flammable Solid N.O.S. UN 1325); and,
 - NOTE: UN numbers are now required in proper shipping names.
5. Place one or more metal cans in a strong outside container such as a picnic cooler or fiberboard box. Preservatives are not used for hazardous waste site samples.

6. Prepare for shipping:

"Flammable Liquid, N.O.S. UN 1993" or "Flammable Solid, N.O.S. UN 1325"; "Cargo Aircraft Only" (if more than 1 quart net per outside package); "Limited Quantity" or "Ltd. Qty."; "Laboratory Samples"; "Net Weight ____" or "Net Volume ____" (of hazardous contents) should be indicated on shipping papers and on outside of shipping container. "This Side Up" or "This End Up" should also be on container. Sign shipper certification.

7. Stand by for possible carrier requests to open outside containers for inspection or modify packaging. It is wise to contact carrier before packing to ascertain local packaging requirements and not to leave area before the carrier vehicle (aircraft, truck) is on its way. The International Air Transport Association's Dangerous Goods regulations will need to be followed for using FedEx for the shipment of hazardous samples.

5.2.1 Shipping Papers

A blank Langan shipping paper should be filled out and maintained within the driver's reach, whenever a Langan employee carries hazardous materials in a vehicle in quantities above those allowed for Materials of Trade (MOTs). Such materials may include more than 8 gallons of the following:

- Gasoline (for use in a generator) UN 1203, Guide #27;
- Methanol (for use in decontamination procedures) UN 1230, Guide #28;
- Nitric Acid (for use in decontamination procedures) UN 1760, Guide #60; and,
- Hydrochloric Acid (for use in decontamination procedures) UN 1789, Guide #60.

Other materials may include the following:

- > 220 lbs of compressed Gas [Air, Compressed] (calibration gas for the PID, or Grade D breathing air for Level B work) UN 1002, Class 2.2; and,
- Other hazardous materials as defined by the DOT.

Appropriate MSDS should be maintained with the shipping papers and/or the pocket DOT Emergency Response Guidebook.

6.0 ACCIDENT PREVENTION AND CONTINGENCY PLAN

6.1 Accident Prevention

6.1.1 Site-Specific Training

All field personnel will receive health and safety training prior to the initiation of any site activities. The Site-Specific Training Form provided in Attachment B must be signed, dated, and returned to the Langan FSO. On a day-to-day basis, individual personnel should be constantly alert for indicators of potentially hazardous situations and for signs and symptoms in themselves and others that warn of hazardous conditions and exposures. Rapid recognition of dangerous situations can avert an emergency. Before daily work assignments, a regular meeting should be held. Discussion should include:

- Tasks to be performed;
- Time constraints (e.g., rest breaks, cartridge changes);
- Hazards that may be encountered, including their effects, how to recognize symptoms or monitor them, concentration limits, or other danger signals; and,
- Emergency procedures.

6.1.2 Vehicles and Heavy Equipment

Working with large motor vehicles and heavy equipment could be a major hazard at this site. Injuries can result from equipment hitting or running over personnel, impacts from flying objects, or overturning of vehicles. Vehicle and heavy equipment design and operation will be in accordance with 29 CFR, Subpart O, 1926.600 through 1926.602. In particular, the following precautions will be utilized to help prevent injuries/accidents.

- Brakes, hydraulic lines, light signals, fire extinguishers, fluid levels, steering, tires, horn, and other safety devices will be checked at the beginning of each shift.
- Large construction motor vehicles will not be backed up unless:
 - The vehicle has a reverse signal alarm audible above the surrounding noise level; or
 - The vehicle is backed up only when an observer signals that it is safe to do so.
- Heavy equipment or motor vehicle cable will be kept free of all nonessential items, and all loose items will be secured.
 - Large construction motor vehicles and heavy equipment will be provided with necessary safety equipment (such as seat belts, roll-over protection, emergency shut-off in case of roll-over, backup warning lights and audible alarms).

- Blades and buckets will be lowered to the ground and parking brakes will be set before shutting off any heavy equipment or vehicles.

6.2 Spill Control Plan

All personnel must take every precaution to minimize the potential for spills during site operations. Any spill shall be reported immediately to the FSO. Spill control apparatus (sorberent materials) will be located on-site. All materials used for the cleanup of spills will be containerized and labeled separately from other wastes.

6.3 Contingency Plan

6.3.1 Emergency Procedures

In the event that an emergency develops on-site, the procedures delineated herein are to be immediately followed. Emergency conditions are considered to exist if:

- Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on-site.
- A condition is discovered that suggests the existence of a situation more hazardous than anticipated.

General emergency procedures and specific procedures for personal injury, chemical exposure and radiation exposure, are described below.

6.3.2 Chemical Exposure

If a member of the field crew demonstrates symptoms of chemical exposure the procedures outlined below should be followed:

- Another team member (buddy) should remove the individual from the immediate area of contamination. The buddy should communicate to the Field Team Leader (via voice and hand signals) of the chemical exposure. The Field Team Leader should contact the appropriate emergency response agency;
- Precautions should be taken to avoid exposure of other individuals to the chemical;
- If the chemical is on the individual's clothing, the chemical should be neutralized or removed if it is safe to do so;
- If the chemical has contacted the skin, the skin should be washed with copious amounts of water;
- In case of eye contact, an emergency eye wash should be used. Eyes should be washed for at least 15 minutes; and/or,
- All chemical exposure incidents must be reported in writing to the Langan HSO. The FSO or Field Team Leader is responsible for completing the accident report.

6.3.3 Personal Injury

In case of personal injury at the site, the following procedures should be followed:

- Another team member (buddy) should signal the Field Team Leader that an injury has occurred;
- A field team member trained in first aid can administer treatment to an injured worker;
- The victim should then be transported to the nearest hospital or medical center. If necessary, an ambulance should be called to transport the victim;
- For less severe cases, the individual can be taken to the site dispensary;
- The Field Team Leader or FSO is responsible for making certain that an Accident Report Form is completed. This form is to be submitted to the Langan HSO. Follow-up action should be taken to correct the situation that caused the accident; and/or,
- Any incident (near miss, property damage, first aid, medical treatment, etc.) must be reported.

A first-aid kit and blood-borne pathogens kit will be kept on-site during the field activities.

6.3.4 Evacuation Procedures

- The Field Team Leader will initiate evacuation procedures by signaling to leave the site;
- All personnel in the work area should evacuate the area and meet in the common designated area;
- All personnel suspected to be in or near the contract work area should be accounted for and the whereabouts or missing persons determined immediately; and,
- The Field Team Leader will then give further instruction.

6.3.5 Procedures Implemented in the Event of a Major Fire, Explosion, or Emergency

- Notify the paramedics and/or fire department, as necessary;
- Signal the evacuation procedure previously outlined and implement the entire procedure;
- Isolate the area;
- Stay upwind of any fire;
- Keep the area surrounding the problem source clear after the incident occurs; and,
- Complete accident report for and distribute to appropriate personnel.

6.4 Community Air Monitoring Plan (CAMP)

Community air monitoring will be conducted in compliance with the Community Air Monitoring Plan (CAMP) outlined below.

Monitoring for total organic vapors (TOV) and particulates will be conducted during all ground intrusive activities (e.g., soil excavation and stockpiling). Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background concentrations. TOVs will be monitored at the downwind perimeter of the hot zone with a PID equipped with a 10.6 eV lamp. Monitoring equipment will be capable of calculating 15 minute running average concentrations.

The following actions will be taken based on TOV levels measured:

- If TOV levels exceed 5 ppm above background for the 15 minute average at the perimeter, work activities will be temporarily halted and monitoring continued. If levels readily decrease (per instantaneous readings) below 5 ppm above background, work activities will resume with continued monitoring;
- If TOV levels at the downwind perimeter of the hot zone persist at levels in excess of 5 ppm above background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the TOV level 200-feet downwind of the hot zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less – but in no case less than 20-feet, is below 5 ppm above background for the 15 minute average; and/or,
- If the TOV level is above 25 ppm at the perimeter of the hot zone, activities will be shutdown.

The following actions will be taken based on visible dust emissions:

- If airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work will continue with dust suppression techniques provided that no visible dust is migrating from the work area;
- If, after implementation of dust suppression techniques, dust is still observed to be leaving the work area, 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 preventing visible dust migration; and/or,
- In order to minimize the generation of dust, water will be sprayed on any areas of the Site where dust could be generated.

6.4.1 Vapor Emission Response Plan

If the ambient air concentration of organic vapors exceeds 5 ppm above background at the perimeter of the hot zone, boring, well installation, and test pit activities will be halted or vapor suppression controls will be employed, and monitoring continued. When work shut-down occurs, downwind air monitoring as directed by the FSO will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission section.

If the organic vapor level decreases below 5 ppm above background, sampling and boring and well installation can resume, provided:

- The organic vapor level 200-feet downwind of the hot zone or half the distance to the nearest residential or commercial structure, whichever is less, is below 1 ppm over background; and,
- More frequent intervals of monitoring, as directed by the FSO, are conducted.

6.4.2 Major Vapor Emission

If any organic levels greater than 5 ppm over background are identified 200-feet downwind from the work site, or half the distance to the nearest residential or commercial property, whichever is less, all work activities must be halted or odor controls must be implemented.

If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200-feet downwind or half the distance to the nearest residential or commercial property from the hot zone, then the air quality must be monitored within 20-feet of the perimeter of the nearest residential or commercial structure (20-Foot Zone).

If either of the following criteria is exceeded in the 20-Foot Zone, then the Major Vapor Emission Response Plan shall automatically be implemented.

- Sustained organic vapor levels approaching 5 ppm above background for a period of more than 30 minutes; and/or,
- Organic vapor levels greater than 5 ppm above background for any time period.

6.4.3 Major Vapor Emission Response Plan

Upon activation, the following activities will be undertaken:

1. The local police authorities will immediately be contacted by the FSO and advised of the situation;

2. Frequent air monitoring will be conducted at 30 minute intervals within the 20-Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the FSO; and
3. All emergency contacts will go into effect as appropriate.

6.5 **DOCUMENTATION**

For emergencies involving personnel injury and/or exposure, the FSO will complete and submit the Accident Report Form within 48 hours of the incident. The form is attached in Attachment B.

ATTACHMENT A

Air Monitoring Equipment Calibration and Maintenance

All monitoring instruments must be calibrated and maintained periodically. Calibration and on-site maintenance records will be kept in the field log book. The operator must understand the limitations and possible sources of error for each instrument. It is important that the operator checks that the instrument responds properly to the substances it was designed to monitor. Air quality monitoring equipment, including photoionization detectors (PIDs) must be calibrated at least once each day. The specific instructions for calibration and maintenance provided for each instrument should be followed.

ATTACHMENT B

Forms for Health and Safety Related Activity

Note: The OSHA Job Safety and Health Protection Poster must be posted prominently during field activities. The following page is an example of the poster to be used in the field. The actual poster must be an 11-inch x 17-inch size version of this page. The OSHA 300 Log of injuries and illnesses is maintained in the home office of each Langan employee.

You Have a Right to a Safe and Healthful Workplace. **IT'S THE LAW!**

- You have the right to notify your employer or OSHA about workplace hazards. You may ask OSHA to keep your name confidential.
- You have the right to request an OSHA inspection if you believe that there are unsafe and unhealthful conditions in your workplace. You or your representative may participate in the inspection.
- You can file a complaint with OSHA within 30 days of discrimination by your employer for making safety and health complaints or for exercising your rights under the *OSH Act*.
- You have a right to see OSHA citations issued to your employer. Your employer must post the citations at or near the place of the alleged violation.
- Your employer must correct workplace hazards by the date indicated on the citation and must certify that these hazards have been reduced or eliminated.
- You have the right to copies of your medical records or records of your exposure to toxic and harmful substances or conditions.
- Your employer must post this notice in your workplace.



The *Occupational Safety and Health Act of 1970 (OSH Act)*, P.L. 91-596, assures safe and healthful working conditions for working men and women throughout the Nation. The Occupational Safety and Health Administration, in the U.S. Department of Labor, has the primary responsibility for administering the *OSH Act*. The rights listed here may vary depending on the particular circumstances. To file a complaint, report an emergency, or seek OSHA advice, assistance, or products, call 1-800-321-OSHA or your nearest OSHA office: • Atlanta (404) 562-2300 • Boston (617) 565-9860 • Chicago (312) 353-2220 • Dallas (214) 767-4731 • Denver (303) 844-1600 • Kansas City (816) 426-5861 • New York (212) 337-2378 • Philadelphia (215) 861-4900 • San Francisco (415) 975-4310 • Seattle (206) 553-5930. Teletypewriter (TTY) number is 1-877-889-5627. To file a complaint online or obtain more information on OSHA federal and state programs, visit OSHA's website at www.osha.gov. If your workplace is in a state operating under an OSHA-approved plan, your employer must post the required state equivalent of this poster.

1-800-321-OSHA www.osha.gov

U.S. Department of Labor  • Occupational Safety and Health Administration • OSHA 3165

Project Name: _____

Injured or Ill Employee

1. Name _____ Social Security # _____
(First) (Middle) (Last)
2. Home Address _____
(No. and Street) (City or Town) (State and Zip)
3. Age _____ 4. Sex: Male () Female ()
5. Occupation _____
(Specific job title, not the specific activity employee was performing at time of injury)
6. Department _____
(Enter name of department in which injured person is employed, even though they may have been temporarily working in another department at the time of injury)

Employer

7. Name _____
8. Mailing Address _____
(No. and Street) (City or Town) (State and Zip)
9. Location (if different from mailing address): _____

The Accident or Exposure to Occupational Illness

10. Place of accident or exposure _____
(No. and Street) (City or Town) (State and Zip)
11. Was place of accident or exposure on employer's premises? _____(Yes/No)
12. What was the employee doing when injured? _____

(Be specific - was employee using tools or equipment or handling material?)
13. How did the accident occur? _____
(Describe fully the events that resulted in the injury or occupational illness. Tell what happened and how. Name objects and substances involved.)
- Give details on all factors that led to accident. Use separate sheet if needed)
14. Time of accident: _____
15. Date of injury or initial diagnosis of occupational illness _____

16. WITNESS TO ACCIDENT	_____	_____	_____
	(Name)	(Affiliation)	(Phone No.)
	_____	_____	_____
	(Name)	(Affiliation)	(Phone No.)
	_____	_____	_____
	(Name)	(Affiliation)	(Phone No.)

Occupational Injury or Occupational Illness

17. Describe the injury or illness in detail; indicate part of body affected.

18. Name the object or substance that directly injured the employee. (For example, object that struck employee; the vapor or poison inhaled or swallowed; the chemical or radiation that irritated the skin; or in cases of strains, hernias, etc., the object the employee was lifting, pulling, etc.)

19. Did the accident result in employee fatality? _____ (Yes or No)

20. Number of lost workdays ____/restricted workdays ____ resulting from injury or illness?

Other

21. Did you see a physician for treatment? _____ (Yes or No) _____ (Date)

22. Name and address of physician _____

(No. and Street) (City or Town) (State and Zip)

23. If hospitalized, name and address of hospital _____

(No. and Street) (City or Town) (State and Zip)

Date of report _____ Prepared by _____

Official position _____

Project Health and Safety Plan and Work plan Acceptance Form

(For Langan employees only)

I have read and agree to abide by the contents of the Work Plan and Health and Safety Plan for the following project:

(Project Title)

(Project Number)

Furthermore, I have read and am familiar with the work plan or proposal that describes the field work to be conducted and the procedures to be utilized in the conduct of this work.

Name (print)

Signature

Date

Place in project Health and Safety File as soon as possible

Site-Specific Health and Safety Training

(For all Langan and subcontract employees on site)

I hereby confirm that site-specific health and safety training has been conducted by the site health and safety officer that included:

- Names of personnel responsible for site safety and health
- Safety, health, and other hazards at the site
- Proper use of personal protective equipment
- Work practices by which the employee can minimize risk from hazards
- Safe use of engineering controls and equipment on the site
- Acute effects of compounds at the site
- Decontamination procedures

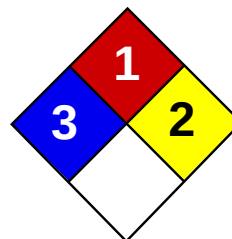
For the following project:

_____	_____	
(Project Title)	(Project Number)	
Name (print)	Signature	Date
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Place in project Health and Safety File as soon as possible

ATTACHMENT C
Material Safety Data Sheets
(Provided on CD)

- Arsenic
- Benzene
- Benzo(a)anthracene
- Benzo(a)pyrene
- Beryllium
- Chloroform
- Chromium
- Chrysene
- Copper
- DDE
- DDT
- 1,1-Dichloroethylene (1,1-DCE)
- Cis-1,2-Dichloroethylene (cis-1,2-DCE)
- Trans-1,2-Dichloroethylene (trans-1,2-DCE)
- Dieldrin
- Diesel Fuel
- Ethylbenzene
- Heptachlor Epoxide
- Iron
- Isobutylene Gas in Air, 100 ppm
- Lead
- Magnesium
- 2-mercaptobenzothiazole
- Mercury
- Motor Oil, 10W-40
- MTBE
- N-nitrosodiphenylamine
- Nickel
- PCBs
- Tetrachloroethylene (PCE)
- Toluene
- 1,2,4-trichlorobenzene
- Trichloroethylene (TCE)
- Unleaded Gasoline
- Vinyl Chloride
- Xylenes
- Zinc



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:**

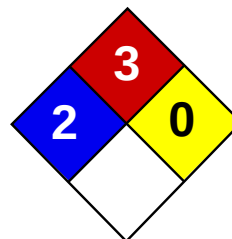
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -Liste des produits purs tératogènes, mutagènes, cancérrogènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec. -Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec. -SAX, N.I. Dangerous Properties of Industrial 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 dangereuses au Canada. Centre de conformité international Ltée. 1986.

Other Special Considerations: Not available.

Created: 10/09/2005 04:16 PM

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Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Benzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Benzene

Catalog Codes: SLB1564, SLB3055, SLB2881

CAS#: 71-43-2

RTECS: CY1400000

TSCA: TSCA 8(b) inventory: Benzene

CI#: Not available.

Synonym: Benzol; Benzine

Chemical Name: Benzene

Chemical Formula: C₆H₆

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

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

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

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

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

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

Section 3: Hazards Identification

Potential Acute Health Effects:

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

Potential Chronic Health Effects:

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

Section 4: First Aid Measures

Eye Contact:

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

Skin Contact:

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

Serious Skin Contact:

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

Inhalation:

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

Serious Inhalation:

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

Ingestion:

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

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

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

Flammable Limits: LOWER: 1.2% UPPER: 7.8%

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

Fire Hazards in Presence of Various Substances:

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

Explosion Hazards in Presence of Various Substances:

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

Fire Fighting Media and Instructions:

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

Special Remarks on Fire Hazards:

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

Special Remarks on Explosion Hazards:

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

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

Section 6: Accidental Release Measures

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

Large Spill:

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

Section 7: Handling and Storage

Precautions:

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

Storage:

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

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

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

Personal Protection:

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

Personal Protection in Case of a Large Spill:

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

Exposure Limits:

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

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor:

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

Taste: Not available.

Molecular Weight: 78.11 g/mole

Color: Clear Colorless. Colorless to light yellow.

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

Boiling Point: 80.1 (176.2°F)

Melting Point: 5.5°C (41.9°F)

Critical Temperature: 288.9°C (552°F)

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

Vapor Pressure: 10 kPa (@ 20°C)

Vapor Density: 2.8 (Air = 1)

Volatility: Not available.

Odor Threshold: 4.68 ppm

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

Ionicity (in Water): Not available.

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

Solubility:

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

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatibles.

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

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

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

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

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

Toxicity to Animals:

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

Chronic Effects on Humans:

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

Other Toxic Effects on Humans:

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

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

Special Remarks on other Toxic Effects on Humans:

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

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

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

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Benzene UNNA: 1114 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

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

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

Other Regulations:

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

Other Classifications:

WHMIS (Canada):

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

DSCL (EEC):

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

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

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

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:35 PM

Last Updated: 06/09/2012 12:00 PM

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MATERIAL SAFETY DATA SHEET**EM SCIENCE****1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION**

Manufacturer.....:

EM SCIENCE
A Division of EM Industries
P.O. Box 70
480 Democrat Road
Gibbstown, N.J. 08027

Preparation Date.: 10/25/96**Information Phone Number.:** 856-423-6300**Hours:** Mon. to Fri. 8:30-5**Chemtrec Emergency Number:** 800-424-9300**Hours:** 24 hrs a day**Catalog Number(s):**

BX0207

Product Name:

1,2-Benzanthracene

Synonyms:

Benzo (A) Anthracene

Chemical Family:

Aromatic Hydrocarbon

Formula: $C_{18}H_{12}$ **Molecular Weight.:**

228.29

2. COMPOSITION / INFORMATION ON INGREDIENTS

Component	CAS #	Appr %
1, 2-Benzanthracene	56-55-3	100%

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

SUSPECT CANCER HAZARD. MAY CAUSE CANCER.

HARMFUL IF INHALED, SWALLOWED OR ABSORBED THROUGH SKIN.

IRRITATING TO SKIN, EYES AND MUCOUS MEMBRANES.

MAY CAUSE DAMAGE TO KIDNEY, URETER, BLADDER.

WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

Appearance:

Light yellow powder

POTENTIAL HEALTH EFFECTS (ACUTE AND CHRONIC)

Symptoms of Exposure:

Harmful if inhaled, swallowed, or absorbed through the skin. Irritating on contact with skin, eyes or mucous membranes. May cause damage to kidney, ureter, bladder. Chronic exposure may cause alteration of genetic material.

Medical Cond. Aggravated by Exposure:

Urinary conditions

Routes of Entry:

Inhalation, ingestion or skin contact.

Carcinogenicity:

Suspected human carcinogenic substance. Suspect Cancer Hazard.

WARNING: This product contains a chemical(s) known to the State of California to cause cancer.

4. FIRST AID MEASURES

Emergency First Aid:

GET MEDICAL ASSISTANCE FOR ALL CASES OF OVEREXPOSURE.

Skin: Immediately flush thoroughly with large amounts of water.

Eyes: Immediately flush thoroughly with water for at least 15 minutes.

Inhalation: Remove to fresh air; give artificial respiration if breathing has stopped.

Ingestion: If conscious, drink water and induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

Remove contaminated clothing and wash before reuse.

5. FIRE FIGHTING MEASURES

Flash Point (F): Noncombustible
Flammable Limits LEL (%): N/A
Flammable Limits UEL (%): N/A
Extinguishing Media:
Foam, Carbon dioxide, Water spray

Fire Fighting Procedures:

Wear self-contained breathing apparatus and protective clothing.

Fire & Explosion Hazards:

Thermal decomposition produces highly toxic fumes.

6. ACCIDENTAL RELEASE MEASURES

Spill Response:

Evacuate the area of all unnecessary personnel. Wear suitable protective equipment listed under Exposure / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Take up and containerize for proper disposal as described under Disposal. Comply with Federal, State, and local regulations on reporting releases. Refer to Regulatory Information for reportable quantity and other regulatory data.

7. HANDLING AND STORAGE

Handling & Storage:

Keep container tightly closed. Store in a cool, dry, well-ventilated area. Do not breathe vapor or dust. Do not get in eyes, on skin, or on clothing.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS AND PERSONAL PROTECTIVE EQUIPMENT:

Ventilation, Respiratory Protection, Protective Clothing, Eye Protection:

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (see your safety equipment supplier). Engineering and/or administrative controls should be implemented to reduce exposure. Material must be handled or transferred in an approved fume hood or with equivalent ventilation. Protective gloves must be worn to prevent skin contact (Viton or equivalent) Safety glasses with side shields must be worn at all times. Impervious protective clothing should be worn to prevent skin contact.

Work/Hygenic Practices:

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

EXPOSURE GUIDELINES

OSHA - PEL:

Component	TWA		STEL		CL		Skin
	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	
1, 2-Benzanthracene							

ACGIH - TLV:

Component	TWA		STEL		CL		Skin
	PPM	MG/M3	PPM	MG/M3	PPM	MG/M3	
1, 2-Benzanthracene							

If there are no exposure limit numbers listed in the Exposure Guidelines chart, this indicates that no OSHA or ACGIH exposure limits have been established.

9. PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point (C 760 mmHg) : 435C Sublimes
Melting Point (C) : 160C
Specific Gravity (H₂O = 1) : N/A
Vapor Pressure (mm Hg) : N/A
Percent Volatile by vol (%) : N/A
Vapor Density (Air = 1) : N/A
Evaporation Rate (BuAc = 1) : N/A
Solubility in Water (%) : Insoluble
Appearance :
Light yellow powder

10. STABILITY AND REACTIVITY

Stability: Yes

Hazardous Polymerization:
Does not occur

Hazardous Decomposition:
CO_x

Conditions to Avoid:
None indicated

Materials To Avoid:

- ☐ Water
- ☒ Acids
- ☒ Bases
- ☐ Corrosives
- ☒ Oxidizers
- ☐ Other:

11. TOXICOLOGICAL INFORMATION

Toxicity Data

ivn-mus LDLo: 10 mg/kg

Toxicological Findings:

Tests on laboratory animals indicate material may produce adverse mutagenic effects and cause tumors.

Cited in Registry of Toxic Effects of Chemical Substances (RTECS)

12. DISPOSAL CONSIDERATIONS

EPA Waste Numbers: U018

Treatment:

Specified Technology - Incineration to a level below TCA (Total Constituent Analyses) levels. Contact your local permitted waste disposal company (TSD) for permissible treatment site.

ALWAYS CONTACT A PERMITTED WASTE DISPOSER (TSD) TO ASSURE COMPLIANCE WITH ALL CURRENT LOCAL, STATE AND FEDERAL REGULATIONS.

13. TRANSPORT INFORMATION

DOT Proper Shipping Name:

Environmentally Hazardous Substance, Solid, n.o.s. (1,2-Benzanthracene)

DOT ID Number :

UN3077

14. REGULATORY INFORMATION

TSCA Statement:

The CAS number of this product is listed on the TSCA Inventory.

Component	SARA EHS (302)	SARA EHS TPQ (lbs)	CERCLA RQ (lbs)
1,2-Benzanthracene			10

Component	OSHA Floor List	SARA 313	DeMinimis for SARA 313 (%)
1,2-Benzanthracene	Y	Y	0.1

If there is no information listed on the regulatory information chart, this indicates that the chemical is not covered by the specific regulation listed.

15. OTHER INFORMATION

Comments:
None

NFPA Hazard Ratings:

Health : 3
 Flammability : 0
 Reactivity : 0
 Special Hazards :

Revision History: 1/1/84 7/18/87 1/24/91 3/1/91
 11/19/93 3/10/95

| = Revised Section

N/A = Not Available

N/E = None Established

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Material Safety Data Sheet

Version 5.0

Revision Date 10/11/2012

Print Date 04/11/2013

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Benzo[a]pyrene

Product Number : B1760

Brand : Sigma

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Carcinogen, Skin sensitiser, Teratogen, Reproductive hazard, Mutagen

Target Organs

Lungs, Skin

GHS Classification

Skin irritation (Category 3)

Respiratory sensitization (Category 1)

Germ cell mutagenicity (Category 1B)

Carcinogenicity (Category 1B)

Reproductive toxicity (Category 1B)

Acute aquatic toxicity (Category 1)

Chronic aquatic toxicity (Category 1)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H316	Causes mild skin irritation.
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H340	May cause genetic defects.
H350	May cause cancer.
H360	May damage fertility or the unborn child.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P201	Obtain special instructions before use.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P273	Avoid release to the environment.

P308 + P313
P501

IF exposed or concerned: Get medical advice/ attention.
Dispose of contents/ container to an approved waste disposal plant.

HMIS Classification

Health hazard: 3
Chronic Health Hazard: *
Flammability: 0
Physical hazards: 0

NFPA Rating

Health hazard: 3
Fire: 0
Reactivity Hazard: 0

Potential Health Effects

Inhalation May be harmful if inhaled. May cause respiratory tract irritation.
Skin May be harmful if absorbed through skin. May cause skin irritation.
Eyes May cause eye irritation.
Ingestion May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms : 3,4-Benzpyrene
3,4-Benzopyrene
Benzo[def]chrysene

Formula : C₂₀H₁₂
Molecular Weight : 252.31 g/mol

Component		Concentration
Benzo[a]pyrene		
CAS-No.	50-32-8	-
EC-No.	200-028-5	
Index-No.	601-032-00-3	

4. FIRST AID MEASURES

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability

Not flammable or combustible.

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Carbon oxides

6. ACCIDENTAL RELEASE MEASURES**Personal precautions**

Use personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE**Precautions for safe handling**

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION**Components with workplace control parameters**

Components	CAS-No.	Value	Control parameters	Basis
Remarks	Cancer Substances for which there is a Biological Exposure Index or Indices (see BEI® section), see BEI® for Polycyclic Aromatic Hydrocarbons (PAHs) Exposure by all routes should be carefully controlled to levels as low as possible. Suspected human carcinogen			
Benzo[a]pyrene	50-32-8	TWA	0.2 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.2 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	0.2 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	0.2 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants

Personal protective equipment**Respiratory protection**

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Eye protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES**Appearance**

Form	solid
Colour	no data available

Safety data

pH	no data available
Melting point/freezing point	Melting point/range: 177 - 180 °C (351 - 356 °F) - lit.
Boiling point	495 °C (923 °F) - lit.
Flash point	no data available
Ignition temperature	no data available
Autoignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	no data available
Density	1.35 g/cm ³
Water solubility	no data available
Partition coefficient: n-octanol/water	log Pow: 5.97
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY**Chemical stability**

Stable under recommended storage conditions.

Possibility of hazardous reactions

no data available

Conditions to avoid

no data available

Materials to avoid

Strong oxidizing agents

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION**Acute toxicity****Oral LD50**

no data available

Inhalation LC50

no data available

Dermal LD50

no data available

Other information on acute toxicity

LD50 Subcutaneous - rat - 50 mg/kg

Skin corrosion/irritation

Skin - mouse - Mild skin irritation

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitization

Chronic exposure may cause dermatitis.

May cause allergic skin reaction.

Germ cell mutagenicity

May alter genetic material.

In vivo tests showed mutagenic effects

Carcinogenicity

This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Possible human carcinogen

IARC: 1 - Group 1: Carcinogenic to humans (Benzo[a]pyrene)

NTP: Reasonably anticipated to be human carcinogens. (Benzo[a]pyrene)

Reasonably anticipated to be a human carcinogen (Benzo[a]pyrene)

Reproductive toxicity

May cause reproductive disorders.

Teratogenicity

May cause congenital malformation in the fetus.

Presumed human reproductive toxicant

Specific target organ toxicity - single exposure (Globally Harmonized System)

no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

no data available

Aspiration hazard

no data available

Potential health effects**Inhalation**

May be harmful if inhaled. May cause respiratory tract irritation.

Ingestion

May be harmful if swallowed.

Skin

May be harmful if absorbed through skin. May cause skin irritation.

Eyes

May cause eye irritation.

Signs and Symptoms of Exposure

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea, Vomiting

Synergistic effects

no data available

Additional Information

RTECS: DJ3675000

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to daphnia and other aquatic invertebrates EC50 - Daphnia magna (Water flea) - 0.25 mg/l - 48 h

Toxicity to algae EC50 - Pseudokirchneriella subcapitata (green algae) - 0.02 mg/l - 72 h

Persistence and degradability

no data available

Bioaccumulative potential

Bioaccumulation Lepomis macrochirus (Bluegill) - 48 h
Bioconcentration factor (BCF): 3,208

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Benzo[a]pyrene)
Reportable Quantity (RQ): 1 lbs
Marine pollutant:
Poison Inhalation Hazard: No

IMDG

UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Benzo[a]pyrene)
Marine pollutant: No

IATA

UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Benzo[a]pyrene)

Further information

EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

OSHA Hazards

Carcinogen, Skin sensitiser, Teratogen, Reproductive hazard, Mutagen

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Benzo[a]pyrene	50-32-8	2007-03-01

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Benzo[a]pyrene	50-32-8	2007-03-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Benzo[a]pyrene	50-32-8	2007-03-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Benzo[a]pyrene	50-32-8	2007-03-01

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer.	50-32-8	1990-01-01
Benzo[a]pyrene		

16. OTHER INFORMATION**Further information**

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**ELECTRONIC SPACE PRODUCTS INTERNATIONAL**

1050 Benson Way, Ashland, OR 97520
Toll Free (800) 638-2581 * Fax (541) 488-8313
E-Mail: sales@espimetals.com

MATERIAL SAFETY DATA SHEET**I PRODUCT IDENTIFICATION**

Trade Name:	Beryllium	Chemical Family:	Metallic Element
Formula:	Be	CAS #:	7440-41-7

II HAZARDOUS INGREDIENTS

Hazardous Components	%	OSHA/PEL	ACGIH/TLV
Beryllium	0-100	.002 mg/m ³	.002 mg/m ³

Toxic Substances Control Act: Beryllium (CAS # 7440-41-7) is listed on the TSCA Chemical Substance Inventory of Existing Chemical Substances.

NIOSH RTECS#: DS1750000

III PHYSICAL DATA

Boiling Point:	2970 °C	Melting Point (°C):	1289
Density (g/cc):	1.85	Vapor Pressure:	N/A
Atomic Weight:	9.01	Evaporation Rate:	N/A
% Volatiles:	None	Solubility in H₂O:	None
Appearance and Odor:	Grey metallic, odorless		

IV FIRE AND EXPLOSION HAZARDS DATA

Flash Point (Method used): Non-combustible as a solid. Ignition occurred as a powder layer consisting of 1.0 to 5.0 micron particles between 540 °C and 700 °C. Coarser beryllium powder able to pass through a 74 micron sieve did not ignite under like testing.

Explosive limits: Not applicable to solids. As a cloud of 1.0 micron diameter powder ignition occurred at 910 °C. Beryllium powder greater than or equal to 2 microns in diameter did not ignite under like conditions. Regardless of powder size tested beryllium did not ignite as a cloud in a spark apparatus.

Extinguishing Media: As a solid, use extinguishing media appropriate to the surrounding fire. Do not use water or carbon dioxide to extinguish beryllium powder fires. As a powder, extinguish by smothering using a Class D fire extinguisher, dry sand, graphite powder, or sodium chloride.

Special Fire Fighting Procedures: If this material becomes airborne as a respirable particulate during a fire situation, pressure-demand self-contained breathing apparatus must be worn by firefighters or any other persons potentially exposed to the metal fumes.

Unusual Fire and Explosion Hazard: Do not use water to extinguish fires around operations involving molten metal due to the potential for steam explosions. In addition, water may disassociate when in contact with burning beryllium powder or chips releasing flammable hydrogen gas which could burn and result in an explosion. Ventilation duct work which has accumulated a fine coating of

beryllium dust on its internal surface poses a potentially serious fire hazard. Extinguishing using Class D fire extinguisher media and shut down or isolate the affected portion of the ventilation system. Because of this potential risk, sources of ignition such as flame, spark, etc. must not be allowed to enter the ventilation duct work. Also, duct work must be made of non-combustible material.

V HEALTH HAZARD INFORMATION

Primary Routes of Exposure: Inhalation: An exposure to airborne beryllium in excess of the occupational standard can occur during routine handling, material transfer, chemical processing or further processing of powdered material and when machining, melting, casting, gross handling, picking, welding, grinding, sanding, polishing, milling, crushing, or otherwise abrading the surface of solid beryllium in a manner which generates finely divided particles. Machining operations conducted under a flood of liquid coolant usually require local exhaust ventilation. The cycling through a machine of liquid lubricant/coolant containing finely divided beryllium in suspension can result in the concentration building to a point where the particulate may become airborne during use. A filter, centrifuge, or settling chamber can be installed in-line if necessary. The potential for exposures also may occur during repair or maintenance activities on contaminated equipment such as: furnace rebuilding, maintenance or repair of air cleaning equipment, structural renovation, welding, etc.

Acute Effects:

Inhalation: This product is insoluble and does not cause acute health effects.

Ingestion: This product is insoluble and does not cause acute health effects.

Skin: Skin abrasion may cause irritation.

Eye: Injury to the eyes can result from particulate irritation or mechanical injury to the cornea or conjunctiva by dust or particulate.

Chronic Effects:

Inhalation: Overexposure to airborne beryllium particulate may cause a serious lung disease, in certain sensitive individuals, called chronic beryllium disease (chronic berylliosis). Chronic beryllium disease is a condition in which the tissues of the lungs become inflamed, restricting the exchange of oxygen between the lungs and the bloodstream. Symptoms may include cough, chest pain, shortness of breath, weight loss, weakness, and fatigue. Long term effects may include loss of lung function, fibrosis, or subsequent secondary effects on the heart with eventual permanent impairment.

Ingestion: There are no known cases of illness resulting from ingestion of beryllium.

Skin: Skin abrasion may cause irritation.

Eye: Injury to the eyes can result from particulate irritation or mechanical injury to the cornea or conjunctiva by dust or particulate.

Carcinogenic references: Hazard communication regulations of the U.S. Occupational Safety & Health Administration require that caution labels for materials listed as potential carcinogens in either the International Agency for Cancer Research Monograph Series or the National Toxicology Program Annual Report on carcinogens must contain a cancer warning. Beryllium has also been so listed based principally on animal tests and therefore this material bears a label identifying it as a potential cancer hazard.

Medical Conditions Aggravated by Exposure: Persons with impaired pulmonary function, airway diseases, or conditions such as asthma, emphysema, chronic bronchitis, etc. may incur further impairment if excessive concentrations of dust or fume are inhaled. If prior damage or disease to the neurologic (nervous), circulatory, hematologic (blood), or urinary (kidney) system has occurred, proper screening or examinations should be conducted on individuals who may be exposed to further risk where handling and use of this material may cause excessive exposure.

EMERGENCY AND FIRST AID PROCEDURES:

INHALATION: Remove to fresh air. Although no cases in which a person stopped breathing as a result of exposure are known, if breathing has stopped, perform artificial respiration and obtain medical help.

INGESTION: Swallowing metal powder or dust can be treated by having the affected person drink large quantities of water and attempting to induce vomiting if conscious. Obtain medical help.

SKIN: Remove contaminated clothing, brush material off skin, wash affected area with soap and water. If irritation persists, seek medical attention.

EYE: Flush eyes with copious amounts of clean water. If irritation persists obtain medical help. Contact lenses should not be worn when working with metal dusts and powders because the contact lens must be removed to provide adequate treatment.

VI REACTIVITY DATA

Stability: Stable

Conditions to Avoid: Oxidation will form on solid shapes when moist.

Incompatibility (Material to Avoid): Avoid contact with mineral acids and oxidizing agents which may generate hydrogen gas. Hydrogen gas can be an explosion hazard.

Hazardous Decomposition Products: Melting and dross handling or powdering operations can emit airborne dusts or fumes.

Hazardous Polymerization: Will not Occur

VII SPILL AND LEAK PROCEDURES

Steps to Be Taken in Case Material Is Released or Spilled: In solid form this material poses no health or environmental risk. If this material is in powder or dust form, establish a restricted entry zone based on the severity of the spill. Persons entering the restricted zone must wear adequate respiratory protection and protective clothing appropriate for the severity of the spill. Cleanup should be conducted with a vacuum system utilizing a high efficiency particulate air filtration system followed by wet cleaning methods. Special care must be taken when changing filters on HEPA vacuum cleaners when used to clean up potentially toxic materials. Caution should be taken to minimize airborne generation of powder or dust and avoid contamination of air and water. Depending upon the quantity of material released, fine powder or dust spills to the environment may require reporting the National Response Center at (800) 424-8802 as well as the State Emergency Response Commission and Local Emergency Planning Committee.

Waste Disposal Method: Dispose of in accordance with State, Federal and Local regulations.

VIII SPECIAL PROTECTION INFORMATION

Respiratory Protection: When potential exposures are above the occupational limits, approved respirators must be used. Exposure to unknown concentrations of fumes or dusts requires the wearing of a pressure-demand and self-contained breathing apparatus. Pressure-demand airline respirators are recommended for jobs with high potential exposures such as changing bags in a baghouse air cleaning device.

Ventilation: Whenever possible the use of local exhaust ventilation or other engineering controls is the preferred method of controlling exposure to airborne dust and fume to meet established occupational exposure limits. Powders should be stored and transported in tightly sealed containers and must only be handled under controlled ventilated conditions.

Protective Gloves: Wear gloves to prevent metal cuts and skin abrasions particularly during handling.

Eye Protection: Wear safety glasses, goggles, face shield, or welders helmet.

Other Protective Equipment: No protective equipment or clothing is required when handling solid forms. Protective overgarment or work clothing should be worn by persons who may become contaminated with dusts, fumes, or powders.

Work Practices: Vacuum or wet cleaning methods are recommended for dust removal. Be certain to de-energize electrical systems as necessary before beginning wet cleaning. Vacuum cleaners with high efficiency particulate air (HEPA) filters are the recommended type. The use of compressed air to remove dusts should be avoided as such an activity can result in unnecessary short-term elevated exposures to dusts. Contaminated work clothing and overgarment should be managed in such a manner so as to prevent secondary exposure to persons such as laundry operators and to prevent contamination to personal clothing. Never use compressed air to clean work clothing.

IX SPECIAL PRECAUTIONS

Packaging and Labeling Requirements: The following requirements of the U.S. Dept. of Transportation apply only to beryllium metal powder or dust, not to solid shapes:

Shipping Name: RQ Flammable Solid, Poisonous, N.O.S. (Beryllium Metal Powder).

NOTE: Must be marked on shipping papers and on the outside of the shipping container.

Hazard Class: Beryllium metal powder and dust are classified as Flammable Solid and Class B Poison.
NOTE: Hazard class must be included on shipping papers.

Identification Number: UN2926
NOTE: Must be marked on shipping papers and on the outside of the shipping container.

Label(s) Required: Flammable Solid and Poison (For Beryllium Metal Powder or Dust Only).
NOTE: Place on the outside of the shipping container.

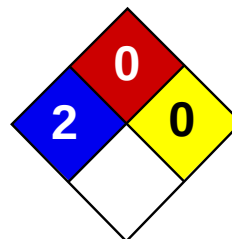
Reportable Quantity: 10 lbs. (4.54).
NOTE: The RQ is limited to particles having a diameter less than 100 micrometers.

DOT Specification Container: Suitable for Flammable Solids. Recommended double overpack when shipping powder.

Other: Emergency response information is provided within this MSDS.
NOTE: This information must be included, in some form, with the shipping papers.

SARA Title III: Beryllium is reportable under Section 313

Issued by: S. Dierks
Date: November 1992



Health	2
Fire	0
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Chloroform MSDS

Section 1: Chemical Product and Company Identification

Product Name: Chloroform

Catalog Codes: SLC1888, SLC5044

CAS#: 67-66-3

RTECS: FS9100000

TSCA: TSCA 8(b) inventory: Chloroform

CI#: Not available.

Synonym: Trichloromethane; Methane, trichlor-

Chemical Name: Chloroform

Chemical Formula: CHCl₃

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
Chloroform	67-66-3	100

Toxicological Data on Ingredients: Chloroform: ORAL (LD50): Acute: 695 mg/kg [Rat]. 36 mg/kg [Mouse]. 820 mg/kg [Guinea pig]. DERMAL (LD50): Acute: >20000 mg/kg [Rabbit]. VAPOR (LC50): Acute: 47702 mg/m 4 hours [Rat].

Section 3: Hazards Identification

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

Potential Chronic Health Effects: CARCINOGENIC EFFECTS: Classified + (Proven.) by NIOSH. Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, heart. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

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

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

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

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

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

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

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

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: May explode if it comes in contact with aluminum powder, lithium, perchlorate, pentoxide, bis(dimethylamino)dimethylstannane, potassium, potassium-sodium alloy, sodium (or sodium hydroxide or sodium methoxide), and methanol

Section 6: Accidental Release Measures

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

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

Section 7: Handling and Storage

Precautions: Do not ingest. Do not breathe gas/fumes/ vapor/spray. 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 metals, alkalis.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Sensitive to light. Store in light-resistant containers.

Section 8: Exposure Controls/Personal Protection

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

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

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

Exposure Limits: TWA: 10 (ppm) [Australia] Inhalation TWA: 2 (ppm) from OSHA (PEL) [United States] Inhalation STEL: 9.78 (mg/m³) from NIOSH Inhalation STEL: 2 (ppm) from NIOSH Inhalation TWA: 9.78 (mg/m³) from OSHA (PEL) [United States] Inhalation TWA: 10 (ppm) from ACGIH (TLV) [United States] [1999] Inhalation TWA: 2 (ppm) [United Kingdom (UK)] Inhalation TWA: 9.9 (mg/m³) [United Kingdom (UK)] Inhalation Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Pleasant. Sweetish. Etheric. Non-irritating

Taste: Burning. Sweet.

Molecular Weight: 119.38 g/mole

Color: Colorless. Clear

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

Boiling Point: 61°C (141.8°F)

Melting Point: -63.5°C (-82.3°F)

Critical Temperature: 263.33°C (506°F)

Specific Gravity: 1.484 (Water = 1)

Vapor Pressure: 21.1 kPa (@ 20°C)

Vapor Density: 4.36 (Air = 1)

Volatility: Not available.

Odor Threshold: 85 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2

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, Light

Incompatibility with various substances: Reactive with metals, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Light Sensitive. Incompatible with triisopropyl phosphine, acetone, disilane, fluorine, strong bases and reactive metals (aluminum, magnesium in powdered form), light.

Special Remarks on Corrosivity: It will attack some forms of plastics, rubber, and coatings.

Polymerization: Will not occur.

Section 11: Toxicological Information

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

Toxicity to Animals: WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 36 mg/kg [Mouse]. Acute dermal toxicity (LD50): >20000 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 47702 mg/m 4 hours [Rat]. 3

Chronic Effects on Humans: CARCINOGENIC EFFECTS: Classified + (Proven.) by NIOSH. Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. May cause damage to the following organs: kidneys, liver, heart.

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: May affect genetic material (possible mutagen) and cause adverse reproductive effects(embryotoxicity and fetotoxicity) Suspected carcinogen (tumorigenic) and teratogen based on animal data. Human: passes the placental barrier, detected in maternal milk.

Special Remarks on other Toxic Effects on Humans: Acute Potential Health Effects: Skin: Causes skin irritation and may cause chemical burns. Eye: Causes eye irritation, burning pain and reversible injury to corneal epithelium. Inhalation: Causes irritation of the respiratory system (mucous membranes). May affect behavior/Nervous system (CNS depressant, fatigue, dizziness, nervousness, giddiness, euphoria, loss of coordination and judgement, weakness, hallucinations, muscle contraction/spasticity, general anesthetic, spastic paralysis, headache), anorexia (neurological and gastrointestinal symptoms resembling chronic alcoholism), and possibly coma and death. May affect the liver, kidneys and gastrointestinal tract (nausea, vomiting). Ingestion: Causes gastrointestinal tract irritation (nausea, vomiting). May affect the liver, urinary system (kidneys), respiration, behavior/nervous system (symptoms similar to inhalation),and heart. Chronic Potential Health Effects: Inhalation: Prolonged or repeated inhalation may affect the liver (hepatitis, jaundice, hepatocellular necrosis), metabolism (weight loss), respiration (fibrosis, pneumoconiosis), behavior/central nervous system (symptoms similar to acute inhalation), blood, musculoskeletal system, and kidneys. Ingestion: Prolonged or repeated ingestion may affect the liver, kidneys, metabolism (weight loss), endocrine system (spleen), blood (changes in cell count).

Section 12: Ecological Information

Ecotoxicity: Ecotoxicity in water (LC50): 43.8 mg/l 96 hours [Trout].

BOD5 and COD: Not available.

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

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as 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 6.1: Poisonous material.

Identification: : Chloroform UNNA: UN1888 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: Chloroform California prop. 65 (no significant risk level): Chloroform: 0.02 mg/day (value) California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Chloroform New York release reporting list: Chloroform Rhode Island RTK hazardous substances: Chloroform Pennsylvania RTK: Chloroform Massachusetts RTK: Chloroform New Jersey: Chloroform California Director's List of Hazardous Substances (8 CCR 339): Chloroform Tennessee: Chloroform TSCA 8(b) inventory: Chloroform TSCA 8(d) H and S data reporting: Chloroform: effective: 6/1/87; sunset: 6/1/97 SARA 302/304/311/312 extremely hazardous substances: Chloroform SARA 313 toxic chemical notification and release reporting: Chloroform CERCLA: Hazardous substances.: Chloroform: 10 lbs. (4.536 kg)

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

Other Classifications:

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

DSCL (EEC): R20/22- Harmful by inhalation and if swallowed. R38- Irritating to skin. R40- Possible risks of irreversible effects. S36/37- Wear suitable protective clothing and gloves.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

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

Section 16: Other Information

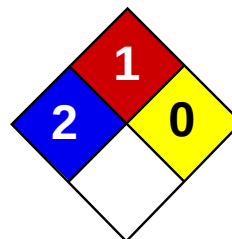
References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:16 PM

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

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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) +/- 10 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, redness of the throat, bronchospasm, asthma, cough, polyps, chronic inflammation, emphysema, chronic bronchitis, pharyngitis, bronchopneumonia, pneumoconiosis. 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: 06/09/2012 12:00 PM

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Material Safety Data Sheet

Version 5.1

Revision Date 01/02/2013

Print Date 04/11/2013

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Chrysene

Product Number : BCR269

Brand : Fluka

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Carcinogen, Mutagen

GHS Classification

Germ cell mutagenicity (Category 2)

Carcinogenicity (Category 1B)

Acute aquatic toxicity (Category 1)

Chronic aquatic toxicity (Category 1)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H341

Suspected of causing genetic defects.

H350

May cause cancer.

H410

Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P201

Obtain special instructions before use.

P273

Avoid release to the environment.

P281

Use personal protective equipment as required.

P308 + P313

IF exposed or concerned: Get medical advice/ attention.

P501

Dispose of contents/ container to an approved waste disposal plant.

HMIS Classification

Health hazard: 0

Chronic Health Hazard: *

Flammability: 0

Physical hazards: 0

NFPA Rating

Health hazard: 0
Fire: 0
Reactivity Hazard: 0

Potential Health Effects

Inhalation May be harmful if inhaled. May cause respiratory tract irritation.
Skin May be harmful if absorbed through skin. May cause skin irritation.
Eyes May cause eye irritation.
Ingestion May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Formula : C₁₈H₁₂
Molecular Weight : 228.29 g/mol

Component		Concentration
Chrysene		
CAS-No.	218-01-9	-
EC-No.	205-923-4	
Index-No.	601-048-00-0	

4. FIRST AID MEASURES

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability

Not flammable or combustible.

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Carbon oxides

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Use personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE

Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place.

Recommended storage temperature: 2 - 8 °C

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value	Control parameters	Basis
Remarks	Cancer Substances for which there is a Biological Exposure Index or Indices (see BEI® section), see BEI® for Polycyclic Aromatic Hydrocarbons (PAHs) Exposure by all routes should be carefully controlled to levels as low as possible. Confirmed animal carcinogen with unknown relevance to humans			
Chrysene	218-01-9	TWA	0.2 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.2 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	0.2 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	0.2 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants

Personal protective equipment

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatrill® (KCL 740 / Aldrich Z677272, Size M)

Splash protection

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatrill® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an Industrial Hygienist familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Eye protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Impervious clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES**Appearance**

Form	solid
Colour	no data available

Safety data

pH	no data available
Melting point/freezing point	Melting point/range: 252 - 254 °C (486 - 489 °F)
Boiling point	448 °C (838 °F)
Flash point	no data available
Ignition temperature	no data available
Auto-ignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	no data available
Density	no data available
Water solubility	insoluble
Partition coefficient: n-octanol/water	log Pow: 5.73
Relative vapor density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY**Chemical stability**

Stable under recommended storage conditions.

Possibility of hazardous reactions

no data available

Conditions to avoid

no data available

Materials to avoid

Strong oxidizing agents

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides

Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity**Oral LD50**

no data available

Inhalation LC50

no data available

Dermal LD50

no data available

Other information on acute toxicity

LD50 Intraperitoneal - mouse - > 320 mg/kg

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitization

no data available

Germ cell mutagenicity

Laboratory experiments have shown mutagenic effects.

In vitro tests showed mutagenic effects

Carcinogenicity

This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Possible human carcinogen

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Chrysene)

NTP: Known to be human carcinogen (Chrysene)

Reasonably anticipated to be a human carcinogen (Chrysene)

NTP: Known to be human carcinogen (Chrysene)

Reasonably anticipated to be a human carcinogen (Chrysene)

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)

no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

no data available

Aspiration hazard

no data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Synergistic effects

no data available

Additional Information

RTECS: Not available

12. ECOLOGICAL INFORMATION**Toxicity**

Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 1.90 mg/l - 2 h

Persistence and degradability

no data available

Bioaccumulative potential

no data available

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Very toxic to aquatic life with long lasting effects.

no data available

13. DISPOSAL CONSIDERATIONS**Product**

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION**DOT (US)**

Not dangerous goods

IMDG

UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Chrysene)
Marine Pollutant: Marine pollutant

IATA

UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Chrysene)

Further information

EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION**OSHA Hazards**

Carcinogen, Mutagen

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Chrysene	218-01-9	2007-03-01

SARA 311/312 Hazards

Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Chrysene	218-01-9	2007-03-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Chrysene	218-01-9	2007-03-01

New Jersey Right To Know Components

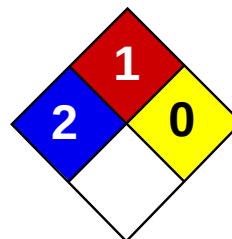
	CAS-No.	Revision Date
Chrysene	218-01-9	2007-03-01

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer. Chrysene	218-01-9	2007-09-28

16. OTHER INFORMATION**Further information**

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Health	2
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Copper MSDS

Section 1: Chemical Product and Company Identification

Product Name: Copper

Catalog Codes: SLC4939, SLC2152, SLC3943, SLC1150, SLC2941, SLC4729, SLC1936, SLC3727, SLC5515

CAS#: 7440-50-8

RTECS: GL5325000

TSCA: TSCA 8(b) inventory: Copper

CI#: Not available.

Synonym:

Chemical Name: Not available.

Chemical Formula: Cu

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
Copper	7440-50-8	100

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

Section 3: Hazards Identification

Potential Acute Health Effects:

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

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to lungs, 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. 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: Not available.

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: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

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

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. 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 breathe dust. Avoid contact with eyes. 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.

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: 1 (mg/m3) from ACGIH [1990] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 63.54 g/mole

Color: Not available.

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

Boiling Point: 2595°C (4703°F)

Melting Point: 1083°C (1981.4°F)

Critical Temperature: Not available.

Specific Gravity: 8.94 (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: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available. LC50: Not available.

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

Other Toxic Effects on Humans:

Very hazardous in case of ingestion. Hazardous in case 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: Human: passes through the placenta, excreted in maternal milk.

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: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: Copper Massachusetts RTK: Copper TSCA 8(b) inventory: Copper CERCLA: Hazardous substances.: Copper

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

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY 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.

Created: 10/09/2005 04:58 PM

Last Updated: 06/09/2012 12:00 PM

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Federal and State Regulations:

Pennsylvania RTK: Copper Massachusetts RTK: Copper TSCA 8(b) inventory: Copper CERCLA: Hazardous substances.: Copper

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

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY 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.

Created: 10/09/2005 04:58 PM

Last Updated: 06/09/2012 12:00 PM

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Material Safety Data Sheet

Version 5.0

Revision Date 10/26/2012

Print Date 04/11/2013

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : 4,4'-DDE

Product Number : 35487

Brand : Fluka

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Carcinogen, Harmful by ingestion.

GHS Classification

Acute toxicity, Oral (Category 4)

Carcinogenicity (Category 2)

Acute aquatic toxicity (Category 1)

Chronic aquatic toxicity (Category 4)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Warning

Hazard statement(s)

H302

Harmful if swallowed.

H351

Suspected of causing cancer.

H400

Very toxic to aquatic life.

H413

May cause long lasting harmful effects to aquatic life.

Precautionary statement(s)

P273

Avoid release to the environment.

P281

Use personal protective equipment as required.

HMIS Classification

Health hazard: 1

Chronic Health Hazard: *

Flammability: 0

Physical hazards: 0

NFPA Rating

Health hazard: 1

Fire: 0

Reactivity Hazard: 0

Potential Health Effects

Inhalation May be harmful if inhaled. May cause respiratory tract irritation.
Skin Harmful if absorbed through skin. May cause skin irritation.
Eyes May cause eye irritation.
Ingestion Harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms : 1,1-Dichloro-2,2-bis(4-chlorophenyl)ethene

Formula : C₁₄H₈Cl₄

Molecular Weight : 318.03 g/mol

Component		Concentration
2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene		
CAS-No.	72-55-9	-
EC-No.	200-784-6	

4. FIRST AID MEASURES

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Use personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE

Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols.

Provide appropriate exhaust ventilation at places where dust is formed. Normal measures for preventive fire protection.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Contains no substances with occupational exposure limit values.

Personal protective equipment

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Eye protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	solid
Colour	no data available

Safety data

pH	no data available
Melting point/freezing point	88.0 - 90.0 °C (190.4 - 194.0 °F)
Boiling point	no data available
Flash point	no data available
Ignition temperature	no data available
Autoignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	< 0.00001 hPa (< 0.00001 mmHg)
Density	no data available
Water solubility	no data available
Partition coefficient: n-octanol/water	log Pow: 6.51
Relative vapour	no data available

density	
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

no data available

Conditions to avoid

no data available

Materials to avoid

Strong oxidizing agents, Strong bases

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50

LD50 Oral - rat - 880.0 mg/kg

Inhalation LC50

no data available

Dermal LD50

no data available

Other information on acute toxicity

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitization

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

Limited evidence of carcinogenicity in animal studies

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a

carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)

no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

no data available

Aspiration hazard

no data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	Harmful if swallowed.
Skin	Harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Synergistic effects

no data available

Additional Information

RTECS: Not available

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to fish	LC50 - <i>Lepomis macrochirus</i> (Bluegill) - 0.2 - 0.3 mg/l - 96.0 h
	LC50 - <i>Oncorhynchus mykiss</i> (rainbow trout) - 0.03 - 0.04 mg/l - 96.0 h
	LC50 - <i>Salmo salar</i> (Atlantic salmon) - 0.05 - 0.18 mg/l - 96.0 h

Persistence and degradability

no data available

Bioaccumulative potential

Bioaccumulation	<i>Gambusia affinis</i> (Mosquito fish) - 33 d
	Bioconcentration factor (BCF): 12,037

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Very toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene)
Reportable Quantity (RQ): 1 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG

UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene)
Marine pollutant: Marine pollutant

IATA

UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene)

15. REGULATORY INFORMATION

OSHA Hazards

Carcinogen, Harmful by ingestion.

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene	72-55-9	2009-07-17

New Jersey Right To Know Components

	CAS-No.	Revision Date
2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene	72-55-9	2009-07-17

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer.	72-55-9	2010-06-11
2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene		

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.
2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene

CAS-No.
72-55-9

Revision Date
2010-06-11

16. OTHER INFORMATION**Further information**

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Material Safety Data Sheet

Version 5.0

Revision Date 10/11/2012

Print Date 04/11/2013

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : 4,4'-DDT

Product Number : C8894

Brand : Sigma

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Carcinogen, Toxic by ingestion, Toxic by skin absorption

Target Organs

Liver, Pancreas.

GHS Classification

Acute toxicity, Dermal (Category 3)

Acute toxicity, Oral (Category 3)

Carcinogenicity (Category 2)

Specific target organ toxicity - repeated exposure, Oral (Category 1)

Acute aquatic toxicity (Category 1)

Chronic aquatic toxicity (Category 4)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H301 + H311

Toxic if swallowed or in contact with skin

H351

Suspected of causing cancer.

H372

Causes damage to organs through prolonged or repeated exposure if swallowed.

H400

Very toxic to aquatic life.

H413

May cause long lasting harmful effects to aquatic life.

Precautionary statement(s)

P273

Avoid release to the environment.

P280

Wear protective gloves/ protective clothing.

P301 + P310

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

P314

Get medical advice/ attention if you feel unwell.

HMIS Classification

Health hazard: 2
Chronic Health Hazard: *
Flammability: 0
Physical hazards: 0

NFPA Rating

Health hazard: 2
Fire: 2
Reactivity Hazard: 0

Potential Health Effects

Inhalation May be harmful if inhaled. May cause respiratory tract irritation.
Skin Toxic if absorbed through skin. May cause skin irritation.
Eyes May cause eye irritation.
Ingestion Toxic if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Formula : C₁₄H₉Cl₅
Molecular Weight : 354.49 g/mol

Component		Concentration
1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane		
CAS-No.	50-29-3	-
EC-No.	200-024-3	
Index-No.	602-045-00-7	

4. FIRST AID MEASURES**General advice**

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES**Conditions of flammability**

Not flammable or combustible.

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas

6. ACCIDENTAL RELEASE MEASURES**Personal precautions**

Wear respiratory protection. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE**Precautions for safe handling**

Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place.

Recommended storage temperature: 2 - 8 °C

8. EXPOSURE CONTROLS/PERSONAL PROTECTION**Components with workplace control parameters**

Components	CAS-No.	Value	Control parameters	Basis
1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane	50-29-3	TWA	0.5 mg/m ³	USA. NIOSH Recommended Exposure Limits
Remarks	Potential Occupational Carcinogen See Appendix A			
		TWA	1 mg/m ³	USA. ACGIH Threshold Limit Values (TLV)
	Liver damage Confirmed animal carcinogen with unknown relevance to humans			
		TWA	1 mg/m ³	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
	Skin notation			
		TWA	1 mg/m ³	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
	Skin designation Substance listed; for more information see OSHA document 1910.1044			

Personal protective equipment**Respiratory protection**

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Immersion protection

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: > 480 min

Material tested: Dermatrill® (Aldrich Z677272, Size M)

Splash protection

Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: > 30 min
Material tested: Dermatrill® (Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 873000, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an Industrial Hygienist familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Eye protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	solid
Colour	no data available

Safety data

pH	no data available
Melting point/freezing point	107.0 - 109.0 °C (224.6 - 228.2 °F)
Boiling point	260.0 °C (500.0 °F)
Flash point	72.0 - 77.0 °C (161.6 - 170.6 °F)
Ignition temperature	no data available
Autoignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	0.0000021 hPa (0.0000016 mmHg) at 20.0 °C (68.0 °F)
Density	0.99 g/cm ³
Water solubility	no data available
Partition coefficient: n-octanol/water	log Pow: 6.91
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

no data available

Conditions to avoid

no data available

Materials to avoid

Oxidizing agents, Iron and iron salts.

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas

Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION**Acute toxicity****Oral LD50**

LD50 Oral - rat - 87.0 mg/kg

Inhalation LC50

no data available

Dermal LD50

LD50 Dermal - rabbit - 300.0 mg/kg

Remarks: Behavioral:Tremor. Behavioral:Muscle weakness. Behavioral:Ataxia.

Other information on acute toxicity

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitization

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

Limited evidence of carcinogenicity in animal studies

NTP: Reasonably anticipated to be a human carcinogen (1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane)

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)

no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

Ingestion - Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard

no data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	Toxic if swallowed.
Skin	Toxic if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

CNS stimulation.

Synergistic effects

no data available

Additional Information

RTECS: KJ3325000

12. ECOLOGICAL INFORMATION**Toxicity**

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 0.01 mg/l - 96.0 h
	LC50 - Lepomis macrochirus (Bluegill) - 0.01 mg/l - 96.0 h
	LC50 - Oncorhynchus mykiss (rainbow trout) - 0.003400 mg/l - 96.0 h
	LOEC - Oncorhynchus mykiss (rainbow trout) - 150 mg/l - 3.0 d
	NOEC - Oncorhynchus mykiss (rainbow trout) - 113 mg/l - 3.0 d
Toxicity to daphnia and other aquatic invertebrates	Immobilization EC50 - Daphnia magna (Water flea) - 0.00108 mg/l - 48 h
Toxicity to algae	LC100 - Scenedesmus quadricauda (Green algae) - > 20 mg/l - 7 d

Persistence and degradability**Bioaccumulative potential**

Bioaccumulation	Oncorhynchus mykiss (rainbow trout) - 20 d
	Bioconcentration factor (BCF): 46,670

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Very toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS**Product**

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 2811 Class: 6.1 Packing group: III
Proper shipping name: Toxic solids, organic, n.o.s. (1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane)
Reportable Quantity (RQ): 1 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG

UN number: 2811 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, ORGANIC, N.O.S. (1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane)
Marine pollutant: Marine pollutant

IATA

UN number: 2811 Class: 6.1 Packing group: III
Proper shipping name: Toxic solid, organic, n.o.s. (1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane)

15. REGULATORY INFORMATION

OSHA Hazards

Carcinogen, Toxic by ingestion, Toxic by skin absorption

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane	50-29-3	2007-03-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane	50-29-3	2007-03-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane	50-29-3	2007-03-01

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer.	50-29-3	1990-06-15
1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane		

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.	50-29-3	1990-06-15
1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane		

16. OTHER INFORMATION

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.



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Fax : 514-956-7504
Fax : 613-226-4229
Fax : 418-834-3774

1,1,-DICHLORETHYLENE- MATERIAL SAFETY DATA SHEET

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24 Hour EMERGENCY CONTACT

**U.S- CHEMTREC 1-800-
424-9300**

**CANADA- CANUTEC 613-
996-6666**

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

[Up to Table
of Contents](#)

Matheson Tri-Gas, Inc.

*The telephone numbers listed below are
emergency numbers, please contact your local
branch for routine inquiries.*

USA

959 Route 46 East
Parsippany, New Jersey
07054-0624 USA
Phone: 973-257-1100

CANADA

530 Watson Street
Whitby, Ontario
L1N 5R9 Canada
Phone: 905-668-3570

SUBSTANCE: 1,1-DICHLOROETHYLENE

SYMBOL: C₂H₂Cl₂

TRADE NAMES/SYNONYMS:

1,1-DICHLOROETHENE; 1,1-DICHLOROETHYLENE; VDC; VINYLIDENE CHLORIDE MONOMER; VINYLIDENE DICHLORIDE; VINYLIDENE CHLORIDE, INHIBITED; RCRA U078; UN 1303; C₂H₂CL₂; MAT25070; RTECS KV9275000

CHEMICAL FAMILY: halogens

CREATION DATE: Jan 24 1989

REVISION DATE: Mar 16 1999

2. COMPOSITION, INFORMATION ON INGREDIENTS

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COMPONENT: 1,1-DICHLOROETHYLENE

CAS NUMBER: 75-35-4

EC NUMBER (EINECS): 200-864-0

PERCENTAGE: >99.9

COMPONENT: 4-METHOXYPHENOL

CAS NUMBER: 150-76-5

EC NUMBER (EINECS): 205-769-8

PERCENTAGE: 0.02000

3. HAZARDS IDENTIFICATION

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

WHMIS CLASSIFICATION: BD2

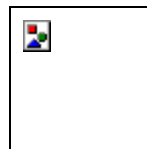
EC CLASSIFICATION (ASSIGNED):

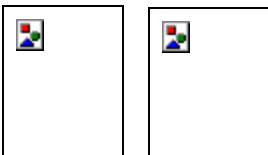
F+ Extremely Flammable

Xn Harmful

R 12-20-40

EC Classification may be inconsistent with independently-researched data.



**EMERGENCY OVERVIEW:**

Color: colorless

Physical Form: volatile liquid

Odor: faint odor, sweet odor

Major Health Hazards: harmful if swallowed, respiratory tract irritation, skin irritation, eye irritation, central nervous system depression

Physical Hazards: Flammable liquid and vapor. Vapor may cause flash fire. May polymerize. Containers may rupture or explode. May form peroxides during prolonged storage.

POTENTIAL HEALTH EFFECTS:**INHALATION:**

Short Term Exposure: irritation, symptoms of drunkenness, lung congestion, liver damage, convulsions

Long Term Exposure: kidney damage, tumors

SKIN CONTACT:

Short Term Exposure: irritation (possibly severe)

Long Term Exposure: same as effects reported in short term exposure

EYE CONTACT:

Short Term Exposure: irritation (possibly severe), eye damage

Long Term Exposure: same as effects reported in short term exposure

INGESTION:

Short Term Exposure: same as effects reported in short term exposure

Long Term Exposure: same as effects reported in short term exposure

CARCINOGEN STATUS:

OSHA: N

NTP: N

IARC: N

4. FIRST AID MEASURES

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INHALATION:

Remove from exposure immediately. Use a bag valve mask or similar device to perform artificial respiration (rescue breathing) if needed. Get medical attention.

SKIN CONTACT:

Remove contaminated clothing, jewelry, and shoes immediately. Wash with soap or mild detergent and large amounts of water until no evidence of chemical remains (at least 15-20 minutes). Get medical attention, if needed.

EYE CONTACT:

Wash eyes immediately with large amounts of water or normal saline, occasionally lifting upper and lower lids, until no evidence of chemical remains. Get medical attention immediately.

INGESTION:

If vomiting occurs, keep head lower than hips to help prevent aspiration. Get medical attention, if needed.

5. FIRE FIGHTING MEASURES

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FIRE AND EXPLOSION HAZARDS:

Severe fire hazard. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back. Vapor/air mixtures are explosive above flash point. Containers may rupture or explode if exposed to heat.

EXTINGUISHING MEDIA:

alcohol resistant foam, carbon dioxide, regular dry chemical, water

Large fires: Use alcohol-resistant foam or flood with fine water spray.

FIRE FIGHTING:

Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Evacuation radius: 800 meters (1/2 mile). Do not attempt to extinguish fire unless flow of material can be stopped first. Flood with fine water spray. Do not scatter spilled material with high-pressure water streams. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Water may be ineffective.

FLASH POINT:

14 F (-10 C)

LOWER FLAMMABLE LIMIT:

5.6%

UPPER FLAMMABLE LIMIT:

11.4%

AUTOIGNITION:

855 F (457 C)

FLAMMABILITY CLASS (OSHA):

IA

6. ACCIDENTAL RELEASE MEASURES

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AIR RELEASE:

Reduce vapors with water spray. Stay upwind and keep out of low areas.

SOIL RELEASE:

Dig holding area such as lagoon, pond or pit for containment. Dike for later disposal. Absorb with sand or other non-combustible material.

WATER RELEASE:

Collect with absorbent into suitable container. Collect spilled material using mechanical equipment.

OCCUPATIONAL RELEASE:

Avoid heat, flames, sparks and other sources of ignition. Remove sources of ignition. Stop leak if possible without personal risk. Reduce vapors with water spray. Small spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Large spills: Dike for later disposal. Keep unnecessary people away, isolate hazard area and deny entry. Stay upwind and keep out of low areas. Reportable Quantity (RQ): Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

7. HANDLING AND STORAGE

[Up to Table of Contents](#)

Store and handle in accordance with all current regulations and standards. Subject to storage regulations: U.S. OSHA 29 CFR 1910.106. Grounding and bonding required. Store in a cool, dry place. Store in a well-ventilated area. Keep in the dark. Keep separated from incompatible substances. Store outside or in a detached building. Store with flammable liquids. Store in a tightly closed container. Containers must have overpressure release device. Avoid heat, flames, sparks and other sources of ignition. Keep separated from incompatible substances. Monitor inhibitor content. Avoid exposure to low temperatures or freezing. May form explosive peroxides. Store in a tightly closed container. Avoid contact with light. Store in a cool, dry place. Monitor inhibitor content. Do not evaporate or distill to dryness. Keep separated from incompatible substances.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

[Up to Table of Contents](#)

EXPOSURE LIMITS:**1,1-DICHLOROETHYLENE:**

1 ppm (4 mg/m³) OSHA TWA (vacated by 58 FR 35338, June 30, 1993)

5 ppm (20 mg/m³) ACGIH TWA

20 ppm (80 mg/m³) ACGIH STEL

VENTILATION: Provide local exhaust ventilation system. Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from

NIOSH and/or OSHA.

At any detectable concentration -

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

Escape -

Any air-purifying respirator with a full facepiece and an organic vapor canister.

Any appropriate escape-type, self-contained breathing apparatus.

For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

Any self-contained breathing apparatus with a full facepiece.

9. PHYSICAL AND CHEMICAL PROPERTIES

[Up to Table of Contents](#)

PHYSICAL STATE: liquid

COLOR: colorless

PHYSICAL FORM: volatile liquid

ODOR: faint odor, sweet odor

MOLECULAR WEIGHT: 96.64

MOLECULAR FORMULA: C₂H₂CL₂

BOILING POINT: 86-90 F (30-32 C)

FREEZING POINT: -188 F (-122 C)

VAPOR PRESSURE: 400 mmHg @ 14.8 C

VAPOR DENSITY (air=1): 3.4

SPECIFIC GRAVITY (water=1): 1.213

WATER SOLUBILITY: 0.04% @ 20 C

PH: Not available

VOLATILITY: Not available

ODOR THRESHOLD: 500 ppm

EVAPORATION RATE: Not available

COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available

SOLVENT SOLUBILITY:

Soluble: organic solvents

10. STABILITY AND REACTIVITY

[Up to Table of Contents](#)

REACTIVITY:

May form explosive peroxides. Avoid contact with temperatures above -40 C. Avoid contact with heat, air, light or moisture and monitor inhibitor content. May polymerize. Closed containers may rupture violently.

CONDITIONS TO AVOID:

Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat.

INCOMPATIBILITIES:

metals, acids, oxidizing materials

HAZARDOUS DECOMPOSITION:

Thermal decomposition products: phosgene, halogenated compounds, oxides of carbon

POLYMERIZATION:

May polymerize. Avoid contact with heat or light and monitor inhibitor content.

11. TOXICOLOGICAL INFORMATION

[Up to Table of Contents](#)

VINYLDENE CHLORIDE:

TOXICITY DATA:

6350 ppm/4 hour(s) inhalation-rat LC50; 200 mg/kg oral-rat LD50

CARCINOGEN STATUS:

IARC: Human Inadequate Evidence, Animal Limited Evidence, Group 3; ACGIH: A3 -Animal Carcinogen

LOCAL EFFECTS:

Irritant: inhalation, skin, eye

ACUTE TOXICITY LEVEL:

Toxic: ingestion

Slightly Toxic: inhalation

TARGET ORGANS:

central nervous system, liver

TUMORIGENIC DATA:

Available.

MUTAGENIC DATA:

Available.

REPRODUCTIVE EFFECTS DATA:

Available.

12. ECOLOGICAL INFORMATION

[Up to Table of Contents](#)

ECOTOXICITY DATA:

FISH TOXICITY:

74000 ug/L 96 hour(s) LC50 (Mortality) Bluegill (*Lepomis macrochirus*)

INVERTEBRATE TOXICITY:

224000 ug/L 96 hour(s) LC50 (Mortality) Opossum shrimp (*Mysidopsis bahia*)

ALGAL TOXICITY:

>712000 ug/L 96 hour(s) EC50 (Photosynthesis) Diatom (*Skeletonema costatum*)

ENVIRONMENTAL SUMMARY:

Moderately toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

[Up to Table of Contents](#)

Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): U078. Hazardous Waste Number(s): D029. Dispose of in accordance with U.S. EPA 40 CFR 262 for concentrations at or above the Regulatory level. Regulatory level- 0.7 mg/L. Dispose in accordance with all applicable regulations.

14. TRANSPORT INFORMATION

[Up to Table of Contents](#)

U.S. DOT 49 CFR 172.101. SHIPPING NAME-UN NUMBER; HAZARD CLASS; PACKING GROUP; LABEL:

Vinylidene chloride, inhibited-UN1303; 3; I; Flammable liquid



15. REGULATORY INFORMATION

[Up to Table of Contents](#)

U.S. REGULATIONS:

TSCA INVENTORY STATUS: Y

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CERCLA SECTION 103 (40CFR302.4): Y

1,1-Dichloroethylene: 100 LBS RQ

SARA SECTION 302 (40CFR355.30): N

SARA SECTION 304 (40CFR355.40): N

SARA SECTION 313 (40CFR372.65): Y

1,1-Dichloroethylene

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40CFR370.21):

ACUTE: Y

CHRONIC: Y

FIRE: Y

REACTIVE: Y

SUDDEN RELEASE: Y

OSHA PROCESS SAFETY (29CFR1910.119): N

STATE REGULATIONS:

California Proposition 65: N

EUROPEAN REGULATIONS:

EC NUMBER (EINECS): 200-864-0

EC RISK AND SAFETY PHRASES:

R 12	Extremely flammable.
R 20	Harmful by inhalation.
R 40	Possible risks of irreversible effects.
S 2	Keep out of reach of children.
S 7	Keep container tightly closed.
S 16	Keep away from sources of ignition - No smoking.
S 29	Do not empty into drains.

CONCENTRATION LIMITS:

C>=12.5% Xn R 20-40

1%<=C<12.5% Xn R 40

16. OTHER INFORMATION

[Up to Table of Contents](#)

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Material Safety Data Sheet

cis-1,2-Dichloroethylene, 97%

ACC# 97773

Section 1 - Chemical Product and Company Identification

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

Acros Organics N.V.

One Reagent Lane

Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01**For emergencies in the US, call CHEMTREC:** 800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
156-59-2	cis-1,2-Dichloroethylene	97	205-859-7

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: Clear liquid. Flash Point: 6 deg C.

Warning! Flammable liquid and vapor. Harmful if inhaled. Unstabilized substance may polymerize. Causes eye and skin irritation. May be harmful if swallowed. May cause respiratory tract irritation.

Target Organs: Central nervous system, respiratory system, eyes, skin.

Potential Health Effects

Eye: Causes moderate eye irritation.

Skin: Causes moderate skin irritation. May cause dermatitis.

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

Inhalation: May cause respiratory tract irritation. May cause narcotic effects in high concentration. Eye irritation, vertigo, and nausea were reported in humans exposed at 2200 ppm.

Chronic: Not available. Some German investigators reported fatty degeneration of the liver upon repeated narcotic doses in rats and

Section 4 - First Aid Measures

Eyes: In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical aid.

Skin: In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes.

Get medical aid if irritation develops and persists. Wash clothing before reuse.

Ingestion: If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical aid.

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

Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors may form an explosive mixture with air. Use water spray to keep fire-exposed containers cool. Flammable liquid and vapor. Fire or excessive heat may result in violent rupture of the container due to bulk polymerization. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas. Hazardous polymerization may occur under fire conditions.

Extinguishing Media: Use water fog, dry chemical, carbon dioxide, or regular foam.

Flash Point: 6 deg C (42.80 deg F)

Autoignition Temperature: 440 deg C (824.00 deg F)

Explosion Limits, Lower: 9.70 vol %

Upper: 12.80 vol %

NFPA Rating: (estimated) Health: 2; Flammability: 3; Instability: 2

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Remove all sources of ignition. Use a spark-proof tool. Provide ventilation.

Section 7 - Handling and Storage

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

Storage: Keep away from sources of ignition. Store in a tightly closed container. Flammables-area. Store protected from light and air.

Section 8 - Exposure Controls, Personal Protection

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

Exposure Limits

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

OSHA Vacated PELs: cis-1,2-Dichloroethylene: No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes: Wear chemical splash goggles.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Section 9 - Physical and Chemical Properties

Physical State: Liquid

Appearance: Clear

Odor: Pleasant odor

pH: Not available.

Vapor Pressure: 201 mm Hg @ 25 deg C

Vapor Density: 3.34 (air=1)

Evaporation Rate: Not available.

Viscosity: Not available.

Boiling Point: 60 deg C @ 760 mm Hg

Freezing/Melting Point: -80 deg C

Decomposition Temperature: Not available.

Solubility: Insoluble.

Specific Gravity/Density: 1.2800

Molecular Formula: C₂H₂Cl₂

Molecular Weight: 96.94

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures. This material is a monomer and may polymerize under certain conditions if the stabilizer is lost.

Conditions to Avoid: Light, ignition sources, exposure to air, excess heat.

Incompatibilities with Other Materials: Strong oxidizing agents, strong bases, copper.

Hazardous Decomposition Products: Hydrogen chloride, phosgene, carbon monoxide, carbon dioxide.

Hazardous Polymerization: May occur.

Section 11 - Toxicological Information

RTECS#:

CAS# 156-59-2: KV9420000

LD50/LC50:

CAS# 156-59-2:

Inhalation, rat: LC50 = 13700 ppm;

Carcinogenicity:

CAS# 156-59-2: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: No data available.

Teratogenicity: No data available.

Reproductive Effects: No data available.

Mutagenicity: No data available.

Neurotoxicity: No data available.

Other Studies:

Section 12 - Ecological Information

No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series: None listed.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	DOT regulated - small quantity provisions apply (see 49CFR173.4)	1,2-DICHLOROETHYLENE
Hazard Class:		3
UN Number:		UN1150
Packing Group:		II

Section 15 - Regulatory Information

US FEDERAL

TSCA

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

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

None of the chemicals in this material have an RQ.

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

Section 313 No chemicals are reportable under Section 313.

Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

None of the chemicals in this product are listed as Priority Pollutants under the CWA.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 156-59-2 can be found on the following state right to know lists: Pennsylvania, Massachusetts.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations**European Labeling in Accordance with EC Directives****Hazard Symbols:**

XN F

Risk Phrases:

R 11 Highly flammable.

R 20 Harmful by inhalation.

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

Safety Phrases:

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

S 29 Do not empty into drains.

S 7 Keep container tightly closed.

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

WGK (Water Danger/Protection)

CAS# 156-59-2: No information available.

Canada - DSL/NDSL

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

Canada - WHMIS

WHMIS: Not available.

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

Canadian Ingredient Disclosure List

Section 16 - Additional Information

MSDS Creation Date: 2/09/1998

Revision #5 Date: 3/16/2007

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



MATERIAL SAFETY DATA SHEET

SECTION 1 – CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Company Address:

5301 Keystone Ct,
Rolling Meadows, IL 60008

Tel: 1-847-253-8868

Fax: 1-847-253-8877

Emergency: (CHEMTREC) 800-424-9300

Revision Date: April 8, 2013

Chemical Family: Chlorinated Unsaturated Hydrocarbon

Product Name: Trans-1,2-dichloroethylene

Synonyms: Trans-acetylene Dichloride; Trans-dichloroethylene; Trans; C₂H₂Cl₂

SECTION 2 – COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	CAS #	OSHA PEL	ACGIH TLV	NIOSH REL	Wt. %
Trans-1,2-Dichloroethylene	156-60-5	200	200	200	>99%

SECTION 3 – HAZARDS IDENTIFICATION

Emergency Overview:

WARNING! Flammable. May cause irritation to eyes and skin. Vapor harmful. Harmful if swallowed.

Potential Health Effects:

Inhalation: This product is a central nervous system depressant. Inhalation can cause irritation of the respiratory tract, dizziness, nausea, headache, loss of coordination and equilibrium, unconsciousness and even death in confined or poorly ventilated areas. Cardiac sensitization has occurred in dogs dosed at concentrations greater than 25%.

Eye: Eye contact can result in discomfort, pain, irritation and discharge. Washing of the eyes with water may result in corneal injury.

Skin: Prolonged contact such as occurs when material is trapped on the skin (e.g. under a glove) may result in severe irritation. Skin absorption is not expected to be of toxicological significance under normal industrial use.

Ingestion: Swallowing may irritate the mouth and GI tract as well as cause the effects listed for inhalation exposure. Vomiting may cause aspiration into the lungs that may lead to potentially fatal chemical pneumonia and pulmonary edema.

SECTION 4 – FIRST AID MEASURES

Inhalation: Remove from area to fresh air. If symptomatic, contact a poison control center, emergency room or physician for treatment information.

Eye: Remove contact lens and pour a gentle stream of warm water through the affected eye for at least 15 minutes. If irritation persists, contact a poison control center, emergency room, or physician as further treatment may be necessary.

Skin: Run a gentle stream of water over the affected area for 15 minutes. A mild soap may be used if available. If any symptoms persist, contact a poison control center, emergency room, or physician as further treatment may be necessary.

Ingestion: Gently wipe or rinse the inside of the mouth with water. Sips of water may be given if person is fully conscious. Never give anything by mouth to an unconscious or convulsing person. Do Not induce vomiting. Contact a poison control center, emergency room or physician right away as further treatment will be necessary.

SECTION 5 – FIRE FIGHTING MEASURES

Flash Point: 36 °F (closed cup)

LEL: 6.7%

UEL: 18%

Extinguishing Media: Water spray, carbon dioxide, dry chemical powder or appropriate foam.

Fire-Fighting Instruction: Emits toxic fumes under fire conditions. Vapor concentration in a confined or poorly ventilated area can be ignited upon contact with a high energy spark, flame, or high intensity source of heat. Vapors may travel a considerable distance to source of ignition and flash back. Vapor/air mixtures are explosive.

Fire-Fighting Equipment: NIOSH approved pressure demand, self-contained breathing apparatus and full protective clothing.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Spill/Leak Procedures: Immediately evacuate the area. Provide maximum ventilation. Unprotected personnel should move upwind of spill. Only personnel equipped with proper respiratory and eye/skin protection should be permitted in the area. Dike area to contain spill. Take precautions as necessary to prevent contamination of ground and surface waters. Recover spilled material on adsorbents, such as sawdust or vermiculite, and sweep into closed containers for disposal. After all visible traces, including ignitable vapors, have been removed, thoroughly wet vacuum the area. Do not flush to sewer. If area of spill is porous, remove as much earth and gravel, etc. as necessary and place in closed containers for disposal.

SECTION 7 – HANDLING AND STORAGE

Handling Precautions: Keep container closed when not in use. Store only in closed, properly labeled containers. Avoid contamination of water supplies. Handling, storage and use procedures must be carefully monitored to avoid spills or leaks. Any spill or leak has the potential to cause underground water contamination which may, if sufficiently severe, render a drinking water source unfit for human consumption.

Other Precautions: Contamination that does occur cannot be easily corrected. Do not use cutting or welding torches on drums that contained this product unless properly purged and cleaned. Vapors are heavier than air and will collect in low areas. This material can react with air to form explosive peroxide. Do not use in poorly ventilated or confined spaces without proper respiratory protection.

SECTION 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION

Ventilation Requirements: Use local exhaust or general room/dilution ventilation sufficient to maintain employee exposure below permissible exposure limits.



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Respiratory Protection: Use a half or full facepiece organic vapor chemical cartridge or canister respirator when concentrations exceed permissible limits. Use self-contained breathing apparatus (SCBA) or full facepiece airline respirator with auxiliary SCBA operated in the pressure demand mode for emergencies and for all work performed in storage vessels, poorly ventilated rooms, and other confined areas. Respirators must be approved by NIOSH. The respiratory use limitations made by NIOSH or the manufacturer must be observed. Respiratory protection programs must be in accordance with 29 CFR 1910.134

Eye/Face: Splash proof goggles and face shield.

Protective Gloves: Viton®.

Protective Clothing: Personal protective clothing and use of equipment must be in accordance with 29 CFR 1910.132 (general requirements), .133 (eye and face protection), and .13 (hand protection).

Special/Other: Boots, aprons, or chemical suits should be used when necessary to prevent skin contact.

NPFA and HMIS Codes	NPFA	HMIS
Health	2	2
Flammability	0	0
Reactivity	1	1

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Physical State: liquid	Water Solubility: slightly
Appearance: clear, colorless	Vapor Pressure: 400 mmHg @87 °F
Odor: Pleasant	pH: NA
Boiling Point: 118 °F (48 °C)	Relative Vapor Density: 3.34
Freezing Point: -58 °F (-50 °C)	Specific Gravity: 1.2565 (water =1)
Evaporation Rate: NA	Bulk Density: NA
Heat of Solution: NA	Volume % Volatile: NA

SECTION 10 – STABILITY AND REACTIVITY

Stability: Stable.

Conditions to Avoid: Steam, oxidizers, elevated temperatures, caustic soda, caustic potash. Shock sensitive compounds may be formed.

Hazardous Polymerization: Will not occur.

Incompatibility: Steam, oxidizers, elevated temperatures, caustic soda, caustic potash. Shock sensitive compounds may be formed.

Products of Decomposition: Hydrogen chloride gas. Oxides of carbon.

SECTION 11 – TOXICOLOGICAL INFORMATION

Acute Inhalation LC₅₀: (rat) 24,100 ppm (4 hours).

Acute Dermal LD₅₀: (rabbit) >5000 mg/kg.

Skin Irritation: Mildly to moderately irritating.

Eye Irritation: Moderately to severely irritating.

Acute Oral LD₅₀: Slight to very low toxicity.

Chronic Effects/Carcinogenicity: This product is NOT listed as a carcinogen or suspected carcinogen by NTP, IARC, or OSHA.

Medical Conditions Aggravated: None known.

Delayed Effects Of Overexposure:

Subchronic: A 90 day inhalation study exposing rats to 1,2-dichloroethylene reported no adverse effects on body weight, clinical observations, food consumption, clinical or anatomical pathology parameters, or liver cell proliferation. The no-observed-effect level (NOEL) for this study was 4000 ppm in rats that suggests a low order of toxicity by the inhalation.

In an NTP study, rats and mice were dose fed for a period of 13 weeks. No mortality, clinical observations of toxicity, or food consumption effects was noted in mice or rats. Minor reductions in body weights were observed in mice. Liver organ weights changes were reported in rats. Rats dosed at the highest level (50,000 ppm) showed a few abnormal clinical pathology findings.

Histopathology reports revealed no microscopic evidence of treatment-related target organ effects.

In separate 90-day drinking water studies, 1,2-dichloroethylene exposed rats and mice showed no does related effects in hematological, serological, and gross pathological, or urinary parameters.

MUTAGENESIS: Trans-1,2-dichloroethylene was not mutagenic to E-coli or S. Typhimurium when tested with microsomal activation. In another study, trans-1,2-dichloroethylene did not product mutations in Saccharomyces cerevisiae with or without microsomal activation. No genetic effects were reported in a vivo host mediated mutagenic assay.

REPRODUCTIVE/DEVELOPMENTAL: In a teratology study conducted in rats by the inhalation route of exposure, significant fetal toxicity (i.e., decreased body weight, increased skeletal variations) was observed only at maternally toxic concentrations (12,000 ppm). Based on the results of this study, trans-1,2-dichloroethylene would not be considered to be a developmental toxicant.

SECTION 12 – ECOLOGICAL INFORMATION

No information available for the product

SECTION 13 – DISPOSAL CONSIDERATIONS

Waste Disposal Method:

Contaminated sand, sawdust, vermiculite, soil or porous surface must be disposed of in a permitted hazardous waste management facility. Recovered liquids may be reprocessed or incinerated or must be treated in a permitted hazardous waste management facility. Care must be taken when using or disposing of chemical materials and/or their containers to prevent environmental contamination. It



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is your duty to dispose of the chemical materials and/or their containers in accordance with the Clean Air Act, the Clean Water Act, the Resource Conservation and Recovery Act, as well as any other relevant Federal, State, or local laws/regulations regarding disposal.

SECTION 14 – TRANSPORT INFORMATION

Proper Shipping Name: 1,2-Dichloroethylene

Hazard Class: 3 (Flammable Liquid)

UN Number: UN1150

Packing Group: II

USA-RQ, Hazardous Substance and Quantity: 1000 lbs./454 kg (1,2-trans- Dichloroethylene)

SECTION 15 – REGULATORY INFORMATION

USA TSCA: All components of this product are listed on the TSCA Inventory.

EUROPE EINECS: All components in this product are listed on EINECS or meet the polymer definition. (205-860-2)

CANADA DOMESTIC SUBSTANCES LIST (DSL): This product and/or all of its components are listed on the Canadian DSL.

AUSTRALIA AICS: All components of this product are listed on AICS.

KOREA ECL: All components in this product are listed on the Korean Existing Chemicals Inventory (KECI).

JAPAN MITI (ENCS): All components of this product are listed on MITI.

PHILIPPINES PICCS: One or more components in this product are not listed on the Phillipines Inventory of Chemical and Chemical Substances (PICCS). This product can only be used in R&D applications.

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart

B): Not regulated.

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart

C): Not regulated.

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370 Subparts B and C):

ACUTE: Yes

CHRONIC: No

FIRE: Yes

REACTIVE: Yes

SUDDEN RELEASE: No

SARA TITLE III SECTION 313 (40 CFR 372.65): 1,2-DICHLOROETHYLENE (ALL ISOMERS)

CERCLA Hazardous Substance: Listed in Table 302.4 of 40 CFR Part 302 as a hazardous substance with a reportable quantity of 1000 pounds. Releases to air, land or water which exceed the RQ must be reported to the National Response Center, 800-424-8802.

OSHA PROCESS SAFETY (29 CFR 1910.119): Not regulated

STATE REGULATIONS:

California Proposition 65: Not regulated.

CANADA INVENTORY (DSL/NDL): Not determined.

RCRA: Waste trans and contaminated soils/materials from spill cleanup are U079 hazardous waste as per 40 CFR 261.33 and must be disposed of accordingly under RCRA.

CANADA REGULATIONS (WHMIS): Class B2 - Flammable Liquids. Class D2B - Toxic Materials.

SECTION 16 – OTHER INFORMATION

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Material Safety Data Sheet

Version 5.0

Revision Date 10/24/2012

Print Date 04/11/2013

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Dieldrin

Product Number : 291218

Brand : Aldrich

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Target Organ Effect, Highly toxic by ingestion, Toxic by skin absorption, Carcinogen

Target Organs

Central nervous system, Liver, Blood

GHS Classification

Acute toxicity, Inhalation (Category 1)

Acute toxicity, Dermal (Category 3)

Acute toxicity, Oral (Category 2)

Carcinogenicity (Category 2)

Specific target organ toxicity - repeated exposure, Oral (Category 1)

Acute aquatic toxicity (Category 1)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H300 + H330

Fatal if swallowed or if inhaled

H311

Toxic in contact with skin.

H351

Suspected of causing cancer.

H372

Causes damage to organs through prolonged or repeated exposure if swallowed.

H400

Very toxic to aquatic life.

Precautionary statement(s)

P260

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

P264

Wash hands thoroughly after handling.

P273

Avoid release to the environment.

P280

Wear protective gloves/ protective clothing.

P284

Wear respiratory protection.

P310

Immediately call a POISON CENTER or doctor/ physician.

HMIS Classification

Health hazard: 4
Chronic Health Hazard: *
Flammability: 0
Physical hazards: 0

NFPA Rating

Health hazard: 4
Fire: 0
Reactivity Hazard: 0

Potential Health Effects

Inhalation May be fatal if inhaled. May cause respiratory tract irritation.
Skin Toxic if absorbed through skin. May cause skin irritation.
Eyes May cause eye irritation.
Ingestion May be fatal if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms : 1,2,3,4,10,10-Hexachloro-1,4,4a,5,6,7,8,8a-octahydro-6,7-epoxy-1,4:5,8-dimethanonaphthalene

Formula : C₁₂H₈Cl₆O

Molecular Weight : 380.91 g/mol

Component		Concentration
Dieldrin		
CAS-No.	60-57-1	-
EC-No.	200-484-5	
Index-No.	602-049-00-9	

4. FIRST AID MEASURES**General advice**

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES**Conditions of flammability**

Not flammable or combustible.

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Wear respiratory protection. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE**Precautions for safe handling**

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION**Components with workplace control parameters**

Components	CAS-No.	Value	Control parameters	Basis
Dieldrin	60-57-1	TWA	0.25 mg/m ³	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
Remarks	Skin notation			
		TWA	0.25 mg/m ³	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
	Skin designation			
		TWA	0.25 mg/m ³	USA. NIOSH Recommended Exposure Limits
	Potential Occupational Carcinogen See Appendix A Potential for dermal absorption			
		TWA	0.1 mg/m ³	USA. ACGIH Threshold Limit Values (TLV)
	Central Nervous System impairment Liver damage Reproductive effects 2010 Adoption Confirmed animal carcinogen with unknown relevance to humans Danger of cutaneous absorption			

Personal protective equipment**Respiratory protection**

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Eye protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the

concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	solid
Colour	no data available

Safety data

pH	no data available
Melting point/freezing point	Melting point/range: 143 - 144 °C (289 - 291 °F)
Boiling point	no data available
Flash point	no data available
Ignition temperature	no data available
Autoignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	no data available
Density	no data available
Water solubility	no data available
Partition coefficient: n-octanol/water	no data available
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

no data available

Conditions to avoid

no data available

Materials to avoid

Strong oxidizing agents

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50

LD50 Oral - mouse - 38.0 mg/kg

LD50 Oral - dog - 65.0 mg/kg

LD50 Oral - Monkey - 3.0 mg/kg

LD50 Oral - rabbit - 45.0 mg/kg

LD50 Oral - Pig - 38.0 mg/kg

LD50 Oral - guinea pig - 49.0 mg/kg

LD50 Oral - Hamster - 60.0 mg/kg

LD50 Oral - Pigeon - 23.7 mg/kg

LD50 Oral - Chicken - 20.0 mg/kg

Remarks: Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Eye:Miosis (pupillary constriction). Behavioral:Excitement. Behavioral:Food intake (animal).

LD50 Oral - Quail - 10.8 mg/kg

Remarks: Behavioral:Altered sleep time (including change in righting reflex). Behavioral:Somnolence (general depressed activity). Behavioral:Irritability.

LD50 Oral - Duck - 381.0 mg/kg

LD50 Oral - Mammal - 94.0 mg/kg

Remarks: Peripheral Nerve and Sensation:Flaccid paralysis without anesthesia (usually neuromuscular blockage). Behavioral:Tremor. Behavioral:Convulsions or effect on seizure threshold.

LD50 Oral - Bird (wild) - 13.3 mg/kg

LDLO Oral - rat - 30.0 mg/kg

Remarks: Liver:Other changes.

LDLO Oral - Human - male - 65.0 mg/kg

LDLO Oral - cat - 500 mg/kg

Remarks: Lungs, Thorax, or Respiration:Chronic pulmonary edema. Liver:Fatty liver degeneration. Kidney, Ureter, Bladder:Other changes.

TDLo Oral - rat - 140 mg/kg

Remarks: Liver:Other changes. Blood:Other changes. Biochemical:Enzyme inhibition, induction, or change in blood or tissue levels: Other esterases.

TDLo Oral - rat - 109 mg/kg

Remarks: Liver:Changes in liver weight.

TDLo Oral - rat - 88 mg/kg

Remarks: Behavioral:Food intake (animal). Nutritional and Gross Metabolic:Weight loss or decreased weight gain. Biochemical:Enzyme inhibition, induction, or change in blood or tissue levels: Phosphatases.

Inhalation LC50

no data available

Dermal LD50

LD50 Dermal - rabbit - 250.0 mg/kg

Other information on acute toxicity

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitization

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

Limited evidence of carcinogenicity in animal studies

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (Dieldrin)
NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)

no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

Ingestion - Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard

no data available

Potential health effects

Inhalation	May be fatal if inhaled. May cause respiratory tract irritation.
Ingestion	May be fatal if swallowed.
Skin	Toxic if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

Discomfort, Headache, Nausea, Vomiting, Dizziness, Tremors, tonic convulsions, clonic spasms, Coma., respiratory failure, To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Synergistic effects

no data available

Additional Information

RTECS: IO1750000

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to fish	mortality LC50 - Carassius auratus (goldfish) - 1.6 µg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates	Immobilization EC50 - Daphnia magna (Water flea) - 79.5 µg/l - 48 h

Persistence and degradability

no data available

Bioaccumulative potential

no data available

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Very toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS**Product**

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION**DOT (US)**

UN number: 2811 Class: 6.1 Packing group: I

Proper shipping name: Toxic solids, organic, n.o.s. (Dieldrin)

Reportable Quantity (RQ): 1 lbs

Marine pollutant: No

Poison Inhalation Hazard: No

IMDG

UN number: 2811 Class: 6.1 Packing group: I

EMS-No: F-A, S-A

Proper shipping name: TOXIC SOLID, ORGANIC, N.O.S. (Dieldrin)

Marine pollutant: Marine pollutant

IATA

UN number: 2811 Class: 6.1 Packing group: I

Proper shipping name: Toxic solid, organic, n.o.s. (Dieldrin)

IATA Passenger: Not permitted for transport

15. REGULATORY INFORMATION**OSHA Hazards**

Target Organ Effect, Highly toxic by ingestion, Toxic by skin absorption, Carcinogen

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

Dieldrin

CAS-No.
60-57-1

Revision Date
2010-08-02

Pennsylvania Right To Know Components

CAS-No.

Revision Date

Dieldrin	60-57-1	2010-08-02
New Jersey Right To Know Components		
Dieldrin	CAS-No. 60-57-1	Revision Date 2010-08-02
California Prop. 65 Components		
WARNING! This product contains a chemical known to the State of California to cause cancer.	CAS-No. 60-57-1	Revision Date 1990-06-15
Dieldrin		

16. OTHER INFORMATION

Further information

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Material Safety Data Sheet

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

DIESEL FUEL No. 2

Product Use: Fuel

Product Number(s): CPS220122 [See Section 16 for Additional Product Numbers]

Synonyms: 15 S Diesel Fuel 2, Alternative Low Aromatic Diesel (ALAD), Calco LS Diesel 2, Calco ULS DF2, Calco ULS Diesel 2, Chevron LS Diesel 2, Chevron ULS Diesel 2, Diesel Fuel Oil, Diesel Grade No. 2, Diesel No. 2-D S15, Diesel No. 2-D S500, Diesel No. 2-D S5000, Distillates, straight run, Gas Oil, HS Diesel 2, HS Heating Fuel 2, Light Diesel Oil Grade No. 2-D, LS Diesel 2, LS Heating Fuel 2, Marine Diesel, RR Diesel Fuel, Texaco Diesel, Texaco Diesel No. 2, Ultra Low Sulfur Diesel 2

Company Identification

Chevron Products Company
Marketing, MSDS Coordinator
6001 Bollinger Canyon Road
San Ramon, CA 94583
United States of America

Transportation Emergency Response

CHEMTREC: (800) 424-9300 or (703) 527-3887

Health Emergency

ChevronTexaco Emergency Information Center: Located in the USA. International collect calls accepted. (800) 231-0623 or (510) 231-0623

Product Information

MSDS Requests: (800) 689-3998 Technical Information: (510) 242-5357

SPECIAL NOTES: This MSDS covers all Chevron and Calco non-CARB Diesel No. 2 Fuels. The sulfur content is less than 0.5% (mass). Red dye is added to non-taxable fuel. (MSDS 6894)

SECTION 2 COMPOSITION/ INFORMATION ON INGREDIENTS

COMPONENTS	CAS NUMBER	AMOUNT
Diesel Fuel No. 2	68476-34-6	100 %wt/wt
Distillates, hydrodesulfurized, middle	64742-80-9	0 - 100 %wt/wt
Distillates, straight run middle (gas oil, light)	64741-44-2	0 - 100 %wt/wt
Kerosine	8008-20-6	0 - 25 %wt/wt
Kerosine, hydrodesulfurized	64742-81-0	0 - 25 %wt/wt
Distillates (petroleum), light catalytic cracked	64741-59-9	0 - 50 %wt/wt
Naphthalene	91-20-3	0.02 - 0.2 %wt/wt
Total sulfur	None	0 - 0.5 %wt/wt

SECTION 3 HAZARDS IDENTIFICATION

***** **EMERGENCY OVERVIEW**

- COMBUSTIBLE LIQUID AND VAPOR
- HARMFUL OR FATAL IF SWALLOWED - MAY CAUSE LUNG DAMAGE IF SWALLOWED
- CAUSES SKIN IRRITATION
- MAY CAUSE CANCER BASED ON ANIMAL DATA
- TOXIC TO AQUATIC ORGANISMS

IMMEDIATE HEALTH EFFECTS

Eye: Not expected to cause prolonged or significant eye irritation.

Skin: Contact with the skin causes irritation. Skin contact may cause drying or defatting of the skin. Symptoms may include pain, itching, discoloration, swelling, and blistering. Contact with the skin is not expected to cause an allergic skin response. Not expected to be harmful to internal organs if absorbed through the skin.

Ingestion: Because of its low viscosity, this material can directly enter the lungs, if swallowed, or if subsequently vomited. Once in the lungs it is very difficult to remove and can cause severe injury or death. May be irritating to mouth, throat, and stomach. Symptoms may include pain, nausea, vomiting, and diarrhea.

Inhalation: Mists of this material may cause respiratory irritation. Symptoms of respiratory irritation may include coughing and difficulty breathing. Breathing this material at concentrations above the recommended exposure limits may cause central nervous system effects. Central nervous system effects may include headache, dizziness, nausea, vomiting, weakness, loss of coordination, blurred vision, drowsiness, confusion, or disorientation. At extreme exposures, central nervous system effects may include respiratory depression, tremors or convulsions, loss of consciousness, coma or death.

DELAYED OR OTHER HEALTH EFFECTS:

Cancer: Prolonged or repeated exposure to this material may cause cancer. Whole diesel engine exhaust has been classified as a Group 2A carcinogen (probably carcinogenic to humans) by the International Agency for Research on Cancer (IARC). Diesel exhaust particulate has been classified as reasonably anticipated to be a human carcinogen in the National Toxicology Program's Ninth Report on Carcinogens. The National Institute of Occupational Safety and Health (NIOSH) has recommended that whole diesel exhaust be regarded as potentially causing cancer. Diesel engine exhaust is known to the State of California to cause cancer. Contains naphthalene, which has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

See Section 11 for additional information. Risk depends on duration and level of exposure.

SECTION 4 FIRST AID MEASURES

Eye: No specific first aid measures are required. As a precaution, remove contact lenses, if worn, and flush eyes with water.

Skin: Wash skin with water immediately and remove contaminated clothing and shoes. Get medical attention if any symptoms develop. To remove the material from skin, use soap and water. Discard contaminated clothing and shoes or thoroughly clean before reuse.

Ingestion: If swallowed, get immediate medical attention. Do not induce vomiting. Never give

anything by mouth to an unconscious person.

Inhalation: Move the exposed person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if breathing difficulties continue.

Note to Physicians: Ingestion of this product or subsequent vomiting may result in aspiration of light hydrocarbon liquid, which may cause pneumonitis.

SECTION 5 FIRE FIGHTING MEASURES

See Section 7 for proper handling and storage.

FIRE CLASSIFICATION:

OSHA Classification (29 CFR 1910.1200): Combustible liquid.

NFPA RATINGS: Health: 0 Flammability: 2 Reactivity: 0

FLAMMABLE PROPERTIES:

Flashpoint: (Pensky-Martens Closed Cup) 52 °C (125 °F) (Min)

Autoignition: 257 °C (494 °F)

Flammability (Explosive) Limits (% by volume in air): Lower: 0.6 Upper: 4.7

EXTINGUISHING MEDIA: Use water fog, foam, dry chemical or carbon dioxide (CO₂) to extinguish flames.

PROTECTION OF FIRE FIGHTERS:

Fire Fighting Instructions: For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.

Combustion Products: Highly dependent on combustion conditions. A complex mixture of airborne solids, liquids, and gases including carbon monoxide, carbon dioxide, and unidentified organic compounds will be evolved when this material undergoes combustion.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures: Eliminate all sources of ignition in the vicinity of the spill or released vapor. If this material is released into the work area, evacuate the area immediately. Monitor area with combustible gas indicator.

Spill Management: Stop the source of the release if you can do it without risk. Contain release to prevent further contamination of soil, surface water or groundwater. Clean up spill as soon as possible, observing precautions in Exposure Controls/Personal Protection. Use appropriate techniques such as applying non-combustible absorbent materials or pumping. All equipment used when handling the product must be grounded. A vapor suppressing foam may be used to reduce vapors. Use clean non-sparking tools to collect absorbed material. Where feasible and appropriate, remove contaminated soil. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations.

Reporting: Report spills to local authorities and/or the U.S. Coast Guard's National Response Center at (800) 424-8802 as appropriate or required.

SECTION 7 HANDLING AND STORAGE

Precautionary Measures: Liquid evaporates and forms vapor (fumes) which can catch fire and burn with explosive force. Invisible vapor spreads easily and can be set on fire by many sources such as pilot lights, welding equipment, and electrical motors and switches. Fire hazard is greater as liquid temperature rises above 29C (85F). Do not get in eyes, on skin, or on clothing. Do not

taste or swallow. Do not breathe vapor or fumes. Do not breathe mist. Wash thoroughly after handling. Keep out of the reach of children.

Unusual Handling Hazards: WARNING! Do not use as portable heater or appliance fuel. Toxic fumes may accumulate and cause death.

General Handling Information: Avoid contaminating soil or releasing this material into sewage and drainage systems and bodies of water.

Static Hazard: Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding may be necessary but may not, by themselves, be sufficient. Review all operations which have the potential of generating and accumulating an electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures. For more information, refer to OSHA Standard 29 CFR 1910.106, 'Flammable and Combustible Liquids', National Fire Protection Association (NFPA 77, 'Recommended Practice on Static Electricity', and/or the American Petroleum Institute (API) Recommended Practice 2003, 'Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents'.

General Storage Information: DO NOT USE OR STORE near heat, sparks, flames, or hot surfaces. USE AND STORE ONLY IN WELL VENTILATED AREA. Keep container closed when not in use.

Container Warnings: Container is not designed to contain pressure. Do not use pressure to empty container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid, and/or vapor) and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition. They may explode and cause injury or death. Empty containers should be completely drained, properly closed, and promptly returned to a drum reconditioner or disposed of properly.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONSIDERATIONS:

Consider the potential hazards of this material (see Section 3), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

ENGINEERING CONTROLS:

Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below the recommended exposure limits.

PERSONAL PROTECTIVE EQUIPMENT

Eye/Face Protection: No special eye protection is normally required. Where splashing is possible, wear safety glasses with side shields as a good safety practice.

Skin Protection: Wear protective clothing to prevent skin contact. Selection of protective clothing may include gloves, apron, boots, and complete facial protection depending on operations conducted. Suggested materials for protective gloves include: Chlorinated Polyethylene (or Chlorosulfonated Polyethylene), Nitrile Rubber, Polyurethane, Viton.

Respiratory Protection: Determine if airborne concentrations are below the recommended occupational exposure limits for jurisdiction of use. If airborne concentrations are above the acceptable limits, wear an approved respirator that provides adequate protection from this material, such as: Air-Purifying Respirator for Organic Vapors. When used as a fuel, this material can produce carbon monoxide in the exhaust. Determine if airborne concentrations are below the occupational exposure limit for carbon monoxide. If not, wear an approved positive-pressure air-

supplying respirator. Use a positive pressure air-supplying respirator in circumstances where air-purifying respirators may not provide adequate protection.

Occupational Exposure Limits:

Component	Agency	TWA	STEL	Ceiling	Notation
Diesel Fuel No. 2	ACGIH	100 mg/m3	--	--	Skin A3 total hydrocarbon
Diesel Fuel No. 2	CVX	--	1000 mg/m3	--	--
Kerosine	ACGIH	200 mg/m3	--	--	Skin A3 Total hydrocarbon vapor
Kerosine	CVX	--	1000 mg/m3	--	--
Kerosine, hydrodesulfurized	ACGIH	200 mg/m3	--	--	Skin A3 Total hydrocarbon vapor
Kerosine, hydrodesulfurized	CVX	--	1000 mg/m3	--	--
Naphthalene	ACGIH	10 ppm (weight)	15 ppm (weight)	--	Skin
Naphthalene	OSHA Z-1	50 mg/m3	--	--	--

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Attention: the data below are typical values and do not constitute a specification.

Color: Varies depending on specification

Physical State: Liquid

Odor: Petroleum odor

pH: Not Applicable

Vapor Pressure: 0.04 kPa (Approximate) @ 40 °C (104 °F)

Vapor Density (Air = 1): >1

Boiling Point: 175.6°C (348°F) - 370°C (698°F)

Solubility: Soluble in hydrocarbons; insoluble in water

Freezing Point: Not Applicable

Melting Point: Not Applicable

Specific Gravity: 0.8 - 0.88 @ 15.6°C (60.1°F) (Typical)

Viscosity: 1.9 cSt - 4.1 cSt @ 40°C (104°F)

SECTION 10 STABILITY AND REACTIVITY

Chemical Stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.

Incompatibility With Other Materials: May react with strong acids or strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.

Hazardous Decomposition Products: None known (None expected)

Hazardous Polymerization: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

IMMEDIATE HEALTH EFFECTS

Eye Irritation: The eye irritation hazard is based on evaluation of data for similar materials or product components.

Skin Irritation: The skin irritation hazard is based on evaluation of data for similar materials or product components.

Skin Sensitization: This material did not cause skin sensitization reactions in a Buehler guinea pig test.

Acute Dermal Toxicity: LD50: >5ml/kg (rabbit).

Acute Oral Toxicity: LD50: > 5 ml/kg (rat)

Acute Inhalation Toxicity: 4 hour(s) LC50: > 5mg/l (rat).

ADDITIONAL TOXICOLOGY INFORMATION:

This product contains gas oils.

CONCAWE (product dossier 95/107) has summarized current health, safety and environmental data available for a number of gas oils, typically hydrodesulfurized middle distillates, CAS 64742-80-9, straight-run middle distillates, CAS 64741-44-2, and/or light cat-cracked distillate CAS 64741-59-9. CARCINOGENICITY: All materials tested have caused the development of skin tumors in mice, but all featured severe skin irritation and sometimes a long latency period before tumors developed. Straight-run and cracked gas oil samples were studied to determine the influence of dermal irritation on the carcinogenic activity of middle distillates. At non-irritant doses the straight-run gas oil was not carcinogenic, but at irritant doses, weak activity was demonstrated. Cracked gas oils, when diluted with mineral oil, demonstrated carcinogenic activity irrespective of the occurrence of skin irritation. Gas oils were tested on male mice to study tumor initiating/promoting activity. The results demonstrated that while a straight-run gas oil sample was neither an initiator or promotor, a blend of straight-run and FCC stock was both a tumor initiator and a promoter.

GENOTOXICITY: Hydrotreated & hydrodesulfurized gas oils range in activity from inactive to weakly positive in in-vitro bacterial mutagenicity assays. Mouse lymphoma assays on straight-run gas oils without subsequent hydrodesulphurization gave positive results in the presence of S9 metabolic activation. In-vivo bone marrow cytogenetics and sister chromatic exchange assay exhibited no activity for straight-run components with or without hydrodesulphurization. Thermally or catalytically cracked gas oils tested with in-vitro bacterial mutagenicity assays in the presence of S9 metabolic activation were shown to be mutagenic. In-vitro sister chromatic exchange assays on cracked gas oil gave equivocal results both with and without S9 metabolic activation. In-vivo bone marrow cytogenetics assay was inactive for two cracked gas oil samples. Three hydrocracked gas oils were tested with in-vitro bacterial mutagenicity assays with S9, and one of the three gave positive results. Twelve distillate fuel samples were tested with in-vitro bacterial mutagenicity assays & with S9 metabolic activation and showed negative to weakly positive results. In one series, activity was shown to be related to the PCA content of samples tested. Two in-vivo studies were also conducted. A mouse dominant lethal assay was negative for a sample of diesel fuel. In the other study, 9 samples of No 2 heating oil containing 50% cracked stocks caused a slight increase in the number of chromosomal aberrations in bone marrow cytogenetics assays. DEVELOPMENTAL TOXICITY: Diesel fuel vapor did not cause fetotoxic or teratogenic effects when pregnant rats were exposed on days 6-15 of pregnancy. Gas oils were applied to the skin of pregnant rats daily on days 0-19 of gestation. All but one (coker light gas oil) caused fetotoxicity (increased resorptions, reduced litter weight, reduced litter size) at dose levels that were also maternally toxic.

This product contains naphthalene. GENERAL TOXICITY: Exposure to naphthalene has been reported to cause methemoglobinemia and/or hemolytic anemia, especially in humans deficient in the enzyme glucose-6-phosphate dehydrogenase. Laboratory animals given repeated oral doses of naphthalene have developed cataracts. REPRODUCTIVE TOXICITY AND BIRTH DEFECTS:

Naphthalene did not cause birth defects when administered orally to rabbits, rats, and mice during pregnancy, but slightly reduced litter size in mice at dose levels that were lethal to the pregnant females. Naphthalene has been reported to cross the human placenta. GENETIC TOXICITY: Naphthalene caused chromosome aberrations and sister chromatid exchanges in Chinese hamster ovary cells, but was not a mutagen in several other in-vitro tests. CARCINOGENICITY: In a study conducted by the National Toxicology Program (NTP), mice exposed to 10 or 30 ppm of naphthalene by inhalation daily for two years had chronic inflammation of the nose and lungs and increased incidences of metaplasia in those tissues. The incidence of benign lung tumors (alveolar/bronchiolar adenomas) was significantly increased in the high-dose female group but not in the male groups. In another two-year inhalation study conducted by NTP, exposure of rats to 10, 30, and 60 ppm naphthalene caused increases in the incidences of a variety of nonneoplastic lesions in the nose. Increases in nasal tumors were seen in both sexes, including olfactory neuroblastomas in females at 60 ppm and adenomas of the respiratory epithelium in males at all exposure levels. The relevance of these effects to humans has not been established. No carcinogenic effect was reported in a 2-year feeding study in rats receiving naphthalene at 41 mg/kg/day.

This product may contain significant amounts of Polynuclear Aromatic Hydrocarbons (PAH's) which have been shown to cause skin cancer after prolonged and frequent contact with the skin of test animals. Brief or intermittent skin contact with this product is not expected to have serious effects if it is washed from the skin. While skin cancer is unlikely to occur in human beings following use of this product, skin contact and breathing, of mists, vapors or dusts should be reduced to a minimum.

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY

96 hour(s) LC50: 21-210 mg/l (*Salmo gairdneri*)
48 hour(s) EC50: 20-210 mg/l (*Daphnia magna*)
72 hour(s) EC50: 2.6-25 mg/l (*Raphidocellus subcapitata*)
This material is expected to be toxic to aquatic organisms.

ENVIRONMENTAL FATE

On release to the environment the lighter components of diesel fuel will generally evaporate but depending on local environmental conditions (temperature, wind, mixing or wave action, soil type, etc.) the remainder may become dispersed in the water column or absorbed to soil or sediment. Diesel fuel would not be expected to be readily biodegradable. In a modified Strum test (OECD method 301B) approximately 40% biodegradation was recorded over 28 days. However, it has been shown that most hydrocarbon components of diesel fuel are degraded in soil in the presence of oxygen. Under anaerobic conditions, such as in anoxic sediments, rates of biodegradation are negligible.

SECTION 13 DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible. This material, if it must be discarded, may meet the criteria of a hazardous waste as defined by US EPA under RCRA (40 CFR 261) or other State and local regulations. Measurement of certain physical properties and analysis for regulated components may be necessary to make a correct determination. If this material is classified as a hazardous waste, federal law requires disposal at a licensed hazardous waste disposal facility.

SECTION 14 TRANSPORT INFORMATION

The description shown may not apply to all shipping situations. Consult 49CFR, or appropriate Dangerous Goods Regulations, for additional description requirements (e.g., technical name) and mode-specific or quantity-specific shipping requirements.

DOT Shipping Description: GAS OIL, Combustible Liquid, UN1202,III

IMO/IMDG Shipping Description: GAS OIL,3,UN1202,III, FLASH POINT SEE SECTION 5

ICAO/IATA Shipping Description: GAS OIL,3,UN1202,III,

SECTION 15 REGULATORY INFORMATION

EPCRA 311/312 CATEGORIES:

1. Immediate (Acute) Health Effects: YES 2. Delayed (Chronic) Health Effects: YES
3. Fire Hazard: YES 4. Sudden Release of Pressure Hazard: NO 5. Reactivity Hazard: NO

REGULATORY LISTS SEARCHED:

01-1=IARC Group 1	03=EPCRA 313
01-2A=IARC Group 2A	04=CA Proposition 65
01-2B=IARC Group 2B	05=MA RTK
02=NTP Carcinogen	06=NJ RTK
	07=PA RTK

The following components of this material are found on the regulatory lists indicated.

Diesel Fuel No. 2	07
Distillates, straight run middle (gas oil, light)	06
Kerosine	05, 06, 07
Naphthalene	01-2B, 02, 03, 04, 05, 06, 07

CERCLA REPORTABLE QUANTITIES(RQ)/EPCRA 302 THRESHOLD PLANNING QUANTITIES(TPQ):

Component	Component RQ	Component TPQ	Product RQ
Naphthalene	100 lbs	None	55556 lbs

CHEMICAL INVENTORIES:

All components comply with the following chemical inventory requirements: AICS (Australia), DSL (Canada), EINECS (European Union), IECSC (China), KECI (Korea), PICCS (Philippines), TSCA (United States).

NEW JERSEY RTK CLASSIFICATION:

Refer to components listed in Section 2. Under the New Jersey Right-to-Know Act L. 1983 Chapter 315 N.J.S.A. 34:5A-1 et. seq., the product is to be identified as follows: DIESEL FUEL

WHMIS CLASSIFICATION:

Class B, Division 3: Combustible Liquids
Class D, Division 2, Subdivision A: Very Toxic Material -
Carcinogenicity
Class D, Division 2, Subdivision B: Toxic Material -
Skin or Eye Irritation

SECTION 16 OTHER INFORMATION

NFPA RATINGS: Health: 0 Flammability: 2 Reactivity: 0

(0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme, PPE:- Personal Protection Equipment Index recommendation, *- Chronic Effect Indicator). These values are obtained using the guidelines or published evaluations prepared by the National Fire Protection Association (NFPA) or the National Paint and Coating Association (for HMIS ratings).

Additional Product Number(s): CPS225114, CPS225115, CPS225150, CPS266176, CPS270005, CPS270094, CPS270095, CPS270096, CPS271006, CPS272093, CPS272102, CPS272126, CPS272152, CPS272185, CPS272190, CPS272195, CPS272593, CPS272601, CPS272693, CPS272793, CPS273003, CPS273030, CPS273053, CPS275000

REVISION STATEMENT: This revision updates the following sections of this Material Safety Data Sheet: 1,8

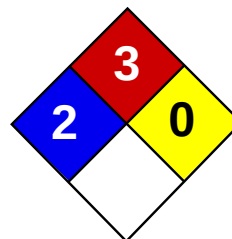
Revision Date: 02/14/2006

ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT:

TLV - Threshold Limit Value	TWA - Time Weighted Average
STEL - Short-term Exposure Limit	PEL - Permissible Exposure Limit
	CAS - Chemical Abstract Service Number
ACGIH - American Conference of Government Industrial Hygienists	IMO/IMDG - International Maritime Dangerous Goods Code
API - American Petroleum Institute	MSDS - Material Safety Data Sheet
CVX - ChevronTexaco	NFPA - National Fire Protection Association (USA)
DOT - Department of Transportation (USA)	NTP - National Toxicology Program (USA)
IARC - International Agency for Research on Cancer	OSHA - Occupational Safety and Health Administration

Prepared according to the OSHA Hazard Communication Standard (29 CFR 1910.1200) and the ANSI MSDS Standard (Z400.1) by the Chevron Texaco Energy Research & Technology Company, 100 Chevron Way, Richmond, California 94802.

The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Ethylbenzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Ethylbenzene

Catalog Codes: SLE2044

CAS#: 100-41-4

RTECS: DA0700000

TSCA: TSCA 8(b) inventory: Ethylbenzene

CI#: Not available.

Synonym: Ethyl Benzene; Ethylbenzol; Phenylethane

Chemical Name: Ethylbenzene

Chemical Formula: C₈H₁₀

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

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

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

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

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

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

Section 3: Hazards Identification

Potential Acute Health Effects:

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

Potential Chronic Health Effects:

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

Section 4: First Aid Measures

Eye Contact:

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

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

Serious Skin Contact: Not available.

Inhalation:

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

Serious Inhalation:

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

Ingestion:

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

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

Flash Points:

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

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

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

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

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Slightly explosive in presence of heat.

Fire Fighting Media and Instructions:

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

Special Remarks on Fire Hazards:

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

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

Section 6: Accidental Release Measures

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

Large Spill:

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

Section 7: Handling and Storage

Precautions:

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

Storage:

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

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

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

Personal Protection:

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

Personal Protection in Case of a Large Spill:

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

Exposure Limits:

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

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweetish. Gasoline-like. Aromatic.

Taste: Not available.

Molecular Weight: 106.16 g/mole

Color: Colorless.

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

Boiling Point: 136°C (276.8°F)

Melting Point: -94.9 (-138.8°F)

Critical Temperature: 617.15°C (1142.9°F)

Specific Gravity: 0.867 (Water = 1)

Vapor Pressure: 0.9 kPa (@ 20°C)

Vapor Density: 3.66 (Air = 1)

Volatility: 100% (v/v).

Odor Threshold: 140 ppm

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

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility:

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

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

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

Incompatibility with various substances: Reactive with oxidizing agents.

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

Special Remarks on Reactivity:

Can react vigorously with oxidizing materials. Sensitive to light.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation.

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

Chronic Effects on Humans:

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

Other Toxic Effects on Humans:

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

Special Remarks on Toxicity to Animals:

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

Special Remarks on Chronic Effects on Humans:

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

Special Remarks on other Toxic Effects on Humans:

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

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

Section 12: Ecological Information

Ecotoxicity:

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

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

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

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Ethylbenzene UNNA: 1175 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

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

Other Regulations:

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

Other Classifications:

WHMIS (Canada):

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

DSCL (EEC):

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

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

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

Section 16: Other Information**References:**

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

Other Special Considerations: Not available.

Created: 10/09/2005 05:28 PM

Last Updated: 06/09/2012 12:00 PM

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Material Safety Data Sheet

Version 5.0

Revision Date 09/10/2012

Print Date 04/11/2013

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : Heptachlor epoxide

Product Number : 49042

Brand : Supelco

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Highly toxic by ingestion, Carcinogen

Target Organs

Central nervous system, Liver, Blood

GHS Classification

Acute toxicity, Oral (Category 2)

Carcinogenicity (Category 2)

Acute aquatic toxicity (Category 1)

Chronic aquatic toxicity (Category 1)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H300

Fatal if swallowed.

H351

Suspected of causing cancer.

H410

Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P264

Wash hands thoroughly after handling.

P273

Avoid release to the environment.

P281

Use personal protective equipment as required.

P301 + P310

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

P501

Dispose of contents/ container to an approved waste disposal plant.

HMIS Classification

Health hazard:

3

Chronic Health Hazard:

*

Flammability: 0
Physical hazards: 0

NFPA Rating

Health hazard: 3
Fire: 0
Reactivity Hazard: 0

Potential Health Effects

Inhalation May be harmful if inhaled. May cause respiratory tract irritation.
Skin May be harmful if absorbed through skin. May cause skin irritation.
Eyes May cause eye irritation.
Ingestion May be fatal if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms : Heptachlor exo-epoxide
HCE
exo-1,4,5,6,7,8,8-Heptachloro-2,3-epoxy-4,7-methano-3a,4,7,7a-tetrahydroindane

Formula : $C_{10}H_5Cl_7O$
Molecular Weight : 389.32 g/mol

Component		Concentration
Heptachlor epoxide		
CAS-No.	1024-57-3	-
EC-No.	213-831-0	
Index-No.	602-063-00-5	

4. FIRST AID MEASURES

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability

Not flammable or combustible.

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Wear respiratory protection. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE**Precautions for safe handling**

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place.

Recommended storage temperature: 2 - 8 °C

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Contains no substances with occupational exposure limit values.

Personal protective equipment**Respiratory protection**

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Eye protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

9. PHYSICAL AND CHEMICAL PROPERTIES**Appearance**

Form	solid
Colour	no data available

Safety data

pH	no data available
Melting point/freezing point	157.0 - 161.0 °C (314.6 - 321.8 °F)
Boiling point	no data available
Flash point	no data available

Ignition temperature	no data available
Autoignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	no data available
Density	no data available
Water solubility	no data available
Partition coefficient: n-octanol/water	log Pow: 5.40
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

no data available

Conditions to avoid

no data available

Materials to avoid

Strong oxidizing agents

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50

LD50 Oral - rat - 15.0 mg/kg

LD50 Oral - mouse - 39.0 mg/kg

LD50 Oral - rabbit - 144.0 mg/kg

Inhalation LC50

no data available

Dermal LD50

no data available

Other information on acute toxicity

LD50 Intracerebral - mouse - 8 mg/kg

Remarks: Behavioral:Convulsions or effect on seizure threshold.

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitization

no data available

Germ cell mutagenicity

no data available

Carcinogenicity

This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

Limited evidence of carcinogenicity in animal studies

IARC:	2B - Group 2B: Possibly carcinogenic to humans (Heptachlor epoxide)
ACGIH:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)

no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

no data available

Aspiration hazard

no data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	May be fatal if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Synergistic effects

no data available

Additional Information

RTECS: PB9450000

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - 0.02 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates	LC50 - Daphnia magna (Water flea) - 0.24 mg/l - 48 h

Persistence and degradability

no data available

Bioaccumulative potential

Bioaccumulation	Pimephales promelas (fathead minnow) - 32 d
	Bioconcentration factor (BCF): 14,400

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS**Product**

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION**DOT (US)**

UN number: 2811 Class: 6.1 Packing group: II
Proper shipping name: Toxic solids, organic, n.o.s. (Heptachlor epoxide)
Reportable Quantity (RQ): 1 lbs
Marine pollutant: Marine pollutant
Poison Inhalation Hazard: No

IMDG

UN number: 2811 Class: 6.1 Packing group: II EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, ORGANIC, N.O.S. (Heptachlor epoxide)
Marine pollutant: No

IATA

UN number: 2811 Class: 6.1 Packing group: II
Proper shipping name: Toxic solid, organic, n.o.s. (Heptachlor epoxide)

15. REGULATORY INFORMATION**OSHA Hazards**

Highly toxic by ingestion, Carcinogen

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

Heptachlor epoxide

CAS-No.
1024-57-3Revision Date
1994-04-01**Pennsylvania Right To Know Components**

Heptachlor epoxide

CAS-No.
1024-57-3Revision Date
1994-04-01**New Jersey Right To Know Components**

Heptachlor epoxide

CAS-No.
1024-57-3Revision Date
1994-04-01**California Prop. 65 Components**WARNING! This product contains a chemical known to the State of
California to cause cancer.CAS-No.
1024-57-3Revision Date
2007-09-28

Heptachlor epoxide

16. OTHER INFORMATION**Further information**

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Skin Contact: Wash with soap and water. 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: 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: Flammable in presence of heat.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Explosive in presence of open flames and sparks, of heat.

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:

Chlorine Trifluoride reacts with iron with incandescence. Powdered iron reacts with fluorine below redness with incandescence. Reduced iron decomposes with nitrogen dioxide @ ordinary temperature with incandescence. Reacting mass formed by mixture of phosphorus and iron can become incandescent when heated. This material is flammable in powder form only.

Special Remarks on Explosion Hazards: Material in powdered form can explode when exposed to heat or 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.

Section 7: Handling and Storage

Precautions:

Do not ingest. Do not breathe dust. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids.

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

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. (Solid metallic powder.)

Odor: Odorless.

Taste: Tasteless.

Molecular Weight: 55.85 g/mole

Color: Black to Grey.

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

Boiling Point: 3000°C (5432°F)

Melting Point: 1535°C (2795°F)

Critical Temperature: Not available.

Specific Gravity: Density: 7.86 (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, diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, ignition sources, incompatible materials, water/moisture, air, dust generation.

Incompatibility with various substances:

Reactive with oxidizing agents, acids. Slightly reactive to reactive with moisture.

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

Special Remarks on Reactivity:

Hot iron(wire) burns in Chlorine gas. Violent decomposition of hydrogen peroxide (53% by weight or greater) may be caused by contact with iron. Readily oxidizes in moist air forming rust. Reactive with halogens. Incompatible with acetaldehyde, ammonium peroxodisulfate, chloroformamidine, chloric acid, ammonium nitrate, dinitrogen tetroxide, nitryl fluoride, polystyrene, sodium acetylide, potassium dichromate, peroxyformic acid, sulfuric acid, sodium carbide. Readily attacked by dilute mineral acids and/or attacked or dissolved by organic acids. Not appreciably attacked by cold sulfuric acid, or nitric acid, but is attacked by hot acids.

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): 30000 mg/kg [Rat].

Chronic Effects on Humans: May cause damage to the following organs: liver, cardiovascular system, upper respiratory tract, pancreas.

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: Iron metal filings or dust: May cause skin irritation by mechanical action. Iron metal wire: Not likely to cause skin irritation. Eyes: Iron metal filings or dust: Can irritate eyes by mechanical action. Iron metal wire: No hazard. Will not cause eye irritation. Inhalation: Iron dust: Can irritate the respiratory tract by mechanical action. Iron metal wire or filings: 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: Iron metal wire: Not an ingestion hazard. Iron metal filings or dust: The amount of ingested iron which constitutes a toxic dose is not well defined. Proposed toxic doses of elemental iron are 20 mg/kg for gastrointestinal irritation to greater than 60 mg/kg for systemic toxicity. Gastrointestinal effects are the first signs to appear, with hemorrhagic vomiting and diarrhea, hematochezia, abdominal pain, lethargy, metabolic acidosis, coagulopathy, shock, coma and convulsions developing from 0 to 6 hours after ingestion. Leukocytosis may also occur. An asymptomatic phase may ensue at 6 to 12 hours post-ingestion, followed by hypoglycemia or hyperglycemia, hepatic and renal failure, severe acidosis, cyanosis, fever, CNS depression (lethargy, restlessness and/or confusion/seizures), hypotension, and cardiovascular collapse/cardiac failure in 12 to 48 hours. Hepatic cirrhosis, gastrointestinal scarring and/or strictures may arise in 2 to 6 weeks. It may also cause an anaphylactoid reaction. Non-cardiogenic pulmonary edema also develops in severe cases of iron intoxication. Chronic Potential Health Effects: Inhalation: Chronic inhalation of iron dust can lead to accumulation in the lungs and a characteristic stippled appearance on X-rays. This condition, called SIDEROSIS, is considered benign in that it does not interfere with lung function and does not predispose to other disease. Chronic inhalation of iron dust may also cause fibrosis in the lungs. Ingestion: Clinical signs of iron overload appear when the total body iron is 5 to 10 times higher than normal. Neurobehavioral defects including depression, decreased activity, habituation, reflex startle, and conditioned avoidance response performance may occur. However, similar effects were also seen in iron deficiency. It is therefore likely that these behavioral effects are secondary to general toxicity. High serum iron levels may be associated with an increased risk of fatal acute myocardial infarction (MI). Skin: Prolonged or repeated contact may cause hypersensitivity.

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: : Metal powder, flammable, n.o.s. (Iron metal powder) UNNA: 3089 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California Director's List of Hazardous Substances: Iron Metal TSCA 8(b) inventory: Iron Metal

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS B-4: Flammable solid.

DSCL (EEC):

R11- Highly flammable. S16- Keep away from sources of ignition - No smoking. S22- Do not breathe dust.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 2

Reactivity: 1

Personal Protection: E

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

Health: 1

Flammability: 2

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

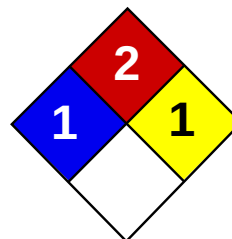
References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 05:52 PM

Last Updated: 06/09/2012 12:00 PM

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Health	1
Fire	2
Reactivity	1
Personal Protection	E

Material Safety Data Sheet

Iron Metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Iron Metal

Catalog Codes: SLI2047, SLI1996

CAS#: 7439-89-6

RTECS: NO4565500

TSCA: TSCA 8(b) inventory: Iron Metal

CI#: Not applicable.

Synonym:

Chemical Name: Iron

Chemical Formula: Fe

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
Iron Metal, powder	7439-89-6	100

Toxicological Data on Ingredients: Not applicable.

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. The substance may be toxic to liver, cardiovascular system, upper respiratory tract, pancreas. 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.



Material Safety Data Sheet

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SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Isobutylene Replacement Gas 10PPM, 100 PPM Isobutylene/Air

MANUFACTURER: 3M

DIVISION: Occupational Health & Environ. Safety

ADDRESS: 3M Center
St. Paul, MN 55144-1000

EMERGENCY PHONE: 1-800-364-3577 or (651) 737-6501 (24 hours)

Issue Date: 05/05/10

Supersedes Date: 06/13/07

Document Group: 23-0006-9

Product Use:

Intended Use: Calibration Gas

SECTION 2: INGREDIENTS

<u>Ingredient</u>	<u>C.A.S. No.</u>	<u>% by Wt</u>
NITROGEN	7727-37-9	Approximately 82
OXYGEN	7782-44-7	Approximately 18
ISOBUTYLENE	115-11-7	< 0.02

SECTION 3: HAZARDS IDENTIFICATION

3.1 EMERGENCY OVERVIEW

Specific Physical Form: Compressed Gas Cylinder under pressure (typically 500-1000 psig)

Odor, Color, Grade: colorless, no odor

General Physical Form: Gas

Immediate health, physical, and environmental hazards: Closed containers exposed to heat from fire may build pressure and explode. May cause target organ effects.

3.2 POTENTIAL HEALTH EFFECTS

Eye Contact:

No health effects are expected.

Skin Contact:

No health effects are expected.

Inhalation:

May be absorbed following inhalation and cause target organ effects.

Ingestion:

No health effects are expected.

Target Organ Effects:

Central Nervous System (CNS) Depression: Signs/symptoms may include headache, dizziness, drowsiness, incoordination, nausea, slowed reaction time, slurred speech, giddiness, and unconsciousness.

SECTION 4: FIRST AID MEASURES**4.1 FIRST AID PROCEDURES**

The following first aid recommendations are based on an assumption that appropriate personal and industrial hygiene practices are followed.

Eye Contact: No need for first aid is anticipated.

Skin Contact: No need for first aid is anticipated.

Inhalation: If signs/symptoms develop, remove person to fresh air. If signs/symptoms persist, get medical attention.

If Swallowed: No need for first aid is anticipated.

SECTION 5: FIRE FIGHTING MEASURES**5.1 FLAMMABLE PROPERTIES**

Autoignition temperature	<i>Not Applicable</i>
Flash Point	<i>Not Applicable</i>
Flammable Limits - LEL	<i>Not Applicable</i>
Flammable Limits - UEL	<i>Not Applicable</i>
OSHA Flammability Classification:	Not Determined

5.2 EXTINGUISHING MEDIA

Material will not burn.

5.3 PROTECTION OF FIRE FIGHTERS

Special Fire Fighting Procedures: Wear full protective equipment (Bunker Gear) and a self-contained breathing apparatus (SCBA).

Unusual Fire and Explosion Hazards: Closed containers exposed to heat from fire may build pressure and explode. No container should be exposed to a temperature higher than 82 degrees C (approximately 125 degrees F).

Note: See STABILITY AND REACTIVITY (SECTION 10) for hazardous combustion and thermal decomposition information.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Accidental Release Measures:

Evacuate unprotected and untrained personnel from hazard area. The spill should be cleaned up by qualified personnel. Ventilate the area with fresh air. Close cylinder. If the cylinder can't be closed, place in a well-ventilated area, preferably an operating exhaust hood, or if necessary outdoors.

Place in a closed container approved for transportation by appropriate authorities. Dispose of collected material as soon as possible. Observe precautions from other sections. Call 3M- HELPS line (1-800-364-3577) for more information on handling and managing the spill. Clean up residue.

In the event of a release of this material, the user should determine if the release qualifies as reportable according to local, state, and federal regulations.

SECTION 7: HANDLING AND STORAGE

7.1 HANDLING

For industrial or professional use only. Use general dilution ventilation and/or local exhaust ventilation to control airborne exposures to below Occupational Exposure Limits. If ventilation is not adequate, use respiratory protection equipment.

7.2 STORAGE

Store away from heat. Store out of direct sunlight.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 ENGINEERING CONTROLS

Not applicable.

8.2 PERSONAL PROTECTIVE EQUIPMENT (PPE)

8.2.1 Eye/Face Protection

Avoid eye contact.

The following eye protection(s) are recommended: Safety Glasses with side shields

8.2.2 Skin Protection

Not applicable. Gloves are not required.

8.2.3 Respiratory Protection

Under normal use conditions, airborne exposures are not expected to be significant enough to require respiratory protection.

8.2.4 Prevention of Swallowing

Not applicable.

8.3 EXPOSURE GUIDELINES

<u>Ingredient</u>	<u>Authority</u>	<u>Type</u>	<u>Limit</u>	<u>Additional Information</u>
BUTENES	ACGIH	TWA	250 ppm	
ISOBUTYLENE	ACGIH	TWA	250 ppm	

SOURCE OF EXPOSURE LIMIT DATA:

ACGIH: American Conference of Governmental Industrial Hygienists

CMRG: Chemical Manufacturer Recommended Guideline

OSHA: Occupational Safety and Health Administration

AIHA: American Industrial Hygiene Association Workplace Environmental Exposure Level (WEEL)

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Specific Physical Form:	Compressed Gas Cylinder under pressure (typically 500-1000 psig)
Odor, Color, Grade:	colorless, no odor
General Physical Form:	Gas
Autoignition temperature	<i>Not Applicable</i>
Flash Point	<i>Not Applicable</i>
Flammable Limits - LEL	<i>Not Applicable</i>
Flammable Limits - UEL	<i>Not Applicable</i>
Boiling point	-317.8 °F
Density	1.25 g/l
Vapor Density	1.00 [Ref Std: AIR=1]
Vapor Pressure	<i>Not Applicable</i>
Specific Gravity	<i>No Data Available</i>
pH	<i>Not Applicable</i>
Melting point	<i>Not Applicable</i>
Solubility In Water	<i>Not Applicable</i>
Evaporation rate	<i>Not Applicable</i>
Volatile Organic Compounds	<i>Not Applicable</i>
Kow - Oct/Water partition coef	<i>No Data Available</i>
Percent volatile	100 %
VOC Less H2O & Exempt Solvents	<i>Not Applicable</i>
Viscosity	<i>Not Applicable</i>
Conditions to avoid	Heat

SECTION 10: STABILITY AND REACTIVITY

Stability: Stable.

Materials and Conditions to Avoid:

10.1 Conditions to avoid

Heat

10.2 Materials to avoid

None known

Hazardous Polymerization: Hazardous polymerization will not occur.

Hazardous Decomposition or By-Products

Substance

None known.

Condition

Not Specified

SECTION 11: TOXICOLOGICAL INFORMATION

Please contact the address listed on the first page of the MSDS for Toxicological Information on this material and/or its components.

SECTION 12: ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL INFORMATION

Not determined.

CHEMICAL FATE INFORMATION

Not determined.

SECTION 13: DISPOSAL CONSIDERATIONS

Waste Disposal Method: Dispose of waste product in a facility permitted to accept chemical waste. Vent cylinder or pressurized container in an operating exhaust hood or remote area.

Dispose of empty cylinders in a landfill.

EPA Hazardous Waste Number (RCRA): Not regulated

Since regulations vary, consult applicable regulations or authorities before disposal.

SECTION 14: TRANSPORT INFORMATION

ID Number(s):

70-0714-8414-4, 70-0714-8416-9, 70-0714-8441-7, 70-0715-8274-9, 70-0715-8717-7

Please contact the emergency numbers listed on the first page of the MSDS for Transportation Information for this material.

SECTION 15: REGULATORY INFORMATION

US FEDERAL REGULATIONS

Contact 3M for more information.

311/312 Hazard Categories:

Fire Hazard - No Pressure Hazard - Yes Reactivity Hazard - No Immediate Hazard - Yes Delayed Hazard - No

STATE REGULATIONS

Contact 3M for more information.

CHEMICAL INVENTORIES

The components of this product are in compliance with the chemical notification requirements of TSCA.

Contact 3M for more information.

INTERNATIONAL REGULATIONS

Contact 3M for more information.

This MSDS has been prepared to meet the U.S. OSHA Hazard Communication Standard, 29 CFR 1910.1200.

SECTION 16: OTHER INFORMATION

NFPA Hazard Classification

Health: 0 **Flammability:** 0 **Reactivity:** 0 **Special Hazards:** None

National Fire Protection Association (NFPA) hazard ratings are designed for use by emergency response personnel to address the hazards that are presented by short-term, acute exposure to a material under conditions of fire, spill, or similar emergencies. Hazard ratings are primarily based on the inherent physical and toxic properties of the material but also include the toxic properties of combustion or decomposition products that are known to be generated in significant quantities.

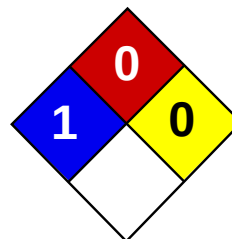
Revision Changes:

Section 1: Product name was modified.
Copyright was modified.
Section 3: Potential effects from inhalation information was modified.
Section 7: Handling information was modified.
Section 8: Skin protection phrase was modified.
Section 8: Eye/face protection information was modified.
Page Heading: Product name was modified.
Section 15: 311/312 Immediate Hazard score was modified.
Section 9: Property description for optional properties was modified.
Section 1: Initial issue message was modified.
Section 3: Other potential health effects heading was added.
Section 4: First aid for inhalation - termination of exposure - was added.
Section 4: First aid for inhalation - medical assistance - was added.
Section 3: Immediate other hazard(s) was added.
Section 3: Other health effects information was added.
Section 9: Property description for required properties was added.
Section 14: ID Number Heading Template 1 was added.
Section 14: ID Number(s) Template 1 was added.
Section 2: Ingredient table was added.
Section 8: Exposure guidelines ingredient information was added.
Section 8: Exposure guidelines data source legend was added.
Section 10.1 Conditions to avoid heading was added.
Section 10.2 Materials to avoid heading was added.
Section 6: Personal precautions information was added.
Section 6: Environmental procedures information was added.
Section 6: Methods for cleaning up information was added.
Section 10: Materials to avoid physical property was added.
Section 10: Conditions to avoid physical property was added.
Section 8: Hand protection information was added.
Section 6: Release measures information was deleted.
Section 10: Materials and conditions to avoid physical property was deleted.
Section 4: First aid for inhalation - none - was deleted.

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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 lungs by 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 absorbed 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, delirium, 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 colic), spasms, nausea, vomiting, headache, muscle weakness, hallucinations, distorted perceptions, "lead line" on the gums, metallic taste, loss of appetite, insomnia, dizziness and other symptoms similar to that of inhalation. Acute poisoning may result in high lead levels in the blood and urine, shock, coma and death in extreme cases. Lead metal foil, shot or sheets: Not an ingestion hazard for usual industrial handling.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations**Waste Disposal:**

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

Section 14: Transport Information

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

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information**Federal and State Regulations:**

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (female) which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (male) which would require a warning under the statute: Lead California prop. 65 (no significant risk level): Lead: 0.0005 mg/day (value) California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Lead Connecticut hazardous material survey.: Lead Illinois toxic substances disclosure to employee act: Lead Illinois chemical safety act: Lead New York release reporting list: Lead Rhode Island RTK hazardous substances: Lead Pennsylvania RTK: Lead

Other Regulations:

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

Other Classifications:

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

DSCL (EEC):

R20/22- Harmful by inhalation and if swallowed. R33- Danger of cumulative effects. R61- May cause harm to the unborn child. R62- Possible risk of impaired fertility. S36/37- Wear suitable protective clothing and gloves. S44- If you feel unwell, seek medical advice (show the label when possible). S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

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

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

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

Section 16: Other Information

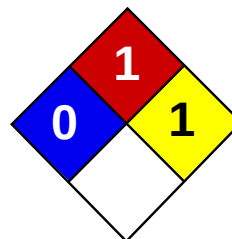
References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:21 PM

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

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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 which is highly flammable and explosive

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 usual 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. Ingestion 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.

Created: 10/09/2005 06:00 PM

Last Updated: 06/09/2012 12:00 PM

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Material Safety Data Sheet

Version 4.5

Revision Date 04/09/2013

Print Date 04/11/2013

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : 2-Mercaptobenzothiazole

Product Number : M3302

Brand : Aldrich

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Skin sensitiser

GHS Classification

Skin sensitisation (Category 1)

Acute aquatic toxicity (Category 1)

Chronic aquatic toxicity (Category 1)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Warning

Hazard statement(s)

H317

May cause an allergic skin reaction.

H410

Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P273

Avoid release to the environment.

P280

Wear protective gloves.

P501

Dispose of contents/ container to an approved waste disposal plant.

HMIS Classification

Health hazard: 2

Flammability: 1

Physical hazards: 0

NFPA Rating

Health hazard: 2

Fire: 1

Reactivity Hazard: 0

Potential Health Effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.
Ingestion	May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms : 2-Benzothiazolethiol

Formula : C₇H₅NS₂

Molecular Weight : 167.25 g/mol

Component		Concentration
Benzothiazole-2-thiol		
CAS-No.	149-30-4	90 - 100 %
EC-No.	205-736-8	
Index-No.	613-108-00-3	

4. FIRST AID MEASURES

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability

Not flammable or combustible.

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, nitrogen oxides (NO_x), Sulphur oxides

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Avoid breathing dust.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE

Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION**Components with workplace control parameters**

Components	CAS-No.	Value	Control parameters	Basis
Benzothiazole-2-thiol	149-30-4	TWA	5 mg/m ³	USA. Workplace Environmental Exposure Levels (WEEL)
Remarks	Skin Dermal Sensitization Notation			

Personal protective equipment**Respiratory protection**

For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatrill® (KCL 740 / Aldrich Z677272, Size M)

Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatrill® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Eye protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES**Appearance**

Form crystalline

Colour light yellow

Safety data

pH	no data available
Melting point/freezing point	Melting point/range: 177 - 181 °C (351 - 358 °F) - lit.
Boiling point	> 260 °C (> 500 °F) - Decomposes on heating.
Flash point	200 °C (392 °F) - closed cup
Ignition temperature	no data available
Auto-ignition temperature	no data available
Lower explosion limit	15 %(V)
Vapour pressure	no data available
Density	1.42 g/cm ³ at 20 °C (68 °F)
Water solubility	0.118 g/l at 25 °C (77 °F) - insoluble
Partition coefficient: n-octanol/water	log Pow: 2.41
Relative vapour density	no data available
Odour	pungent
Odour Threshold	no data available
Evapouration rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

no data available

Conditions to avoid

no data available

Materials to avoid

Oxidizing agents

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, nitrogen oxides (NO_x), Sulphur oxides
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD₅₀

LD₅₀ Oral - rat - male and female - 3,800 mg/kg

Inhalation LC₅₀

LC₅₀ Inhalation - rat - > 1,270 mg/m³

Dermal LD₅₀

LD₅₀ Dermal - rabbit - male and female - > 7,940 mg/kg

Other information on acute toxicity

no data available

Skin corrosion/irritation

Skin - rabbit - No skin irritation - 24 h

Serious eye damage/eye irritation

Eyes - rabbit - No eye irritation - 24 h

Respiratory or skin sensitisation

Buehler Test - guinea pig - May cause allergic skin reaction.

Maximisation Test - guinea pig - May cause allergic skin reaction.

Germ cell mutagenicity

Genotoxicity in vitro - Ames test - S. typhimurium - with and without metabolic activation - negative

Genotoxicity in vivo - mouse - male and female - Intraperitoneal - negative

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)

no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)

no data available

Aspiration hazard

no data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Synergistic effects

no data available

Additional Information

Repeated dose toxicity - rat - male and female - Lowest observed adverse effect level - 2,500 mg/kg
RTECS: DL6475000

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to fish	flow-through test LC50 - Oncorhynchus mykiss (rainbow trout) - 0.73 mg/l - 96 h Method: OECD Test Guideline 203
Toxicity to daphnia and other aquatic	Immobilization EC50 - Daphnia magna (Water flea) - 0.71 mg/l - 48 h Method: OECD Test Guideline 202

invertebrates

Toxicity to algae

Growth inhibition EC50 - Selenastrum capricornutum (green algae) - 0.5 mg/l - 72 h
Method: OECD Test Guideline 201

Persistence and degradability

Biodegradability

Biotic/Aerobic

Result: < 1 % - Not readily biodegradable.

Bioaccumulative potential

Bioaccumulation

Cyprinus carpio (Carp) - 42 d at 25 °C

Bioconcentration factor (BCF): < 0.8

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

Product

Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

Not dangerous goods

IMDG

UN number: 3077 Class: 9

Packing group: III

EMS-No: F-A, S-F

Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Benzothiazole-2-thiol)

Marine pollutant: Marine pollutant

IATA

UN number: 3077 Class: 9

Packing group: III

Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Benzothiazole-2-thiol)

Further information

EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

OSHA Hazards

Skin sensitiser

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

Benzothiazole-2-thiol

CAS-No.
149-30-4

Revision Date
2007-07-01

SARA 311/312 Hazards

Acute Health Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

Benzothiazole-2-thiol

CAS-No.
149-30-4Revision Date
2007-07-01**New Jersey Right To Know Components**

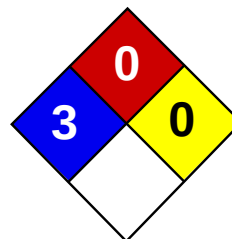
Benzothiazole-2-thiol

CAS-No.
149-30-4Revision Date
2007-07-01**California Prop. 65 Components**

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION**Further information**

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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; Hydragryum

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, tetracarbonylnickel, nitromethane, silver perchlorate, chlorates, sulfuric acid, nitrates,); tetracarbonylnickel, oxygen, acetylinic compounds, ammonia, ethylene oxide, methylsilane, calcium,

Special Remarks on Corrosivity:

The high mobility and tendency to dispersion exhibited by mercury, and the ease with which it forms alloys (amalgam) with many laboratory and electrical contact metals, can cause severe corrosion problems in laboratories. Special precautions: Mercury can attack copper and copper alloy materials.

Polymerization: Will not occur.

Section 11: Toxicological Information

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

Toxicity to Animals:

LD50: Not available. LC50: Not available.

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A5 (Not suspected for human.) by ACGIH. 3 (Not classifiable for human.) by IARC. May cause damage to the following organs: blood, kidneys, liver, brain, peripheral nervous system, central nervous system (CNS).

Other Toxic Effects on Humans:

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

May affect genetic material. May cause cancer based on animal data. Passes through the placental barrier in animal. May cause adverse reproductive effects(paternal effects- spermatogenesis; effects on fertility - fetotoxicity, post-implantation mortality), and birth defects.

Special Remarks on other Toxic Effects on Humans:

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

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

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Mercury UNNA: 2809 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Mercury California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Mercury Connecticut hazardous material survey.: Mercury Illinois toxic substances disclosure to employee act: Mercury Illinois chemical safety act: Mercury New York acutely hazardous substances: Mercury Rhode Island RTK hazardous substances: Mercury Pennsylvania RTK: Mercury Minnesota: Mercury Massachusetts RTK: Mercury New Jersey: Mercury New Jersey spill list: Mercury Louisiana spill reporting: Mercury California Director's List of Hazardous Substances.: Mercury TSCA 8(b) inventory: Mercury SARA 313 toxic chemical notification and release reporting: Mercury CERCLA: Hazardous substances.: Mercury: 1 lbs. (0.4536 kg)

Other Regulations:

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

Other Classifications:

WHMIS (Canada):

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

DSCL (EEC):

R23- Toxic by inhalation. R33- Danger of cumulative effects. R38- Irritating to skin. R41- Risk of serious damage to eyes. R50/53- Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. S2- Keep out of the

reach of children. S7- Keep container tightly closed. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S39- Wear eye/face protection. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S46- If swallowed, seek medical advice immediately and show this container or label. S60- This material and its container must be disposed of as hazardous waste. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 0

Personal Protection:

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

Health: 3

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:22 PM

Last Updated: 06/09/2012 12:00 PM

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Material Safety Data Sheet**1. MATERIAL AND COMPANY IDENTIFICATION**

Material Name : FormulaShell Motor Oil SAE 10W-40

Manufacturer/Supplier : SOPUS Products
PO Box 4427
Houston, TX 77210-4427
USA

MSDS Request : 877-276-7285

Emergency Telephone Number

Spill Information : 877-242-7400

Health Information : 877-504-9351

2. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Identity	CAS No.	Concentration
Distillates (petroleum), hydrotreated light paraffinic	64742-55-8	1.00 - 5.00 %

The highly refined mineral oil contains <3% (w/w) DMSO-extract, according to IP346.
Highly refined mineral oils and additives.

3. HAZARDS IDENTIFICATION

Emergency Overview	
Appearance and Odour	: Amber. Liquid at room temperature. Slight hydrocarbon.
Health Hazards	: Not classified as dangerous for supply or conveyance.
Safety Hazards	: Not classified as flammable but will burn.
Environmental Hazards	: Not classified as dangerous for the environment.

Health Hazards : Not expected to be a health hazard when used under normal conditions.

Health Hazards Inhalation : Under normal conditions of use, this is not expected to be a primary route of exposure.

Skin Contact : Prolonged or repeated skin contact without proper cleaning can clog the pores of the skin resulting in disorders such as oil acne/folliculitis.

Eye Contact : May cause slight irritation to eyes.

Ingestion : Low toxicity if swallowed.

Other Information : Used oil may contain harmful impurities.

Signs and Symptoms : Oil acne/folliculitis signs and symptoms may include formation of black pustules and spots on the skin of exposed areas.
Ingestion may result in nausea, vomiting and/or diarrhoea.

Aggravated Medical Condition : Pre-existing medical conditions of the following organ(s) or organ system(s) may be aggravated by exposure to this material: Skin.

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Environmental Hazards : Not classified as dangerous for the environment.
Additional Information : Under normal conditions of use or in a foreseeable emergency, this product does not meet the definition of a hazardous chemical when evaluated according to the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

4. FIRST AID MEASURES

General Information : Not expected to be a health hazard when used under normal conditions.
Inhalation : No treatment necessary under normal conditions of use. If symptoms persist, obtain medical advice.
Skin Contact : Remove contaminated clothing. Flush exposed area with water and follow by washing with soap if available. If persistent irritation occurs, obtain medical attention.
Eye Contact : Flush eye with copious quantities of water. If persistent irritation occurs, obtain medical attention.
Ingestion : In general no treatment is necessary unless large quantities are swallowed, however, get medical advice.
Advice to Physician : Treat symptomatically.

5. FIRE FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

Flash point : Typical 400 °C / 752 °F (COC)
Upper / lower : Typical 1 - 10 %(V)(based on mineral oil)
Flammability or
Explosion limits
Auto ignition temperature : > 320 °C / 608 °F
Specific Hazards : Hazardous combustion products may include: A complex mixture of airborne solid and liquid particulates and gases (smoke). Carbon monoxide. Unidentified organic and inorganic compounds.
Suitable Extinguishing Media : Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable Extinguishing Media : Do not use water in a jet.
Protective Equipment for Firefighters : Proper protective equipment including breathing apparatus must be worn when approaching a fire in a confined space.

6. ACCIDENTAL RELEASE MEASURES

Avoid contact with spilled or released material. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. See Chapter 13 for information on disposal. Observe all relevant local and international regulations.

Protective measures : Avoid contact with skin and eyes. Use appropriate containment to avoid environmental contamination. Prevent from spreading or entering drains, ditches or rivers by using sand, earth, or other appropriate barriers.
Clean Up Methods : Slippery when spilt. Avoid accidents, clean up immediately.

Material Safety Data Sheet

Prevent from spreading by making a barrier with sand, earth or other containment material. Reclaim liquid directly or in an absorbent. Soak up residue with an absorbent such as clay, sand or other suitable material and dispose of properly.

Additional Advice : Local authorities should be advised if significant spillages cannot be contained.

7. HANDLING AND STORAGE

General Precautions : Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material.

Handling : Avoid prolonged or repeated contact with skin. Avoid inhaling vapour and/or mists. When handling product in drums, safety footwear should be worn and proper handling equipment should be used.

Storage : Keep container tightly closed and in a cool, well-ventilated place. Use properly labelled and closeable containers. Storage Temperature: 0 - 50 °C / 32 - 122 °F

Recommended Materials : For containers or container linings, use mild steel or high density polyethylene.

Unsuitable Materials : PVC.

Additional Information : Polyethylene containers should not be exposed to high temperatures because of possible risk of distortion.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION**Occupational Exposure Limits**

Material	Source	Type	ppm	mg/m3	Notation
Oil mist, mineral	ACGIH	TWA(Mist.)		5 mg/m3	
Oil mist, mineral	ACGIH	STEL(Mist.)		10 mg/m3	
Distillates (petroleum), hydrotreated light paraffinic	ACGIH	TWA(Mist.)		5 mg/m3	
Distillates (petroleum), hydrotreated light paraffinic	ACGIH	STEL(Mist.)		10 mg/m3	

Material Safety Data Sheet

- Exposure Controls** : The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Adequate ventilation to control airborne concentrations. Where material is heated, sprayed or mist formed, there is greater potential for airborne concentrations to be generated.
- Personal Protective Equipment** : Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.
- Respiratory Protection** : No respiratory protection is ordinarily required under normal conditions of use. In accordance with good industrial hygiene practices, precautions should be taken to avoid breathing of material. If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are suitable, select an appropriate combination of mask and filter. Select a filter suitable for combined particulate/organic gases and vapours [boiling point >65 °C (149 °F)].
- Hand Protection** : Where hand contact with the product may occur the use of gloves approved to relevant standards (e.g. Europe: EN374, US: F739) made from the following materials may provide suitable chemical protection: PVC, neoprene or nitrile rubber gloves. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, glove thickness, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended.
- Eye Protection** : Wear safety glasses or full face shield if splashes are likely to occur.
- Protective Clothing** : Skin protection not ordinarily required beyond standard issue work clothes.
- Monitoring Methods** : Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate.
- Environmental Exposure Controls** : Minimise release to the environment. An environmental assessment must be made to ensure compliance with local environmental legislation.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance : Amber. Liquid at room temperature.

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Odour	: Slight hydrocarbon.
pH	: Data not available
Initial Boiling Point and Boiling Range	: > 280 °C / 536 °F estimated value(s)
Pour point	: Typical -20 °C / -4 °F
Flash point	: Typical 400 °C / 752 °F (COC)
Upper / lower Flammability or Explosion limits	: Typical 1 - 10 %(V) (based on mineral oil)
Auto-ignition temperature	: > 320 °C / 608 °F
Vapour pressure	: < 0.5 Pa at 20 °C / 68 °F (estimated value(s))
Specific gravity	: Typical 0.85
Density	: Typical 7.43 g/cm ³
Water solubility	: Negligible.
n-octanol/water partition coefficient (log Pow)	: > 6 (based on information on similar products)
Kinematic viscosity	: Typical 50 mm ² /s at 40 °C / 104 °F
Vapour density (air=1)	: > 1 (estimated value(s))
Evaporation rate (nBuAc=1)	: Data not available

10. STABILITY AND REACTIVITY

Stability	: Stable.
Conditions to Avoid	: Extremes of temperature and direct sunlight.
Materials to Avoid	: Strong oxidising agents.
Hazardous Decomposition Products	: Hazardous decomposition products are not expected to form during normal storage.

11. TOXICOLOGICAL INFORMATION

Basis for Assessment	: Information given is based on data on the components and the toxicology of similar products.
Acute Oral Toxicity	: Expected to be of low toxicity: LD50 > 5000 mg/kg , Rat
Acute Dermal Toxicity	: Expected to be of low toxicity: LD50 > 5000 mg/kg , Rabbit
Acute Inhalation Toxicity	: Not considered to be an inhalation hazard under normal conditions of use.
Skin Irritation	: Expected to be slightly irritating. Prolonged or repeated skin contact without proper cleaning can clog the pores of the skin resulting in disorders such as oil acne/folliculitis.
Eye Irritation	: Expected to be slightly irritating.
Respiratory Irritation	: Inhalation of vapours or mists may cause irritation.
Sensitisation	: Not expected to be a skin sensitiser.
Repeated Dose Toxicity	: Not expected to be a hazard.
Mutagenicity	: Not considered a mutagenic hazard.
Carcinogenicity	: Product contains mineral oils of types shown to be non-carcinogenic in animal skin-painting studies. Highly refined mineral oils are not classified as carcinogenic by the International Agency for Research on Cancer (IARC). Other components are not known to be associated with carcinogenic effects.
Reproductive and Developmental Toxicity	: Not expected to be a hazard.

Material Safety Data Sheet

Additional Information : Used oils may contain harmful impurities that have accumulated during use. The concentration of such impurities will depend on use and they may present risks to health and the environment on disposal. ALL used oil should be handled with caution and skin contact avoided as far as possible. Continuous contact with used engine oils has caused skin cancer in animal tests.

12. ECOLOGICAL INFORMATION

Ecotoxicological data have not been determined specifically for this product. Information given is based on a knowledge of the components and the ecotoxicology of similar products.

Acute Toxicity : Poorly soluble mixture. May cause physical fouling of aquatic organisms. Expected to be practically non toxic: LL/EL/IL50 > 100 mg/l (to aquatic organisms) (LL/EL50 expressed as the nominal amount of product required to prepare aqueous test extract). Mineral oil is not expected to cause any chronic effects to aquatic organisms at concentrations less than 1 mg/l.

Mobility : Liquid under most environmental conditions. Floats on water. If it enters soil, it will adsorb to soil particles and will not be mobile.

Persistence/degradability : Expected to be not readily biodegradable. Major constituents are expected to be inherently biodegradable, but the product contains components that may persist in the environment.

Bioaccumulation : Contains components with the potential to bioaccumulate.

Other Adverse Effects : Product is a mixture of non-volatile components, which are not expected to be released to air in any significant quantities. Not expected to have ozone depletion potential, photochemical ozone creation potential or global warming potential.

13. DISPOSAL CONSIDERATIONS

Material Disposal : Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations. Do not dispose into the environment, in drains or in water courses.

Container Disposal : Dispose in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the collector or contractor should be established beforehand.

Local Legislation : Disposal should be in accordance with applicable regional, national, and local laws and regulations.

14. TRANSPORT INFORMATION**US Department of Transportation Classification (49CFR)**

This material is not subject to DOT regulations under 49 CFR Parts 171-180.

Material Safety Data Sheet**IMDG**

This material is not classified as dangerous under IMDG regulations.

IATA (Country variations may apply)

This material is not classified as dangerous under IATA regulations.

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.

Federal Regulatory Status**Notification Status**

DSL	All components listed.
EINECS	All components listed.
TSCA	All components listed.

SARA Hazard Categories (311/312)

No SARA 311/312 Hazards.

State Regulatory Status**California Safe Drinking Water and Toxic Enforcement Act (Proposition 65)**

This material does not contain any chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

New Jersey Right-To-Know Chemical List

Distillates (petroleum), hydrotreated light paraffinic (64742- Listed.
55-8)

Pennsylvania Right-To-Know Chemical List

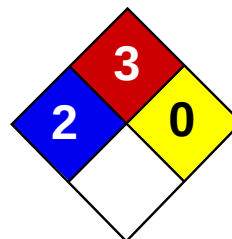
Distillates (petroleum), hydrotreated light paraffinic (64742- Listed.
55-8)

16. OTHER INFORMATION

NFPA Rating (Health, Fire, Reactivity)	: 0, 1, 0
MSDS Version Number	: 7.0

Material Safety Data Sheet

- MSDS Effective Date** : 07/07/2008
- MSDS Revisions** : A vertical bar (|) in the left margin indicates an amendment from the previous version.
- MSDS Regulation** : The content and format of this MSDS is in accordance with the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
- MSDS Distribution** : The information in this document should be made available to all who may handle the product.
- Disclaimer** : The information contained herein is based on our current knowledge of the underlying data and is intended to describe the product for the purpose of health, safety and environmental requirements only. No warranty or guarantee is expressed or implied regarding the accuracy of these data or the results to be obtained from the use of the product.



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Methyl tert-butyl ether MSDS

Section 1: Chemical Product and Company Identification

Product Name: Methyl tert-butyl ether

Catalog Codes: SLM2152

CAS#: 1634-04-4

RTECS: KN5250000

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

CI#: Not available.

Synonym:

Chemical Name: Methyl tert-Butyl Ether

Chemical Formula: C₅H₁₂O

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

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

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

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Methyl {tert-}butyl ether	1634-04-4	100

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

Section 3: Hazards Identification

Potential Acute Health Effects:

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

Potential Chronic Health Effects:

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

Section 4: First Aid Measures

Eye Contact:

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

Skin Contact:

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

Serious Skin Contact:

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

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

Serious Inhalation:

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

Ingestion:

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

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

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

Flammable Limits: LOWER: 2.5% UPPER: 15.1%

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

Fire Hazards in Presence of Various Substances: Flammable in presence of open flames and sparks.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

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

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

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

Large Spill:

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

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes.

Storage:

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

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

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

Personal Protection:

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

Personal Protection in Case of a Large Spill:

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

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Characteristic. (Strong.)

Taste: Not available.

Molecular Weight: 88.15 g/mole

Color: Clear Colorless.

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

Boiling Point: 55.2°C (131.4°F)

Melting Point: -109°C (-164.2°F)

Critical Temperature: Not available.

Specific Gravity: 0.7405 (Water = 1)

Vapor Pressure: 245 mm of Hg (@ 20°C)

Vapor Density: 3.1 (Air = 1)

Volatility: 100% (v/v).

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

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

Solubility:

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

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

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

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 4000 mg/kg [Rat]. Acute toxicity of the vapor (LC50): 23576 ppm 4 hour(s) [Rat].

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

Other Toxic Effects on Humans:

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

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

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

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

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

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

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

Other Classifications:

WHMIS (Canada):

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

DSCL (EEC):

R11- Highly flammable. R38- Irritating to skin. R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

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

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:23 PM

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

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Material Safety Data Sheet

Version 5.0

Revision Date 02/22/2013

Print Date 04/11/2013

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : *N*-Nitrosodimethylamine

Product Number : N3632

Brand : Sigma

Supplier : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

Emergency Phone # (For both supplier and manufacturer) : (314) 776-6555

Preparation Information : Sigma-Aldrich Corporation
Product Safety - Americas Region
1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Combustible Liquid, Carcinogen, Highly toxic by inhalation, Highly toxic by ingestion

Target Organs

Liver, Kidney, Lungs, Bladder

GHS Classification

Flammable liquids (Category 4)

Acute toxicity, Oral (Category 2)

Acute toxicity, Inhalation (Category 1)

Carcinogenicity (Category 1B)

Specific target organ toxicity - repeated exposure (Category 1)

Acute aquatic toxicity (Category 2)

Chronic aquatic toxicity (Category 2)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H227

Combustible liquid

H300 + H330

Fatal if swallowed or if inhaled

H350

May cause cancer.

H372

Causes damage to organs through prolonged or repeated exposure.

H411

Toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P201

Obtain special instructions before use.

P260

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

P264

Wash hands thoroughly after handling.

P273

Avoid release to the environment.

P284 Wear respiratory protection.
P310 Immediately call a POISON CENTER or doctor/ physician.

HMIS Classification

Health hazard: 3
Chronic Health Hazard: *
Flammability: 2
Physical hazards: 0

NFPA Rating

Health hazard: 4
Fire: 2
Reactivity Hazard: 0

Potential Health Effects

Inhalation May be fatal if inhaled. May cause respiratory tract irritation.
Skin May be harmful if absorbed through skin. May cause skin irritation.
Eyes May cause eye irritation.
Ingestion May be fatal if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms : Dimethylnitrosamine

Formula : C₂H₆N₂O

Molecular Weight : 74.08 g/mol

Component		Concentration
N-Nitrosodimethylamine		
CAS-No.	62-75-9	-
EC-No.	200-549-8	
Index-No.	612-077-00-3	

4. FIRST AID MEASURES

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability

Flammable in the presence of a source of ignition when the temperature is above the flash point. Keep away from heat/sparks/open flame/hot surface. No smoking.

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, nitrogen oxides (NOx)

Hazardous decomposition products formed under fire conditions. - Nature of decomposition products not known.

Hazardous decomposition products formed under fire conditions. - Carbon oxides, nitrogen oxides (NOx)

Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES**Personal precautions**

Wear respiratory protection. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13). Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE**Precautions for safe handling**

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Recommended storage temperature: 2 - 8 °C

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Contains no substances with occupational exposure limit values.

Personal protective equipment**Respiratory protection**

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Eye protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	liquid
Colour	yellow

Safety data

pH	no data available
Melting point/freezing point	no data available
Boiling point	153 °C (307 °F) at 1,032 hPa (774 mmHg) - lit.
Flash point	61.0 °C (141.8 °F) - closed cup
Ignition temperature	no data available
Auto-ignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	no data available
Density	1.01 g/cm ³
Water solubility	soluble
Partition coefficient: n-octanol/water	no data available
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

no data available

Conditions to avoid

Heat, flames and sparks.

Materials to avoid

Strong oxidizing agents

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, nitrogen oxides (NO_x)

Hazardous decomposition products formed under fire conditions. - Nature of decomposition products not known.

Hazardous decomposition products formed under fire conditions. - Carbon oxides, nitrogen oxides (NO_x)

Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD₅₀

LD₅₀ Oral - rat - 37.0 mg/kg

Inhalation LC₅₀

LC₅₀ Inhalation - rat - 4 h - 78 ppm

Dermal LD50
no data available

Other information on acute toxicity
no data available

Skin corrosion/irritation
no data available

Serious eye damage/eye irritation
no data available

Respiratory or skin sensitisation
no data available

Germ cell mutagenicity
Laboratory experiments have shown mutagenic effects.

Carcinogenicity

This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Possible human carcinogen

IARC: 2A - Group 2A: Probably carcinogenic to humans (N-Nitrosodimethylamine)

NTP: Reasonably anticipated to be a human carcinogen (N-Nitrosodimethylamine)

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)
no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)
Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard
no data available

Potential health effects

Inhalation	May be fatal if inhaled. May cause respiratory tract irritation.
Ingestion	May be fatal if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Synergistic effects
no data available

Additional Information
RTECS: IQ0525000

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to fish LC50 - Pimephales promelas (fathead minnow) - 832.00 - 1,062.00 mg/l - 96 h

Toxicity to algae EC50 - Pseudokirchneriella subcapitata (green algae) - 4.00 mg/l - 96 h

Persistence and degradability

no data available

Bioaccumulative potential

no data available

Mobility in soil

no data available

PBT and vPvB assessment

no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

Product

This combustible material may be burned in a chemical incinerator equipped with an afterburner and scrubber. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3382 Class: 6.1 Packing group: I
Proper shipping name: Toxic by inhalation liquid, n.o.s. (N-Nitrosodimethylamine)
Reportable Quantity (RQ): 10 lbs
Marine pollutant: No
Poison Inhalation Hazard: Hazard zone B

IMDG

UN number: 3382 Class: 6.1 Packing group: I EMS-No: F-A, S-A
Proper shipping name: TOXIC BY INHALATION LIQUID, N.O.S. (N-Nitrosodimethylamine)
Marine pollutant: No

IATA

UN number: 3382 Class: 6.1
Proper shipping name: Toxic by inhalation liquid, n.o.s. (N-Nitrosodimethylamine)
IATA Passenger: Not permitted for transport
IATA Cargo: Not permitted for transport

15. REGULATORY INFORMATION

OSHA Hazards

Combustible Liquid, Carcinogen, Highly toxic by inhalation, Highly toxic by ingestion

SARA 302 Components

The following components are subject to reporting levels established by SARA Title III, Section 302:

	CAS-No.	Revision Date
N-Nitrosodimethylamine	62-75-9	2008-11-03

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
N-Nitrosodimethylamine	62-75-9	2008-11-03

SARA 311/312 Hazards

Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

N-Nitrosodimethylamine

CAS-No.
62-75-9Revision Date
2008-11-03**Pennsylvania Right To Know Components**

N-Nitrosodimethylamine

CAS-No.
62-75-9Revision Date
2008-11-03**New Jersey Right To Know Components**

N-Nitrosodimethylamine

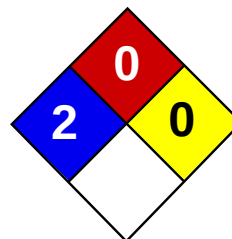
CAS-No.
62-75-9Revision Date
2008-11-03**California Prop. 65 Components**WARNING! This product contains a chemical known to the State of
California to cause cancer.

N-Nitrosodimethylamine

CAS-No.
62-75-9Revision Date
2007-09-28

16. OTHER INFORMATION**Further information**

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.



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] Inhalation Consult 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 coronary 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.

Created: 10/10/2005 08:42 PM

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

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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 °C (285.8 °F)

EXTINGUISHING MEDIA: PCBs are fire-resistant compounds.

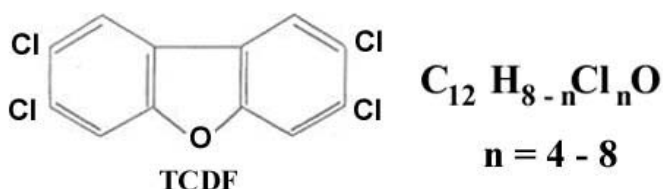
FIRE-FIGHTING PROCEDURES

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.

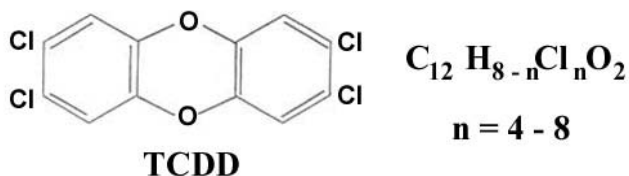
UNUSUAL FIRE/EXPLOSION HAZARD

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.

Note: 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:



2,3,7,8-tetrachlorodibenzofuran



2,3,7,8-tetrachloro-dibenzo-p-dioxin

Note: 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 OSHA 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

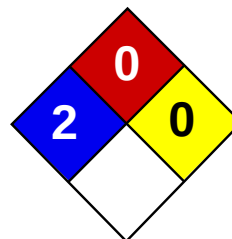
- **Vapour pressure:** (mm Hg @100 °F) 0.005 - 0.00006
- **Viscosity:** (CENTISTOKES) 3.6 - 540
- **Stability indicator/materials to avoid:** Yes
- **Stability Condition to Avoid:** PCBs are very stable, fire-resistant compounds.

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.



Health	2
Fire	0
Reactivity	0
Personal Protection	G

Material Safety Data Sheet

Tetrachloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Tetrachloroethylene

Catalog Codes: SLT3220

CAS#: 127-18-4

RTECS: KX3850000

TSCA: TSCA 8(b) inventory: Tetrachloroethylene

CI#: Not available.

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

Chemical Name: Ethylene, tetrachloro-

Chemical Formula: C₂-Cl₄

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

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

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

Order Online: ScienceLab.com

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

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

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

Section 2: Composition and Information on Ingredients

Composition:

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

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

Section 3: Hazards Identification

Potential Acute Health Effects:

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

Potential Chronic Health Effects:

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

Section 4: First Aid Measures

Eye Contact:

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

Skin Contact:

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

Serious Skin Contact:

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

Inhalation:

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

Serious Inhalation:

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

Ingestion:

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

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

Large Spill:

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

Section 7: Handling and Storage

Precautions:

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

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

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

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

Personal Protection:

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

Personal Protection in Case of a Large Spill:

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

Exposure Limits:

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

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Ethereal.

Taste: Not available.

Molecular Weight: 165.83 g/mole

Color: Clear Colorless.

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

Boiling Point: 121.3°C (250.3°F)

Melting Point: -22.3°C (-8.1°F)

Critical Temperature: 347.1°C (656.8°F)

Specific Gravity: 1.6227 (Water = 1)

Vapor Pressure: 1.7 kPa (@ 20°C)

Vapor Density: 5.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 5 - 50 ppm

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

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:

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

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

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

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

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

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

Polymerization: Will not occur.

Section 11: Toxicological Information

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

Toxicity to Animals:

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

Chronic Effects on Humans:

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

Other Toxic Effects on Humans:

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

Special Remarks on Toxicity to Animals:

Lowest Published Lethal Dose/Conc: LDL [Rabbit] - Route: Oral; Dose: 5000 mg/kg LDL [Dog] - Route: Oral; Dose: 4000 mg/kg LDL [Cat] - Route: Oral; Dose: 4000 mg/kg

Special Remarks on Chronic Effects on Humans:

May cause adverse reproductive effects and birth defects (teratogenic). May affect genetic material (mutagenic). May cause cancer.

Special Remarks on other Toxic Effects on Humans:

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

Section 12: Ecological Information

Ecotoxicity:

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

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

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

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Tetrachloroethylene UNNA: 1897 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:

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

Other Regulations:

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

Other Classifications:**WHMIS (Canada):**

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

DSCL (EEC):

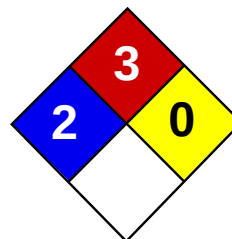
R40- Possible risks of irreversible effects. R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. S23- Do not breathe gas/fumes/vapour/spray S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S37- Wear suitable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

HMIS (U.S.A.):**Health Hazard:** 2**Fire Hazard:** 0**Reactivity:** 0**Personal Protection:** g**National Fire Protection Association (U.S.A.):****Health:** 2**Flammability:** 0**Reactivity:** 0**Specific hazard:****Protective Equipment:**

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

Section 16: Other Information**References:** Not available.**Other Special Considerations:** Not available.**Created:** 10/10/2005 08:29 PM**Last Updated:** 06/09/2012 12:00 PM

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Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Toluene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Toluene

Catalog Codes: SLT2857, SLT3277

CAS#: 108-88-3

RTECS: XS5250000

TSCA: TSCA 8(b) inventory: Toluene

CI#: Not available.

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

Chemical Name: Toluene

Chemical Formula: C₆H₅-CH₃ or C₇H₈

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

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

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

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

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

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

Section 3: Hazards Identification

Potential Acute Health Effects:

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

Potential Chronic Health Effects:

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

Section 4: First Aid Measures

Eye Contact:

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

Skin Contact:

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

Serious Skin Contact:

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

Inhalation:

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

Serious Inhalation:

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

Ingestion:

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

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

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

Flammable Limits: LOWER: 1.1% UPPER: 7.1%

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

Fire Hazards in Presence of Various Substances:

Flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable liquid, insoluble in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards:

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

Section 6: Accidental Release Measures

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

Large Spill:

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

Section 7: Handling and Storage**Precautions:**

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

Storage:

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

Section 8: Exposure Controls/Personal Protection**Engineering Controls:**

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

Personal Protection:

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

Personal Protection in Case of a Large Spill:

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

Exposure Limits:

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

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweet, pungent, Benzene-like.

Taste: Not available.

Molecular Weight: 92.14 g/mole

Color: Colorless.

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

Boiling Point: 110.6°C (231.1°F)

Melting Point: -95°C (-139°F)

Critical Temperature: 318.6°C (605.5°F)

Specific Gravity: 0.8636 (Water = 1)

Vapor Pressure: 3.8 kPa (@ 25°C)

Vapor Density: 3.1 (Air = 1)

Volatility: Not available.

Odor Threshold: 1.6 ppm

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

Ionicity (in Water): Not available.

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

Solubility:

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

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

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

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

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

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

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

Toxicity to Animals:

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

Chronic Effects on Humans:

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

Other Toxic Effects on Humans:

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

Special Remarks on Toxicity to Animals:

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

Special Remarks on Chronic Effects on Humans:

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

Special Remarks on other Toxic Effects on Humans:

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

Section 12: Ecological Information

Ecotoxicity:

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

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

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

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Toluene UNNA: 1294 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

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

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

Other Regulations:

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

Other Classifications:

WHMIS (Canada):

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

DSCL (EEC):

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

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

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

Section 16: Other Information

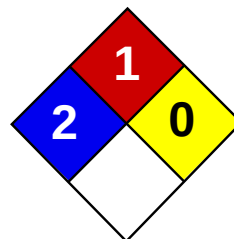
References: Not available.

Other Special Considerations: Not available.

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Health	2
Fire	1
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

1,2,4-Trichlorobenzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: 1,2,4-Trichlorobenzene

Catalog Codes: SLT3619

CAS#: 120-82-1

RTECS: DC2100000

TSCA: TSCA 8(b) inventory: 1,2,4-Trichlorobenzene

CI#: Not applicable.

Synonym:

Chemical Name: 1,2,4,-Trichlorobenzene

Chemical Formula: C₆H₃Cl₃

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
{1,2,4-}Trichlorobenzene	120-82-1	100

Toxicological Data on Ingredients: 1,2,4-Trichlorobenzene: ORAL (LD50): Acute: 756 mg/kg [Rat.]. 300 mg/kg [Mouse]. DERMAL (LD50): Acute: 6139 mg/kg [Rat.].

Section 3: Hazards Identification

Potential Acute Health Effects:

Extremely hazardous in case of skin contact (irritant, permeator), of eye contact (irritant). Very hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (sensitizer). 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. The substance is toxic to blood, kidneys, 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. Do not use an eye ointment. Seek medical attention.

Skin Contact:

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

Serious Skin Contact:

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

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

Serious Inhalation:

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

Ingestion:

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

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

Auto-Ignition Temperature: 571°C (1059.8°F)

Flash Points: CLOSED CUP: 110°C (230°F).

Flammable Limits: LOWER: 2.5% UPPER: 6.6%

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

Fire Hazards in Presence of Various Substances:

Flammable in presence of open flames and sparks, of oxidizing materials. Slightly flammable to flammable in presence of heat, of reducing materials, of combustible materials. Non-flammable in presence 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: Keep container tightly closed.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

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

Large Spill:

If the product is in its solid form: Use a shovel to put the material into a convenient waste disposal container. If the product is in its liquid form: Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. 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, reducing agents, organic materials, metals, acids, alkalis.

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:

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

Personal Protection:

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

Personal Protection in Case of a Large Spill:

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

Exposure Limits:

TWA: 5 (ppm) TWA: 37 (mg/m3) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Liquid.)

Odor: Pungent. (Slight.)

Taste: Toxic by ingestion.

Molecular Weight: 181.46 g/mole

Color: Colorless.

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

Boiling Point: 213°C (415.4°F)

Melting Point: 17°C (62.6°F)

Critical Temperature: Not available.

Specific Gravity: 1.45 (Water = 1)

Vapor Pressure: Not available.

Vapor Density: 6.26 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

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

Solubility:

Easily soluble in diethyl ether. Soluble in methanol, n-octanol. 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. Reactive with reducing agents, organic materials, metals, acids, alkalis.

Corrosivity:

Slightly corrosive to corrosive in presence of steel, of copper. Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

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

Toxicity to Animals:

Acute oral toxicity (LD50): 300 mg/kg [Mouse]. Acute dermal toxicity (LD50): 6139 mg/kg [Rat.].

Chronic Effects on Humans: The substance is toxic to blood, kidneys, liver, upper respiratory tract.

Other Toxic Effects on Humans:

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Can cause gastrointestinal disturbances.

Special Remarks on other Toxic Effects on Humans: Exposure can cause nausea, headache and vomiting.

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: : Trichlorobenzene : UN2321 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: 1,2,4-Trichlorobenzene Florida: 1,2,4-Trichlorobenzene Minnesota: 1,2,4-Trichlorobenzene Massachusetts RTK: 1,2,4-Trichlorobenzene New Jersey: 1,2,4-Trichlorobenzene TSCA 8(b) inventory: 1,2,4-Trichlorobenzene SARA 313 toxic chemical notification and release reporting: 1,2,4-Trichlorobenzene CERCLA: Hazardous substances.: 1,2,4-Trichlorobenzene

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

Other Classifications:

WHMIS (Canada):

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

DSCL (EEC):

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

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

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

Section 16: Other Information

References:

-Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec. -Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II.

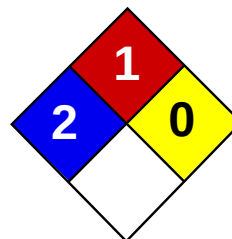
Other Special Considerations: Not available.

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Health	2
Fire	1
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Trichloroethylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Trichloroethylene

Catalog Codes: SLT3310, SLT2590

CAS#: 79-01-6

RTECS: KX4560000

TSCA: TSCA 8(b) inventory: Trichloroethylene

CI#: Not available.

Synonym:

Chemical Formula: C₂HCl₃

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

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

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

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Trichloroethylene	79-01-6	100

Toxicological Data on Ingredients: Trichloroethylene: ORAL (LD50): Acute: 5650 mg/kg [Rat]. 2402 mg/kg [Mouse].
DERMAL (LD50): Acute: 20001 mg/kg [Rabbit].

Section 3: Hazards Identification

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

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH.

MUTAGENIC EFFECTS: Not available. **TERATOGENIC EFFECTS:** Not available. **DEVELOPMENTAL TOXICITY:** Not

available. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

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

Skin Contact:

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

Serious Skin Contact:

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

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

Serious Inhalation:

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

Ingestion:

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

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

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

Flash Points: Not available.

Flammable Limits: LOWER: 8% UPPER: 10.5%

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

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

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

Large Spill:

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

Section 7: Handling and Storage

Precautions:

Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/

spray. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

Storage:

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

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

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

Personal Protection:

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

Personal Protection in Case of a Large Spill:

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

Exposure Limits:

TWA: 50 STEL: 200 (ppm) from ACGIH (TLV) TWA: 269 STEL: 1070 (mg/m³) from ACGIH Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 131.39 g/mole

Color: Clear Colorless.

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

Boiling Point: 86.7°C (188.1°F)

Melting Point: -87.1°C (-124.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.4649 (Water = 1)

Vapor Pressure: 58 mm of Hg (@ 20°C)

Vapor Density: 4.53 (Air = 1)

Volatility: Not available.

Odor Threshold: 20 ppm

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

Ionicity (in Water): Not available.

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

Solubility:

Easily soluble in methanol, diethyl ether, acetone. Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity:

Extremely corrosive in presence of aluminum. Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

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

Toxicity to Animals:

Acute oral toxicity (LD50): 2402 mg/kg [Mouse]. Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit].

Chronic Effects on Humans:

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

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Passes through the placental barrier in human. Detected in maternal milk in human.

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

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Trichloroethylene : UN1710 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Trichloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Trichloroethylene Pennsylvania RTK: Trichloroethylene Florida: Trichloroethylene Minnesota: Trichloroethylene Massachusetts RTK: Trichloroethylene New Jersey: Trichloroethylene TSCA 8(b) inventory: Trichloroethylene CERCLA: Hazardous substances.: Trichloroethylene

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

Other Classifications:

WHMIS (Canada):

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

DSCL (EEC):

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

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

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

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:54 PM

Last Updated: 06/09/2012 12:00 PM

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

MATERIAL SAFETY DATA SHEET

UNLEADED GASOLINE (UNBRANDED)

MSDS No.
APPC975
Version: 1
Date
05/19/2003

IMPORTANT: Read this MSDS before handling and disposing of this product and pass this information on to employees, customers, and users of this product.

1. PRODUCT and COMPANY IDENTIFICATION

Material Identity	Unleaded Gasoline (Unbranded)		
Trade Name(s)	None		
Other Name(s)	Unleaded Motor Vehicle Gasoline, Unleaded Premium Gasoline, Unleaded Regular Gasoline or Petrol, Clear Gasoline.		
Chemical Description	Petroleum Hydrocarbons		
Manufacturer's Address	BP West Coast Products LLC Carson Business Unit 1801 E. Sepulveda Boulevard Carson, California 90749-6210	BP West Coast Products LLC Cherry Point Business Unit 4519 Grandview Road Blaine, Washington 98230	
Telephone Numbers	Emergency Health Information: Emergency Spill Information: Other Product Information: Customer Service:	1 (800) 447-8735 1 (800) 424-9300 CHEMTREC (USA) 1 (866) 4BP-MSDS (866-427-6737 Toll Free - North America) email: bpcares@bp.com 1 (800) 322-3736 INFO	

2. COMPONENTS and EXPOSURE LIMITS

<u>Component</u> ¹	<u>CAS No.</u>	<u>% Composition By Volume</u> ²	<u>ACGIH TLV</u>	<u>Exposure Limits</u>		
				<u>OSHA PEL</u> ³	<u>Units</u>	<u>Type</u>
GASOLINE ⁽²⁾⁽⁴⁾	8006-61-9	EQ 100	500 300	500 300	ppm ppm	STEL TWA
which contains:						
BENZENE ⁽¹⁾⁽²⁾⁽³⁾⁽⁴⁾	71-43-2	AP 1 to 5	2.5 0.5 skin	5 1	ppm ppm	STEL TWA
CYCLOHEXANE	110-82-7	LT 2	400 300	N/AP 300	ppm ppm	STEL TWA
ETHYLBENZENE ⁽²⁾	100-41-4	AP 1 to 3	125 100	125 100	ppm ppm	STEL TWA
HEXANE (N-HEXANE)	110-54-3	AP 2 to 5	50 skin	50	ppm	TWA
TOLUENE	108-88-3	AP 7 to 14	N/AP 50 skin	150 100	ppm ppm	STEL TWA
TRIMETHYL BENZENE (ALL ISOMERS)	25551-13-7	LT 5	25	25	ppm	TWA
1,2,4-TRIMETHYLBENZENE	95-63-6	AP 1 to 4	25	25	ppm	TWA

2,2,4 TRIMETHYLPENTANE	540-84-1	AP	3 to 10	N/AP	N/AP		
XYLENE	1330-20-7	AP	8 to 15	150 100	150 100	ppm ppm	STEL TWA
which may contain:							
ETHANOL	64-17-5	AP	0 to 10	1000	1000	ppm	TWA
METHYL TERTIARY BUTYL ETHER (MTBE) ⁽⁴⁾	1634-04-4	AP	0 to 15	40	N/AP	ppm	TWA

¹ Carcinogen displayed after Component Name. Listed by ⁽¹⁾ NTP, ⁽²⁾ IARC, ⁽³⁾ OSHA, ⁽⁴⁾ Other

² See Abbreviations on last page

³ The OSHA exposure limits were changed in 1993 due to a federal court ruling. ARCO has chosen to list the 1989 OSHA exposure limits in this document as they are generally more stringent and therefore more protective than the current exposure limits. (Refer to 29 CFR 1910.1000).

3. HAZARD IDENTIFICATION

IMMEDIATE HAZARDS

DANGER

HIGHLY FLAMMABLE! OSHA/NFPA Class IB flammable liquid. Keep away from heat, sparks, and open flame.

Never siphon gas by mouth. Harmful if swallowed. Contains petroleum distillates.

ASPIRATION HAZARD! If swallowed, do not induce vomiting since aspiration into the lungs may cause chemical pneumonia. Obtain prompt medical attention.

Prolonged or repeated liquid contact may cause irritation. High vapor concentrations (greater than 1000 ppm) may cause irritation to eyes and respiratory system and may cause dizziness and other nervous system effects.

Generally, human exposures to gasoline are considerably lower than levels which have caused adverse health effects in animal studies or human case studies of gasoline misuse or abuse (such as gasoline sniffing). Adverse health effects are not expected to occur at exposure levels typically encountered in the use of gasoline as a motor fuel.

Avoid breathing vapors or mists. Use only with adequate ventilation. Use as a motor fuel only. Do not use as a cleaning solvent, thinner or for other non-motor fuel use.

Wash hands thoroughly after handling.

ACUTE HEALTH HAZARDS

Routes of Exposure

Signs and Symptoms

Inhalation (Primary)	Exposures at airborne concentrations well above the recommended exposure limits in Section 2 may cause irritation of the nose, throat, and lungs, headache, dizziness, drowsiness, confusion, loss of coordination, fatigue, nausea, labored breathing and irregular heartbeats. May lead to unconsciousness, convulsions, and possibly death.
Eye Contact	May cause some transitory eye irritation but not expected to cause prolonged or significant eye irritation.
Skin Contact	Moderate skin irritation may occur upon short-term exposure. May be absorbed and contribute to the acute inhalation health effects (see above).
Ingestion	ASPIRATION HAZARD! This material can enter the lungs during swallowing or vomiting and may cause acute lung inflammation and damage which in severe cases may be fatal. Ingestion may cause irritation of the mouth, throat and gastrointestinal tract leading to nausea, vomiting, diarrhea, and restlessness. May cause headache, dizziness, drowsiness, confusion, loss of coordination, fatigue, nausea and labored breathing. May lead to unconsciousness, convulsions, and possibly death.

Summary of Chronic Hazards and Special Health Effects

Exposures at airborne concentrations well above the recommended exposure limits in Section 2 may aggravate medical conditions such as chronic respiratory diseases, cardiovascular disease, skin diseases, or blood disorders.

Prolonged/repeated exposures above the recommended exposure limits via skin contact, inhalation or ingestion of this material may result in adverse dermal or systemic effects. Avoid prolonged or repeated overexposure.

Contains benzene, a chemical known to cause cancer in humans. Repeated and prolonged overexposure to benzene vapors may cause leukemia, aplastic anemia, or other blood disorders, immunotoxicity, reproductive harm or fetal toxicity.

Neurotoxic effects have been associated with n-hexane, a component of this material upon prolonged or repeated overexposure.

Generally, human exposures to gasoline are considerably lower than levels which have caused adverse health effects in animal studies or human case studies of gasoline misuse or abuse (such as gasoline sniffing). Adverse health effects are not expected to occur at exposure levels typically encountered in the use of gasoline as a motor fuel.

See Section 11 for Additional Toxicological Information.

4. EMERGENCY and FIRST AID**Inhalation**

Immediately move personnel to area with fresh air. For respiratory distress, give oxygen, rescue breathing or administer CPR (cardiopulmonary resuscitation). Obtain prompt medical attention.

Eye Contact

Flush with clean, low-pressure water for at least 15 minutes, occasionally lifting the eyelids. If pain or redness is present after flushing, obtain medical attention.

Skin Contact

Immediately remove contaminated clothing. Wash affected skin thoroughly with soap and water. If irritation persists, obtain medical attention.

Ingestion

Do not induce vomiting. Obtain prompt medical attention.

ASPIRATION HAZARD: This material can enter the lungs during swallowing or vomiting and may cause lung inflammation and damage.

Emergency Medical Treatment Procedures

See above procedures.

5. FIRE and EXPLOSION**Flash Point (Method)***

AP -45°F **

Autoignition Temperature (Method)*

AP 536°F **

Flammable Limits (% Vol. in Air)*

Lower

AP 1.4

Upper

AP 7.6

* At Normal Atmospheric Temperature and Pressure

** Based on NFPA Gasoline

NFPA Hazard Rating:

Health: 1 = Slight

Fire: 3 = High

Reactivity: 0 = Insignificant

Special: = ---

Fire and Explosion Hazards

HIGHLY FLAMMABLE! Vaporizes easily at normal and below normal temperatures. When mixed with air in certain proportions and exposed to an ignition source, these vapors can burn in the open or explode in confined spaces. Being heavier than air, flammable vapors may travel long distances along the ground before reaching a point of ignition and flashing back.

May accumulate static electricity.

Liquid floats on water and may travel to a source of ignition and spread fire.

"Empty" containers retain liquid and vapor residues and, if exposed to source of ignition, may explode.

Extinguishing Media	Foam, Water fog, Dry chemical, Carbon Dioxide (CO ₂) Water and water spray may cool the fire but may not extinguish the fire.
Special Firefighting Procedures	For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment. This may include self-contained breathing apparatus to protect against the hazardous effects of combustion products and oxygen deficiencies. If firefighters cannot work upwind to the fire, respiratory protective equipment must be worn. Cool tanks and containers exposed to fire with water.

6. ACCIDENTAL RELEASE MEASURES

Precautions if Material is Spilled or Released	Eliminate all potential sources of ignition. Handling equipment and tools should be grounded to prevent sparking. Contain spill, evacuate non-essential personnel, and safely stop flow. Blanket spill with foam or use water fog to reduce vapor cloud. On hard surfaces, spilled material may create a slipping hazard. Equip cleanup crews with proper protective equipment (as specified in Section 8) and advise of hazards. Clean up by recovering as much spilled or contaminated materials as possible and placing into closed containers. Consult with an environmental professional for the federal, state and local cleanup and reporting requirements for spills and releases.

7. HANDLING and STORAGE

Handling, Storage and Decontamination Procedures	Avoid exposure to liquid and gas vapors. Odor is not a reliable warning of overexposure. Use only with adequate ventilation. Keep away from sources of heat, flames, sparks or other ignition sources. Storage and use areas should be "No Smoking" areas. Containers should be bonded and grounded for transfers to avoid static sparks. Outside or detached storage is preferred. Inside storage should be in a standard flammable liquids storage warehouse, room or cabinet. Separate from oxidizing materials. Filling Portable Containers (less than 10 gallons) - to minimize static spark hazard: 1. Fill only metal containers or those approved to hold gasoline; 2. Place containers on the ground while dispensing fuel; 3. Keep hose nozzle in contact with the approved container during the entire filling process. DO NOT fill any portable container in or on a vehicle. "Empty" containers retain liquid and vapor residues and can be dangerous. Do not pressurize, cut, weld, drill, grind or expose to heat, flame, sparks, static electricity, or other sources of ignition containers with ANY residue; they may explode and cause injury or death. For determining National Electrical Code (NEC) Hazardous (Classified) Location requirements for electrical installation, consider this material Class 1, Group D. KEEP OUT OF REACH OF CHILDREN!

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Controls	Where possible, use adequate ventilation to keep vapor and mist concentrations of this material below the occupational exposure limits shown in Section 2. Electrical equipment should comply with National Electrical Code (NEC) standards (see Section 7).
Respiratory	A NIOSH/MSHA-approved air-purifying respirator with an organic vapor cartridge may be permissible under certain circumstances where airborne concentrations may exceed the exposure limits in Section 2. Consult a health and safety professional for guidance in respirator selection. Respirator use should comply with OSHA 29 CFR 1910.134.

CAUTION: The protection provided by air-purifying respirators is limited. Use a positive pressure air-supplied respirator if there is any potential for an uncontrolled release, if exposure levels are not known, or if concentrations exceed the protection limits of the air-purifying respirator.

Eyes	Eye protection should be worn. If there is potential for splashing or spraying, chemical protective goggles and a face shield should be worn. If contact lenses are worn, consult an eye specialist or a safety professional for additional precautions. Suitable eye wash water should be available in case of eye contact with this material.
Skin	Avoid prolonged and/or repeated skin contact. If conditions or frequency of use make significant contact likely, clean and impervious clothing such as gloves, apron, boots and facial protection should be worn. Nitrile and Viton protective clothing material is recommended. Non-impervious clothing which becomes contaminated with this material should be removed promptly and not reworn until the material is effectively removed from the clothing.
Other Hygienic and Work Practices	Use good personal hygiene practices. In case of skin contact, wash with mild soap and water or a waterless hand cleaner. Wash hands and other exposed areas thoroughly before eating, drinking, smoking, or using toilet facilities.

9. PHYSICAL and CHEMICAL PROPERTIES

Boiling Point:	AP 35°F to 437°F
Viscosity Units, Temp. (Method):	N/AP
Dry Point:	AP 430°F
Freezing Point:	N/AP
Vapor Pressure, Temp. (Method):	AP 5 to 15 at 100°F (REID-PSIA)
Volatile Characteristics:	Appreciable
Specific Gravity (H₂O = 1 @ 39.2°F):	AP 0.7 to 0.8
Vapor Sp. Gr. (Air = 1.0 @ 60°F - 90°F):	AP 4
Solubility in Water:	Slight
PH:	N/AP
Appearance and Odor:	Colorless to straw-colored liquid; petroleum naphtha odor.
Other Physical and Chemical Properties:	Vapor pressure will vary seasonally in compliance with industry standards and federal and state regulations.

10. STABILITY and REACTIVITY

Stability	Stable
Hazardous Polymerization	Not expected to occur.
Other Chemical Reactivity	Reacts with oxidizing materials.

Conditions to Avoid	Heat, sparks, flame, and build up of static electricity.
Materials to Avoid	Halogens, strong acids, alkalis, and oxidizers.
Hazardous or Decomposition Products	Burning or excessive heating may produce carbon monoxide and other harmful gases or vapors including oxides and/or other compounds of sulfur. The inhalation of components of exhaust from combusted fuel can be fatal in high concentrations in an enclosed area. Exposure to exhaust from this fuel should be minimized.

11. TOXICOLOGICAL INFORMATION

Toxicological Information	The information found in this section is written for medical, toxicology, occupational health and safety professionals. This section provides technical information on the toxicity testing of this or similar materials or its components. If clarification of the technical content is needed, consult a professional in the areas of expertise listed above.
Inhalation	Toxicity studies on this material resulted in LC50 values greater than 5.0 mg/l indicating a low potency. There were signs of respiratory tract irritation and central nervous system depression.
Eye Contact	Minimal to no irritation in animal studies.
Skin Contact	Animal studies resulted in moderate skin irritation following short term or prolonged/repeated exposure. The acute dermal toxicity tests indicate LD50 values greater than 2.0 g/kg indicating a low potency. Exposure to sunlight does not increase skin irritation. This material appears to be non-sensitizing.
Ingestion	The acute oral toxicity tests produced LD50 values greater than 5.0 g/kg indicating a low potency. There were signs of gastrointestinal tract irritation and central nervous system depression.
Prolonged/ Repeated Exposures	Twenty-eight day dermal toxicity studies resulted in moderate skin irritation. In some studies changes in liver, kidney, testes and whole body weights were noted, but no significant systemic tissue changes characteristic of disease. Ninety-day dermal toxicity studies with similar material resulted in moderate skin irritation and not other significant observations or systemic tissue changes characteristic of disease. Twenty-eight day inhalation toxicity study similar materials resulted in kidney damage in male rats. A two-year inhalation study with a generic unleaded gasoline formulated by the American Petroleum Institute caused kidney damage and kidney tumors in male rats and liver tumors in female mice. These effects are considered specific to these laboratory animals and not applicable to humans. Exposure to components of gasoline such as benzene, toluene, xylene, ethylbenzene, trimethylbenzene, and N-hexane has also been shown to affect reproductive capacity and/or fetal development in laboratory animals. Studies with laboratory animals (dogs) indicate that exposure to extremely high concentrations of gasoline (greater than 50,000 ppm) may cause irregular heartbeats and sudden death. Exposures of laboratory animals to some components of this material at very high concentrations, well above the recommended exposure limits in Section 2, have resulted in cardiac sensitization with irregular heartbeats. Exposure to n-hexane at concentrations considerably higher than the current permissible exposure limit has reportedly been associated with peripheral neuropathy. Commercial hexane exposures up to 9000 ppm were not carcinogenic in laboratory animals. In animal studies and in workers with chronic benzene poisoning, alterations in structure of chromosomes in bone marrow and white blood cells have been observed.
Additional Ethanol Toxicity Information	Exposures to ethanol in gasoline are considerably lower than levels which have caused adverse health effects. Adverse health effects are not expected to occur at exposure levels typically encountered in the use of ethanol as a gasoline additive. Prolonged and repeated exposure to ethanol vapor above 1000 ppm may cause headache, lack of coordination, sleepiness, fatigue, and difficulty concentrating. Chronic ingestion of ethanol in the form of alcoholic beverages has resulted in liver, stomach, heart and nervous system damage as well as cancers of the mouth, pharynx, larynx, esophagus, and liver in humans. Repeated ingestion of ethanol in the form of alcoholic beverages by pregnant women has caused miscarriage, premature birth and low birth weight, and birth defects (fetal alcohol syndrome).
Additional MTBE Toxicity Information	MTBE at very high exposure levels (8000 ppm) did induce developmental toxicity in mice, but only at levels where there was also maternal toxicity. In rabbits exposed to the same MTBE levels, there were no indicators of any effects on the offspring, even in the presence of maternal toxicity. The abnormal findings in the mice (cleft palate, etc.) are well-recognized effects of stress in the pregnant mouse and have no correlation with development hazards in humans.

Chronic toxicity studies have been completed for MTBE. In these studies, B6C3F1 mice and F344 rats were exposed to 400, 3000, or 8000 ppm MTBE vapors, 6 hrs/day, 5 days/week for life. Few adverse effects were noted for either rats or mice.

Male and female mice exposed to 8000 ppm MTBE vapors developed a slightly higher incidence of benign liver tumors during their lifetime. No other adverse effects or increases in tumor incidences were found.

Male and female rats exposed to high concentrations of MTBE vapors developed an increasing incidence of chronic progressive kidney damage, an effect typically noted in aging rats. These effects were most severe in 3000 and 8000 ppm exposure groups and were accompanied by an increased incidence of kidney tumors (males only). These findings are consistent with kidney damage associated with accumulation of protein in cells, an effect which may be unique to the male rat. Benign testicular tumors were numerically increased in high dose MTBE male rats, but this is an age-related lesion which typically occurs in a very high proportion of control untreated rats.

MTBE does not appear to be a mutagen.

All of these effects either occur in tissues prone to the development of tumors or may occur by a mechanism not considered relevant to humans. The significance of these findings for human health hazards estimation is unclear. Furthermore, IARC has determined that MTBE is not classifiable as to its carcinogenicity to humans (Group 3).

12. ECOLOGICAL INFORMATION

Not Available

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods	Consult an environmental professional to determine if state or federal regulations would classify this material as a hazardous waste. Use only approved transporters, recyclers, treatment, storage or disposal facilities. Comply with all federal, state and local laws pertaining to waste management.

14. TRANSPORT INFORMATION

UN Proper Shipping Name	Gasoline
UN Hazard Class	3
UN Number	UN1203
UN Packing Group	PGII

15. REGULATORY INFORMATION

SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (SARA), TITLE III**Section 311/312 Hazard Categories:**

Acute Health Hazard
Delayed (chronic) health hazard
Fire hazard

Section 313:

This product contains the following chemicals subject to the reporting requirements established by SARA Title III:

BENZENE
CYCLOHEXANE
ETHYLBENZENE
METHYL TERT-BUTYL ETHER
TOLUENE
XYLENE

TOXIC SUBSTANCES CONTROL ACT (TSCA)

All components of this product are listed on the TSCA Inventory.

COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT (CERCLA)

This material is covered by CERCLA's PETROLEUM EXEMPTION.
(Refer to 40 CFR 307.14)

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 - PROPOSITION 65**PROP 65 WARNING LABEL:**

Chemicals known to the State to cause cancer, birth defects, or other reproductive harm are found in gasoline, crude oil, and many other petroleum products and their vapors, or result from their use. Read and follow label directions and use care when handling or using all petroleum products.

WARNING:

This product contains the following chemical(s) listed by the State of California as known to cause cancer or birth defects or other reproductive harm.

BENZENE ^(C) ^(R)
TOLUENE ^(R)

Other Prop 65 chemicals will result under certain conditions from the use of this material. For example, burning fuels produces combustion products including carbon monoxide, a Prop 65 reproductive toxin.

^(C) = Carcinogen

^(R) = Birth Defects or other Reproductive Harm

16. OTHER INFORMATION

General Comments

Because of volatility characteristics, gasoline vapors may have concentrations of components different from those of liquid gasoline. The major components of gasoline vapors from liquid gasoline are butane, isobutane, pentane and isopentane.

The information and conclusions herein reflect normal operating conditions and may be from sources other than direct test data on the mixture itself.

Abbreviations:

EQ = Equal
LT = Less Than
GT = Greater Than

AP = Approximately
UK = Unknown
TR = Trace

N/P = No Applicable Information Found
N/AP = Not Applicable
N/DA = No Data Available

Prepared by: Product Stewardship

Disclaimer of Liability

The information in this MSDS was obtained from sources which we believe are reliable. **HOWEVER, THE INFORMATION IS PROVIDED WITHOUT ANY WARRANTY, EXPRESS OR IMPLIED, REGARDING ITS CORRECTNESS.**

The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. **FOR THIS AND OTHER REASONS, WE DO NOT ASSUME RESPONSIBILITY AND EXPRESSLY DISCLAIM LIABILITY FOR LOSS DAMAGE OR EXPENSE ARISING OUT OF OR IN ANY WAY CONNECTED WITH THE HANDLING, STORAGE, USE OR DISPOSAL OF THE PRODUCT.**

This MSDS was prepared and is to be used only for this product. If the product is used as a component in another product, this MSDS information may not be applicable.

Material Safety Data Sheet



Vinyl Chloride (Chloroethylene)

Section 1. Chemical product and company identification

Product name	: Vinyl Chloride (Chloroethylene)
Supplier	: AIRGAS INC., on behalf of its subsidiaries 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
Product use	: Synthetic/Analytical chemistry.
Synonym	: Ethylene, chloro-; Chloroethene; Chloroethylene; Monochloroethylene; Vinyl chloride; Vinyl chloride monomer; Vinyl C monomer; C ₂ H ₃ Cl; Ethylene monochloride; Monochloroethene; Chlorethene; Chlorethylene; Chlorure de vinyle; Cloruro di vinile; Rcra waste number U043; Trovidur; UN 1086; VC; VCM; Vinile; Vinylchlorid; Vinyl chloride, inhibited; Vinyle(chlorure de); Winylu chlorek; 1-Chloroethylene
MSDS #	: 001067
Date of Preparation/Revision	: 4/27/2010.
In case of emergency	: 1-866-734-3438

Section 2. Hazards identification

Physical state	: Gas. [COLORLESS GAS OR LIQUID (BELOW 7 F) WITH A PLEASANT ODOR AT HIGH CONCENTRATIONS. [NOTE: SHIPPED AS A LIQUEFIED COMPRESSED GAS.]]
Emergency overview	: WARNING! FLAMMABLE GAS. MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED. MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA. CANCER HAZARD - CAN CAUSE CANCER. CONTENTS UNDER PRESSURE. Keep away from heat, sparks and flame. Do not puncture or incinerate container. Do not ingest. May cause target organ damage, based on animal data. Risk of cancer depends on duration and level of exposure. Use only with adequate ventilation. Wash thoroughly after handling. Keep container closed. Contact with rapidly expanding gases can cause frostbite.
Target organs	: May cause damage to the following organs: blood, kidneys, liver, mucous membranes, lymphatic system, upper respiratory tract, skin, eyes, central nervous system (CNS).
Routes of entry	: Inhalation
Potential acute health effects	
Eyes	: Irritating to eyes.
Skin	: Irritating to skin.
Inhalation	: Acts as a simple asphyxiant.
Ingestion	: Ingestion is not a normal route of exposure for gases
Potential chronic health effects	: CARCINOGENIC EFFECTS: Classified A1 (Confirmed for humans.) by ACGIH, 1 (Proven for humans.) by IARC, 1 (Known to be human carcinogens.) by NTP, + (Proven.) by OSHA, + (Proven.) by NIOSH, 1 (Proven for humans.) by European Union. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available.
Medical conditions aggravated by over-exposure	: Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (section 11)

Section 3. Composition, Information on Ingredients

<u>Name</u>	<u>CAS number</u>	<u>% Volume</u>	<u>Exposure limits</u>
Vinyl Chloride (Chloroethylene)	75-01-4	100	ACGIH TLV (United States, 1/2009). TWA: 1 ppm 8 hour(s). OSHA PEL (United States, 11/2006). STEL: 5 ppm 15 minute(s). TWA: 1 ppm 8 hour(s). OSHA PEL 1989 (United States, 3/1989). STEL: 5 ppm 15 minute(s). TWA: 1 ppm 8 hour(s).

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

Eye contact	: Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. 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. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.
Frostbite	: Try to warm up the frozen tissues and seek medical attention.
Inhalation	: Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.
Ingestion	: As this product is a gas, refer to the inhalation section.

Section 5. Fire-fighting measures

Flammability of the product	: Flammable.
Auto-ignition temperature	: 471.85°C (881.3°F)
Flash point	: Open cup: -79.15°C (-110.5°F).
Flammable limits	: Lower: 4% Upper: 22%
Products of combustion	: Decomposition products may include the following materials: carbon dioxide carbon monoxide halogenated compounds
Fire-fighting media and instructions	: In case of fire, use water spray (fog), foam or dry chemical. In case of fire, allow gas to burn if flow cannot be shut off immediately. Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk. Contains gas under pressure. Flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.
Special protective equipment for fire-fighters	: Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

- Personal precautions** : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.
- Environmental precautions** : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.
- Methods for cleaning up** : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Section 7. Handling and storage

- Handling** : Use only with adequate ventilation. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Wash thoroughly after handling. High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Do not ingest. Keep container closed. Keep away from heat, sparks and flame. To avoid fire, eliminate ignition sources. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
- 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). Segregate from oxidizing materials. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

- Engineering controls** : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.
- Personal protection**
- Eyes** : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.
- Skin** : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
- Respiratory** : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.
- The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93
- Hands** : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
- Personal protection in case of a large spill** : Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product.

Product name

vinyl chloride

ACGIH TLV (United States, 1/2009).

TWA: 1 ppm 8 hour(s).

OSHA PEL (United States, 11/2006).

STEL: 5 ppm 15 minute(s).

TWA: 1 ppm 8 hour(s).

OSHA PEL 1989 (United States, 3/1989).

STEL: 5 ppm 15 minute(s).

TWA: 1 ppm 8 hour(s).

Consult local authorities for acceptable exposure limits.

Section 9. Physical and chemical properties

Molecular weight	: 62.5 g/mole
Molecular formula	: C ₂ H ₃ Cl
Boiling/condensation point	: -13.8°C (7.2°F)
Melting/freezing point	: -160°C (-256°F)
Critical temperature	: 158.5°C (317.3°F)
Vapor density	: 2.21 (Air = 1)
Specific Volume (ft³/lb)	: 6.25
Gas Density (lb/ft³)	: 0.16

Section 10. Stability and reactivity

Stability and reactivity	: The product is stable.
Incompatibility with various substances	: Extremely reactive or incompatible with the following materials: oxidizing materials.
Hazardous decomposition products	: Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Hazardous polymerization	: Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Toxicity data

Product/ingredient name	Result	Species	Dose	Exposure
vinyl chloride	LD50 Oral	Rat	500 mg/kg	-
	LC50 Inhalation Gas.	Rat	18 pph	15 minutes
	LC50 Inhalation Gas.	Rat	5000 ppm	1 hours

Chronic effects on humans	: CARCINOGENIC EFFECTS: Classified A1 (Confirmed for humans.) by ACGIH, 1 (Proven for humans.) by IARC, 1 (Known to be human carcinogens.) by NTP, + (Proven.) by OSHA, + (Proven.) by NIOSH, 1 (Proven for humans.) by European Union. May cause damage to the following organs: blood, kidneys, liver, mucous membranes, lymphatic system, upper respiratory tract, skin, eyes, central nervous system (CNS).
Other toxic effects on humans	: No specific information is available in our database regarding the other toxic effects of this material to humans.

Specific effects

Carcinogenic effects	: Can cause cancer. Risk of cancer depends on duration and level of exposure.
Mutagenic effects	: No known significant effects or critical hazards.
Reproduction toxicity	: No known significant effects or critical hazards.

Section 12. Ecological information

Aquatic ecotoxicity

Not available.

Products of degradation	: Products of degradation: carbon oxides (CO, CO ₂) and water, halogenated compounds.
Environmental fate	: Not available.
Environmental hazards	: No known significant effects or critical hazards.
Toxicity to the environment	: Not available.

Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation. Return cylinders with residual product to Airgas, Inc. Do not dispose of locally.

Section 14. Transport information

Regulatory information	UN number	Proper shipping name	Class	Packing group	Label	Additional information
DOT Classification	UN1086	VINYL CHLORIDE, STABILIZED	2.1	Not applicable (gas).		Reportable quantity 1 lb. (0.454 kg) Limited quantity Yes. Packaging instruction Passenger aircraft Quantity limitation: Forbidden. Cargo aircraft Quantity limitation: 150 kg Special provisions 21, B44, T50
TDG Classification	UN1086	VINYL CHLORIDE, STABILIZED	2.1	Not applicable (gas).		Explosive Limit and Limited Quantity Index 0.125 ERAP Index 3000 Passenger Carrying Road or Rail Index Forbidden
Mexico Classification	UN1086	VINYL CHLORIDE, STABILIZED	2.1	Not applicable (gas).		-

“Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product.”

Section 15. Regulatory information

United States

- U.S. Federal regulations** :
- United States inventory (TSCA 8b):** This material is listed or exempted.
 - SARA 302/304/311/312 extremely hazardous substances:** No products were found.
 - SARA 302/304 emergency planning and notification:** No products were found.
 - SARA 302/304/311/312 hazardous chemicals:** vinyl chloride
 - SARA 311/312 MSDS distribution - chemical inventory - hazard identification:** vinyl chloride: Fire hazard, reactive, Sudden release of pressure, Immediate (acute) health hazard, Delayed (chronic) health hazard
 - Clean Water Act (CWA) 307:** vinyl chloride
 - Clean Water Act (CWA) 311:** No products were found.
 - Clean Air Act (CAA) 112 accidental release prevention:** vinyl chloride
 - Clean Air Act (CAA) 112 regulated flammable substances:** vinyl chloride
 - Clean Air Act (CAA) 112 regulated toxic substances:** No products were found.

SARA 313

	<u>Product name</u>	<u>CAS number</u>	<u>Concentration</u>
Form R - Reporting requirements	: Vinyl Chloride (Chloroethylene)	75-01-4	100
Supplier notification	: Vinyl Chloride (Chloroethylene)	75-01-4	100

SARA 313 notifications must not be detached from the MSDS and any copying and redistribution of the MSDS shall include copying and redistribution of the notice attached to copies of the MSDS subsequently redistributed.

- State regulations** :
- Connecticut Carcinogen Reporting:** This material is not listed.
 - Connecticut Hazardous Material Survey:** This material is not listed.
 - Florida substances:** This material is not listed.
 - Illinois Chemical Safety Act:** This material is not listed.
 - Illinois Toxic Substances Disclosure to Employee Act:** This material is not listed.
 - Louisiana Reporting:** This material is not listed.
 - Louisiana Spill:** This material is not listed.
 - Massachusetts Spill:** This material is not listed.
 - Massachusetts Substances:** This material is listed.
 - Michigan Critical Material:** This material is not listed.
 - Minnesota Hazardous Substances:** This material is not listed.
 - New Jersey Hazardous Substances:** This material is listed.
 - New Jersey Spill:** This material is not listed.
 - New Jersey Toxic Catastrophe Prevention Act:** This material is not listed.
 - New York Acutely Hazardous Substances:** This material is listed.
 - New York Toxic Chemical Release Reporting:** This material is not listed.
 - Pennsylvania RTK Hazardous Substances:** This material is listed.
 - Rhode Island Hazardous Substances:** This material is not listed.

- California Prop. 65** : **WARNING:** This product contains a chemical known to the State of California to cause cancer.

<u>Ingredient name</u>	<u>Cancer</u>	<u>Reproductive</u>	<u>No significant risk level</u>	<u>Maximum acceptable dosage level</u>
Vinyl Chloride (Chloroethylene)	Yes.	No.	Yes.	No.

Canada

- WHMIS (Canada)** :
- Class A: Compressed gas.
 - Class B-1: Flammable gas.
 - Class D-2A: Material causing other toxic effects (Very toxic).
 - Class D-2B: Material causing other toxic effects (Toxic).
 - Class F: Dangerously reactive material.

Vinyl Chloride (Chloroethylene)

CEPA Toxic substances: This material is listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

United States

Label requirements : FLAMMABLE GAS.
MAY CAUSE FLASH FIRE.
HARMFUL IF SWALLOWED.
MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.
CANCER HAZARD - CAN CAUSE CANCER.
CONTENTS UNDER PRESSURE.

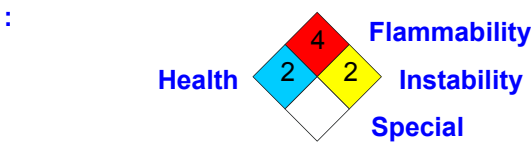
Canada

Label requirements : Class A: Compressed gas.
Class B-1: Flammable gas.
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).
Class F: Dangerously reactive material.

**Hazardous Material
Information System (U.S.A.)**

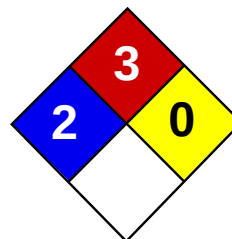
Health	*	2
Flammability		4
Physical hazards		2

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



Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet

Xylenes MSDS

Section 1: Chemical Product and Company Identification

Product Name: Xylenes

Catalog Codes: SLX1075, SLX1129, SLX1042, SLX1096

CAS#: 1330-20-7

RTECS: ZE2100000

TSCA: TSCA 8(b) inventory: Xylenes

CI#: Not available.

Synonym: Xylenes; Dimethylbenzene; xylol; methyltoluene

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

Chemical Formula: C₆H₄(CH₃)₂

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

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

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

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

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

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

Section 3: Hazards Identification

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

Potential Chronic Health Effects:

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

Section 4: First Aid Measures

Eye Contact:

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

Skin Contact:

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

Serious Skin Contact:

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

Inhalation:

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

Serious Inhalation:

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

Ingestion:

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

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

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

Flammable Limits: LOWER: 1% UPPER: 7%

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

Fire Hazards in Presence of Various Substances:

Highly flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:

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

Fire Fighting Media and Instructions:

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

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

Special Remarks on Explosion Hazards:

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

Section 6: Accidental Release Measures

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

Large Spill:

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

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

Section 7: Handling and Storage

Precautions:

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

Storage:

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

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

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

Personal Protection:

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

Personal Protection in Case of a Large Spill:

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

Exposure Limits:

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

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweetish.

Taste: Not available.

Molecular Weight: 106.17 g/mole

Color: Colorless. Clear

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

Boiling Point: 138.5°C (281.3°F)

Melting Point: -47.4°C (-53.3°F)

Critical Temperature: Not available.

Specific Gravity: 0.864 (Water = 1)

Vapor Pressure: 0.9 kPa (@ 20°C)

Vapor Density: 3.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 1 ppm

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

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:

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

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources, incompatibles

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

Corrosivity: Non-corrosive in presence of glass.

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

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

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

Toxicity to Animals:

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

Chronic Effects on Humans:

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

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

Special Remarks on Toxicity to Animals:

Lowest Lethal Dose: LDL [Human] - Route: Oral; Dose: 50 mg/kg LCL [Man] - Route: Oral; Dose: 10000 ppm/6H

Special Remarks on Chronic Effects on Humans:

Detected in maternal milk in human. Passes through the placental barrier in animal. Embryotoxic and/or foetotoxic in animal. May cause adverse reproductive effects (male and female fertility (spontaneous abortion and fetotoxicity)) and birth defects based animal data.

Special Remarks on other Toxic Effects on Humans:

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

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

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

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification : Xylenes UNNA: 1307 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

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

Other Regulations:

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

Other Classifications:

WHMIS (Canada):

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

DSCL (EEC):

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

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

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

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

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

Section 16: Other Information

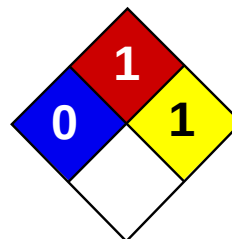
References: Not available.

Other Special Considerations: Not available.

Created: 10/11/2005 12:54 PM

Last Updated: 06/09/2012 12:00 PM

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Health	1
Fire	1
Reactivity	1
Personal Protection	E

Material Safety Data Sheet

Zinc Metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Zinc Metal

Catalog Codes: SLZ1054, SLZ1159, SLZ1267, SLZ1099, SLZ1204

CAS#: 7440-66-6

RTECS: ZG8600000

TSCA: TSCA 8(b) inventory: Zinc Metal

CI#: Not applicable.

Synonym: Zinc Metal Sheets; Zinc Metal Shot; Zinc Metal Strips

Chemical Name: Zinc Metal

Chemical Formula: Zn

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
Zinc Metal	7440-66-6	100

Toxicological Data on Ingredients: Zinc Metal 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: 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: Flammable.

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

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances:

Slightly flammable to flammable in presence of open flames and sparks, of heat, of oxidizing materials, of acids, of alkalis, 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.

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:

Zinc + NaOH causes ignition. Oxidation of zinc by potassium proceeds with incandescence. Residues from zinc dust /acetic acid reduction operations may ignite after long delay if discarded into waste bins with paper. Incandescent reaction when Zinc and Arsenic or Tellurium, or Selenium are combined. When hydrazine mononitrate is heated in contact with zinc, a flaming decomposition occurs at temperatures a little above its melting point. Contact with acids and alkali hydroxides (sodium hydroxide, potassium hydroxide, calcium hydroxide, etc.) results in evolution of hydrogen with sufficient heat of reaction to ignite the hydrogen gas. Zinc foil ignites if traces of moisture are present. It is water reactive and produces flammable gases on contact with water. It may ignite on contact with water or moist air.

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:

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. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe dust. Keep away from incompatibles such as oxidizing agents, acids, alkalis, moisture.

Storage:

Keep container tightly closed. Keep container in a cool, well-ventilated area. Keep from any possible contact with water. Do not allow water to get into container because of violent reaction.

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. (Lustrous solid. Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 65.39 g/mole

Color: Bluish-grey

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

Boiling Point: 907°C (1664.6°F)

Melting Point: 419°C (786.2°F)

Critical Temperature: Not available.

Specific Gravity: Not available.

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, acetone.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, incompatible materials, moisture

Incompatibility with various substances:

Reactive with oxidizing agents, acids, alkalis. Slightly reactive to reactive with moisture. The product may react violently with water to emit flammable but non toxic gases.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Incompatible with acids, halogenated hydrocarbons, NH_4NO_3 , barium oxide, $\text{Ba}(\text{NO}_3)_2$, Cadmium, CS_2 , chlorates, Cl_2 , CrO_3 , F_2 , Hydroxylamine, $\text{Pb}(\text{N}_3)_2$, MnCl_2 , HNO_3 , performic acid, KClO_3 , KNO_3 , N_2O_2 , Selenium, NaClO_3 , Na_2O_2 , Sulfur, Te, water, $(\text{NH}_4)_2\text{S}$, As_2O_3 , CS_2 , CaCl_2 , chlorinated rubber, catalytic metals, halocarbons, o-nitroanisole, nitrobenzene, nonmetals, oxidants, paint primer base, pentacarbonoyliron, transition metal halides, seleninyl bromide, HCl , H_2SO_4 , $(\text{Mg} + \text{Ba}(\text{NO}_3)_2 + \text{BaO}_2)$, (ethyl acetoacetate +tribromoneopentyl alcohol. Contact with Alkali Hydroxides(Sodium Hydroxide, Potassium Hydroxide, Calcium Hydroxide, etc) results in evolution of hydrogen. Ammonium nitrate + zinc + water causes a violent reaction with evolution of steam and zinc oxide. May react with water.

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. Dermal exposure to zinc may produce leg pains, fatigue, anorexia and weight loss. Eyes: May cause eye irritation. Ingestion: May be harmful if swallowed. May cause digestive tract irritation with tightness in throat, nausea, vomiting, diarrhea, loss of appetite, malaise, abdominal pain. fever, and chills. May affect behavior/central nervous system and autonomic nervous system with ataxia, lethargy, staggering gait, mild derrangement in cerebellar function, lightheadness, dizziness, irritability, muscular stiffness, and pain. May also affect blood. Inhalation: Inhalation of zinc dust or fumes may cause respiratory tract and mucous membrane irritation with cough and chest pain. It can also cause "metal fume fever", a flu-like condition characterized appearance of chills, headached fever, maliase, fatigue, sweating, extreme thirst, aches in the legs and chest, and difficulty in breathing. A sweet taste may also be be present in metal fume fever, as well as a dry throat, aches, nausea, and vomiting, and pale grey cyanosis. The toxicological properties of this substance have not been fully investisgated.

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: Not available.

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:

New York release reporting list: Zinc Metal Rhode Island RTK hazardous substances: Zinc Metal Pennsylvania RTK: Zinc Metal Florida: Zinc Metal Michigan critical material: Zinc Metal Massachusetts RTK: Zinc Metal New Jersey: Zinc Metal California Director's List of Hazardous Substances: Zinc Metal TSCA 8(b) inventory: Zinc Metal TSCA 12(b) one time export: Zinc Metal SARA 313 toxic chemical notification and release reporting: Zinc Metal CERCLA: Hazardous substances.: Zinc Metal: 1000 lbs. (453.6 kg)

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): Not Available

DSCL (EEC):

R15- Contact with water liberates extremely flammable gases. R17- Spontaneously flammable in air. S7/8- Keep container tightly closed and dry.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 1

Reactivity: 1

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. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 12:18 AM

Last Updated: 06/09/2012 12:00 PM

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ATTACHMENT D

Standard Safe Work Practices

- 1) Eating, drinking, chewing tobacco, smoking and carrying matches or lighters is prohibited in a contaminated or potentially contaminated area or where the possibility for the transfer of contamination exists.
- 2) Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, etc. Avoid, whenever possible, kneeling on the ground, leaning or sitting on equipment or ground. Do not place monitoring equipment on potentially contaminated surfaces (i.e., ground, etc.).
- 3) All field crew members should make use of their senses to alert them to potentially dangerous situations in which they should not become involved; i.e., presence of strong and irritating or nauseating odors.
- 4) Prevent, to the extent possible, spills. In the event that a spillage occurs, contain liquid if possible.
- 5) Field crew members shall be familiar with the physical characteristics of investigations, including:
 - Wind direction
 - Accessibility to associates, equipment, vehicles
 - Communication
 - Hot zone (areas of known or suspected contamination)
 - Site access
 - Nearest water sources
- 6) All wastes generated during activities on-site should be disposed of as directed by the project manager or his on-site representative.
- 7) Protective equipment as specified in the section on personnel protection will be utilized by workers during the initial site reconnaissance, and other activities.

Employees shall follow procedures to avoid at-risk behaviors that could result in an incident.

APPENDIX E

Quality Assurance Project Plan

APPENDIX E QUALITY ASSURANCE PROJECT PLAN

for

**OU-1 and OU-2 at the Kings Plaza Shopping Center
5102, 5120 & 5502 Avenue U
Brooklyn, New York**

**NYSDEC VCP No. A2-0403-9911
NYSDEC Site No. V00323**

Prepared For:

**Macerich Management Co.
401 Wilshire Boulevard, Suite 700
Santa Monica, California 90401**

Prepared By:

**Langan Engineering, Environmental, Surveying, and
Landscape Architecture, D.P.C.
21 Penn Plaza
360 West 31st Street, 8th Floor
New York, New York 10001**



**Jamie P. Barr, L.E.P.
Senior Associate/Vice President**

LANGAN

**July 6 2015
140080104, 140080105 & 140080106**

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1.0 PROJECT DESCRIPTION

1.1. Introduction and Site Description

This Quality Assurance Project Plan (QAPP) specifies analytical methods to be used to ensure that data from the Remedial Action Work Plan (RAWP) at the Kings Plaza Shopping Center (Kings Plaza) in Brooklyn, New York, is precise, accurate, representative, comparable, and complete. Kings Plaza Mall consists of an approximately 31-acre parcel of land consisting of three tax parcels located at 5102, 5120 and 5502 Avenue U (the "Site") in the Borough of Brooklyn, Kings County, New York. The lot at 5102 Avenue U (Map 23B, Block 8470, Lot 50) is improved with a parking lot, mall office and marina store; the lot at 5120 Avenue U (Map 23B, Block 8470, Lot 55) is improved with a two- to four-story mall building, parking lot, power plant, water treatment facility and concrete walk ways; and the lot at 5502 Avenue U (Map 23B, Block 8470, Lot 114) is improved with a one-story Lowe's building and associated asphalt parking lot.

The Site is currently enrolled in the New York State Department of Environmental Conservation (NYSDEC) Voluntary Cleanup Program (VCP) under Agreement No. A2-0403-9911, and it currently contains two main operable units: OU-1 and OU-2.

- OU-1 encompasses the central and southern portions of the East 55th Street access road to the Site between the mall to the west and the Lowe's building to the east. Impacts at OU-1 consist of residual free-phase product associated with a historic release of #2 heating oil from underground storage tanks (USTs) and chlorinated volatile organic compounds (cVOCs) previously identified at groundwater monitoring well MW-39.
- OU-2 encompasses the first 100-feet of asphalt paved roadway and concrete sidewalk of the East 55th Street access road to the Site and impacts at OU-2 consist of historic fill with base/neutral semi-volatile organic compounds (SVOCs) and metals exceeding NYSDEC soil cleanup criteria.

1.2. Project Objectives

The main objective of the RAWP is to provide the means and methods to remediate areas of concern identified during historical assessments and the remedial investigation (RI), to be protective of human health and the environment, mitigate potential further migration of contaminants in soil, groundwater, and/or soil vapor and to facilitate restoration of the existing conditions of the Site.

1.3. Scope of Work

The RAWP recommends a Track 4 cleanup for addressing impacted soil, groundwater and soil vapor within the Site boundaries. The remedy described is consistent with the procedures defined by the Division of Environmental Remediation's Technical Guidance for Site Investigation and Remediation (DER-10) and complies with all applicable Federal, State and local laws, regulations and requirements. A Track 4 remedy would be executed by accomplishing the following tasks:

- Excavation and off-site disposal of soils exceeding Track 4 site-specific SCOs (Restricted-Commercial Restricted Use SCOs) and grossly-impacted soil, if encountered. The existing asphalt surface cover will be demolished to facilitate excavation;
- Localized dewatering, if required, will be treated as necessary prior to discharge to the municipal sewer system;
- Collection and analysis of soil samples to document residual soil conditions;
- Importing of soil to be used for backfill in compliance with this plan and in accordance with applicable laws and regulations. Imported soil will be sampled and analyzed in accordance with NYSDEC DER-10 Section 5.4 prior to import to the Site, and will meet Restricted Commercial Use SCOs. Recycled concrete aggregate (RCA) and imported virgin stone will not be sampled. Development and implementation of plans for the protection of on-site workers, community, and environment during remediation and construction activities;
- Replacement of the site cover system consisting of asphalt pavement and sidewalks; and,
- Implementation of long-term Institutional Controls in the form of an Environmental Easement and Site Management Plan (SMP).

The remedial excavation extent is shown on Figure 4 of the RAWP. The remedial extent is based on previous data collected at the Site. Collection and analysis of soil waste characterization samples and hotspot confirmation samples as required for off-site disposal in accordance with sampling protocol. These samples will be analyzed using the United States Environmental Protection Agency (USEPA) SW-846 "Test Methods for Evaluating Solid Waste," November 1986, 3rd edition (and subsequent updates).

1.4. Data Quality Objectives and Processes

Data quality objectives (DQOs) are qualitative and quantitative statements, which specify the quality of data required to support the remediation of the Site. DQOs focus on the

identification of the end use of the data to be collected. The project DQOs will be achieved using the definitive data category, as outlined in *Guidance for the Data Quality Objectives Process*, EPA QA/G-4 (September 1994). All sample analyses will provide definitive data, which are generated using rigorous analytical methods, such as the reference methods approved by the USEPA. The purpose of this remediation is to remove the extent of contamination identified in the RAWP. Within the context of the purpose stated above, the project DQOs for data collected during this remediation are:

- To document the conditions in subsurface soil/fill remaining in-place following hot spot removal;
- To maintain the highest possible scientific/professional standards for each procedure; and,
- To develop enough information to classify soil/fill materials proposed for off-site disposal, if necessary, and determine appropriate disposal facilities.

Sample analytical methodology for the media sampled and data deliverables will meet the requirements in the most recent NYSDEC Analytical Services Protocol (ASP). The analytical laboratory will be instructed that completed Sample Preparation and Analysis Summary forms are to be submitted with the analytical data packages. The laboratory also will be instructed that matrix interferences must be cleaned up, to the extent practicable. Data usability summary reports (DUSRs) will be generated. In order to achieve the definitive data category described above, the data quality indicators of precision, accuracy, representativeness, completeness, and comparability will be measured during off-site chemical analysis. The data quality indicators are summarized as the following:

- **Precision** – an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Field sampling precision will be determined by analyzing coded duplicate samples and analytical precision will be determined by analyzing internal quality control (QC) duplicates and matrix spike duplicates.
- **Accuracy** – a measure of the degree of agreement of a measured value with the true or expected value of the quantity of concern. Sampling accuracy will be determined through the assessment of the analytical results of field blanks and trip blanks for each sample set. Analytical accuracy will be assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks.

- **Representativeness** – expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness will be determined by assessing a number of investigation procedures, including chain-of-custody (COC), decontamination, and analysis of field blanks and trip blanks.
- **Completeness** – the percentage of measurements made which are judged to be valid. Completeness will be assessed through third party data validation. The QC objective for completeness is generation of valid data for at least 90% of the analyses requested.
- **Comparability** – expresses the degree of confidence with which one data set can be compared to another. The comparability of all data collected for this project will be ensured using several procedures, including standard methods for sampling and analysis, instrument calibrations, using standard reporting units and reporting formats, and data validation.

Each of the above objectives is discussed in detail in Section 3.

2.0 PROJECT ORGANIZATION

The Remedial Action will be completed for Macerich Management Company, LLC (Macerich), for Kings Plaza by Langan. Langan will oversee the excavation and off-site disposal of contaminated soil. The analytical services will be performed by a certified laboratory. Data validation services will be performed by Alpha Geoscience, Inc., or a similar company.

Key contacts for this project are as follows:

Macerich Management Company, LLC:
Site Owner

Mr. Aladdin Ghafari, AVP Environmental Affairs
Telephone: (310) 899-6387

Langan Project Director:
Consults on project elements and reviews reports prior to submittal to NYSDEC.

Mr. Jamie P. Barr, L.E.P.
Telephone: (917) 882-5428
Email: jbarr@langan.com

Langan Program/Project Manager:
Manages the investigation on a day-to-day basis and coordinates report deliverables.

Mr. Ryan Wohlstrom
Telephone: (203) 464-2731
Email: rwohlstrom@langan.com

Langan Project Executive/Quality Assurance
Reviews reports prior to submittal to NYSDEC

Mr. Joel B. Landes, P.E.
Telephone: (917) 940-3015
Email: jlandes@langan.com

Langan Project Executive/Quality Assurance
Reviews reports prior to submittal to NYSDEC

Mr. Steve Ciambuschini, L.E.P.
Telephone: (201) 410-9238
Email: sciambuschini@langan.com

Langan Field Safety Officer
Manages and inspects field equipment, responsible for decontamination procedures.

Mr. David Granucci
Telephone: (203) 710-4448
Email: dgranucci@langan.com

Langan Field Team Leader
Executes work plan, and documents field activities and sample collection

Mr. Brandon Nathe
Telephone: (407) 484-7394
Email: bnathe@langan.com

Laboratory Contractor (TBD):
Analyze project samples and provides NYSDEC category ASP B deliverables.

TBD

Data Validation Contractor (Alpha Geoscience)
Coordinates with laboratory and reviews and interprets lab results and DUSR prepared by laboratory

Mr. Donald C. Anne
Telephone: (518) 348-6995
Email: Donald@alphageoscience.com

Resumes of key contacts and laboratory statement of qualifications are provided in Appendix B and C, respectively.

3.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) – OBJECTIVES FOR MEASUREMENT OF DATA

Contract Required Quantitation Limits (CRQLs) are given in Section 7.

3.1. Introduction

The QA/QC objectives for all measurement data include precision, accuracy, representativeness, completeness, and comparability. These objectives are defined in following subsections. They are formulated to meet the requirements of the USEPA SW-846. The analytical methods and their CRQLs are given in Section 7.

3.2. Precision

Precision is an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Specifically, it is a quantitative measurement of the variability of a group of measurements compared to their average value (USEPA, 1987). Precision is usually stated in terms of standard deviation, but other estimates such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum value), relative range, and relative percent difference (RPD) are common.

For this project, field sampling precision will be determined by analyzing coded duplicate samples (labeled so that the laboratory does not recognize them as duplicates) for the same parameters, and then, during data validation (Section 8), calculating the RPD for duplicate sample results.

Analytical precision will be determined by the laboratory by calculating the RPD for the results of the analysis of internal QC duplicates and matrix spike duplicates. The formula for calculating RPD is as follows:

$$RPD = \frac{|V1 - V2|}{(V1 + V2)/2} \times 100$$

where:

- RPD = Relative Percent Difference.
- V1, V2 = The two values to be compared.
- |V1 - V2| = The absolute value of the difference between the two values.
- (V1 + V2)/2 = The average of the two values.

The DQOs for analytical precision, calculated as the RPD between duplicate analyses, are presented in Tables 1 and 2.

TABLE 1
QUALITY CONTROL LIMITS FOR WATER SAMPLES

Laboratory Accuracy and Precision							
Analytical Parameters	Analytical Method (a)	Matrix Spike (MS) Compounds	MS/MSD (b) % Recovery	MS/MSD RPD (c)	LCS (d) % Recovery	Surrogate Compounds	Surrogate % Recovery
VOCs (e)	8260	Full List	Varies	Varies	Varies	1,2-Dichloroethane-d4 Bromofluorobenzene Toluene-d8	72.6-129 63.5-145 81.2-127
SVOCs (f)	8270	Full List	Varies	Varies	Varies	2,4,6-Tribromophenol 2-Fluorobiphenyl 2-Fluorophenol Nitrobenzene-d5 Phenol-d5 Terphenyl-d14	15-110 30-130 15-110 30-130 10-110 30-130
PCBs	8082	Aroclor 1016 Aroclor 1260	40-140 60-130	0-30 0-30	40-140 60-130	Decachlorobiphenyl Tetrachloro-m-xylene	30-150 30-150
Pesticides (l)	8081	Full List	Varies	Varies	Varies	Decachlorobiphenyl Tetrachloro-m-xylene	30-150 30-150
Inorganics (i)	6010,7470/7471, 7841,9010/9012/ 9014, OIA-1677, 7196	Inorganic Analytes	Varies	20 (k)	Varies	NA	NA

NA - Not applicable

(a) Analytical Methods: USEPA SW-846, 3rd edition, Revision 1, November 1990; any subsequent revisions shall supersede this information

(b) Matrix Spike/Matrix Spike Duplicate

(c) Relative Percent Difference

(d) Laboratory Control Sample

(e) Target Compound List Volatile Organic Compounds plus library search

(f) Target Compound List Semivolatile Organic Compounds plus library search

(g) Limits are advisory only

(i) 6 NYCRR Part 375 metals

(j) Matrix spike only

(k) Laboratory duplicate RPD

(l) Includes herbicide 2,4,5 TP- Silvex

TABLE 2
QUALITY CONTROL LIMITS FOR SOIL SAMPLES

Laboratory Accuracy and Precision							
Analytical Parameters	Analytical Method (a)	Matrix Spike (MS) Compounds	MS/MSD (b) % Recovery	MS/MSD RPD (c)	LCS (d) % Recovery	Surrogate Compounds	Surrogate % Recovery
VOCs (e)	8260	Full List	Varies	Varies	Varies	1,2-Dichloroethane-d4 Bromofluorobenzene Toluene-d8	73-130 72-127 84-117
SVOCs (f)	8270	Full List	Varies	Varies	Varies	2,4,6-Tribromophenol 2-Fluorobiphenyl 2-Fluorophenol Nitrobenzene-d5 Phenol-d5 Terphenyl-d14	15-110 30-130 15-110 30-130 15-110 30-130
PCBs	8082	Aroclor 1016 Aroclor 1260	40-140 60-130	0-30 0-30	40-140 60-130	Decachlorobiphenyl Tetrachloro-m-xylene	30-150 30-150
Pesticides (l)	8081	Full List	Varies	Varies	Varies	Decachlorobiphenyl Tetrachloro-m-xylene	30-150 30-150
Inorganics (i)	6010,7470/7471, 7841,9010/9012/ 9014, OIA-1677, 7196	Inorganic Analytes	Varies	20 (k)	Varies	NA	NA

NA – Not Applicable

(a) Analytical Methods: USEPA SW-846, 3rd edition, Revision 1, November 1990, any subsequent revisions shall supersede this information

(b) Matrix Spike/Matrix Spike Duplicate

(c) Relative Percent Difference

(d) Laboratory Control Sample

(e) Target Compound List Volatile Organic Compounds

(f) Target Compound List Semivolatile Organic Compounds

(g) Limits are advisory only

(h) Polychlorinated Biphenyls

(i) 6 NYCRR Part 375 metals

(j) Matrix spike only

(k) Laboratory duplicate RPD

(l) Includes herbicide 2,4,5 TP- Silvex

3.3. Accuracy

Accuracy is a measure of the degree of agreement of a measured value with the true or expected value of the quantity of concern (Taylor, 1987), or the difference between a measured value and the true or accepted reference value. The accuracy of an analytical procedure is best determined by the analysis of a sample containing a known quantity of material, and is expressed as the percent of the known quantity which is recovered or measured. The recovery of a given analyte is dependent upon the sample matrix, method of analysis, and the specific compound or element being determined. The concentration of the analyte relative to the detection limit of the analytical method is also a major factor in determining the accuracy of the measurement. Concentrations of analytes which are close to the detection limits are less accurate because they are more affected by such factors as instrument "noise". Higher concentrations will not be as affected by instrument noise or other variables and thus should be more accurate.

Sampling accuracy may be determined through the assessment of the analytical results of field blanks and trip blanks for each sample set. Analytical accuracy is typically assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks. Additionally, initial and continuing calibrations must be performed and accomplished within the established method control limits to define the instrument accuracy before analytical accuracy can be determined for any sample set.

Accuracy is normally measured as the percent recovery (%R) of a known amount of analyte, called a spike, added to a sample (matrix spike) or to a blank (blank spike). The %R is calculated as follows:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

where:

%R = Percent recovery.

SSR = Spike sample result: concentration of analyte obtained
by analyzing the sample with the spike added (measured).

- SR = Sample result: the background value, i.e., the concentration of the analyte obtained by analyzing the sample (measures).
- SA = Spiked analyte: concentration of the analyte spike added to the sample (known).

The acceptance limits for accuracy for each parameter are presented in Tables 1 and 2.

3.4. Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter which is most concerned with the proper design of the sampling program (USEPA, 1987). Samples must be representative of the environmental media being sampled. Selection of sample locations and sampling procedures will incorporate consideration of obtaining the most representative sample possible.

Field and laboratory procedures will be performed in such a manner as to ensure, to the degree that is technically possible, that the data represents the in-place quality of the material sampled. Every effort will be made to ensure chemical compounds will not be introduced into the sample via sample containers, handling, and analysis. Decontamination of sampling devices and digging equipment will be performed between samples as outlined in the RAWP. Analysis of field blanks, trip blanks, and method blanks will also be performed to monitor for potential sample contamination from field and laboratory procedures.

The assessment of representativeness also must consider the degree of heterogeneity in the material from which the samples are collected. Sampling heterogeneity will be evaluated during data validation through the analysis of coded field duplicate samples. The analytical laboratory will also follow acceptable procedures to assure the samples are adequately homogenized prior to taking aliquots for analysis, so the reported results are representative of the sample received.

Chain-of-custody procedures will be followed to document that contamination of samples has not occurred during container preparation, shipment, and sampling. Details of blank, duplicate and COC procedures are presented in Sections 4 and 5.

3.5. Completeness

Completeness is defined as the percentage of measurements made which are valid (USEPA, 1987). The QC objective for completeness is generation of valid data for at least 90% of the analyses requested. Completeness is defined as follows for all sample measurements:

$$\%C = \frac{V}{T} \times 100$$

where:

%C = Percent completeness.

V = Number of measurements judged valid.

T = Total number of measurements.

3.6. Comparability

Comparability expresses the degree of confidence with which one data set can be compared to another (USEPA, 1987). The comparability of all data collected for this project will be ensured by:

- Using identified standard methods for both sampling and analysis phases of this project;
- Requiring traceability of all analytical standards and/or source materials to the USEPA or National Institute of Standards and Technology (NIST);
- Requiring that all calibrations be verified with an independently prepared standard from a source other than that used for calibration (if applicable);
- Using standard reporting units and reporting formats including the reporting of QC data;
- Performing a complete 3rd party data validation on a representative fraction of the analytical results, including the use of data qualifiers in all cases where appropriate; and
- Requiring that all validation qualifiers be used any time an analytical result is used for any purpose.

These steps will ensure all future users of either the data or the conclusions drawn from them will be able to judge the comparability of these data and conclusions.

4.0 SAMPLING PROGRAM QA/QC

4.1. Introduction

The sampling program will provide data concerning the presence and the nature and extent of contamination of soil, groundwater, and soil vapor, if any. This section presents sample container preparation procedures, sample preservation procedures, sample holding times, and field QC sample requirements. Sample type, and the number of environmental and QC samples to be taken are given in Table 3. The sampling procedures are presented in the RAWP.

4.2. Sample Container Preparation, Sample Collection, and Sample Preservation

Sample containers will be properly washed and decontaminated prior to their use by either the analytical laboratory or the container vendor to the specifications required by the USEPA. Copies of the sample container QC analyses will be provided by the laboratory for each container lot used to obtain samples. The containers will be tagged, and the appropriate preservatives will be added. The types of containers are shown in Tables 4 and 5.

Soil samples from end points will be collected either by hand or from polystyrene certified sterile sampling scoops from excavated sidewalls and excavated bases. When handling soil samples, field personnel will wear nitrile gloves that will be replaced after each sample.

Samples shall be preserved according to the preservation techniques given in Tables 4 and 5. Samples will be kept in a secure area on-site. Preservatives will be added to the sample bottles by the laboratory prior to their shipment in sufficient quantities to ensure that proper sample pH is met. Samples will be picked up from the Site by a laboratory courier and delivered to the laboratory for analysis. Chain-of-custody procedures are described in Section 5.

4.3. Sample Laboratory Holding Times

The sample holding times for organic and inorganic parameters are given in Tables 4 and 5 and will be in accordance with the NYSDEC ASP requirements. The NYSDEC ASP holding times will be adhered to by the laboratory. Any holding time exceedances will be reported to Langan.

4.4. Field QC Samples

To assess field sampling and decontamination performance, two types of "blanks" will be collected and submitted to the laboratory for analyses. In addition, the precision of field sampling procedures will be assessed by collecting coded field duplicates and matrix spike/matrix spike duplicates (MS/MSDs). The blanks will include:

- a. Trip Blanks – A trip blank will be prepared before the sample containers are sent by the laboratory. The trip blank will consist of a 40-milliter (mL) volatile organic analyte (VOA) vial containing distilled, deionized (DI) water, which accompanies the other water sample bottles into the field and back to the laboratory. A trip blank will be included with each shipment of soil and groundwater samples for target compound list (TCL) volatiles analysis. The trip blank will be analyzed for TCL volatile organic compounds (VOCs) to assess any contamination from sampling and transport, and internal laboratory procedures.
- b. Field Blanks – Field blanks will be taken at a minimum frequency of one per 20 field samples (soil and groundwater). Field blanks are used to determine the effectiveness of the decontamination procedures for sampling equipment. It is a sample of DI, distilled water provided by the laboratory that has passed through a decontaminated bailer or other sampling apparatus. It is usually collected as a last step in the decontamination procedure, prior to taking an environmental sample. The field blank may be analyzed for all or some of the parameters of interest.

The duplicates will consist of:

- a. Coded Field Duplicate – To determine the representativeness of the sampling methods, coded field duplicates will be collected. The samples are termed "coded" because they will be labeled in such a manner that the laboratory will not be able to determine that they are a duplicate sample. This will eliminate any possible bias that could arise.
- b. Matrix Spike/Matrix Spike Duplicate (MS/MSD) – MS/MSD samples (MS/MSD for organics; MS and laboratory duplicate for inorganics) will be taken at a frequency of one pair per 20 field samples (groundwater). These samples are used to assess the effect of the sample matrix on the recovery of target compounds or target analytes. The percent recoveries and RPDs are given in Tables 1 and 2.

TABLE 3
SUMMARY OF PROPOSED SAMPLES AND ANALYSIS

Matrix	Parameter	Analytical Methods	Field Samples			Sub-Total	QC Blanks		Total
			Field Samples ^(c)	Field Duplicate ^(c)	MS/MSD ^{(a) (c)} (Total)		Trip Blank ^(c)	Rinse Blank ^{(b) (c)}	
Waste Classification Soil Samples	TBD (Waste Classification Parameters will be determined by the disposal facility)	TBD	N/A (approximate)	1/20 FD-SOIL_1	1/20 MS-SOIL_0-2 MSD-SOIL_0-2	N/A	1/day TB-SOIL	1/20	N/A
cVOC Post Excavation Samples	VOCs	EPA 8260	13	1 FD-SOIL_1	1 MS-SOIL_0-2 MSD-SOIL_0-2	15	1/day TB-SOIL	1	16

- (a) MS/MSD for organic analyses; MS and laboratory duplicate for inorganic analysis.
(b) Rinse blanks for soil sampling will be collected off unused sampling scoops.
(c) Sample nomenclature is identified below sample quantity.

TABLE 4
WATER SAMPLE CONTAINERIZATION, PRESERVATION,
AND HOLDING TIMES

Analysis	USEPA Method	Bottle Type	Preservation ^(a)	Holding Time ^(b)
Volatile Organic Compounds	8260	Two (2) 40 mL glass vials w/ Teflon septum	Cool to 4°C Preserved to pH <2 with either HCl or sodium bisulfate	14 days

(a) All samples to be preserved in ice during collection and transport.

(b) Days from validated time of sample receipt (VTSR).

TABLE 5
SOIL SAMPLE
CONTAINERIZATION PRESENTATION AND HOLDING TIMES

Analysis	USEPA Method	Bottle Type	Preservation ^(a)	Holding Time ^(b)
Volatile Organic Compounds	8260	EnCore Samplers	Cool to 4 °C	48 hours ^(c)

- (a) All samples to be preserved in ice during collection and transport.
- (b) Days from date of sample collection.
- (c) Extraction of VOCs must be completed within 48 hours days of sampling. Extracts of soil samples must be analyzed within 14 days of extraction.

5.0 SAMPLE TRACKING AND CUSTODY

5.1. Introduction

This section presents sample custody procedures for both the field and laboratory. Implementation of proper custody procedures for samples generated in the field is the responsibility of field personnel. Both laboratory and field personnel involved in the COC and transfer of samples will be trained as to the purpose and procedures prior to implementation.

Evidence of sample traceability and integrity is provided by COC procedures. These procedures document the sample traceability from the selection and preparation of the sample containers by the laboratory, to sample collection, to sample shipment, to laboratory receipt and analysis. The sample custody flowchart is shown in Figure 1. A sample is considered to be in a person's custody if the sample is:

- In a person's possession;
- Maintained in view after possession is accepted and documented;
- Locked and tagged with Custody Seals so that no one can tamper with it after having been in physical custody; or,
- In a secured area which is restricted to authorized personnel.

5.2. Field Sample Custody

A COC record (Figure 2) accompanies the sample containers during preparation at the laboratory shipment to the field, sample containment and preservation, and during return to the laboratory. Triplicate copies of the COC must be completed for each sample collected.

The COC lists the field personnel responsible for taking samples, the project name and number, the name of the analytical laboratory to which the samples are sent, and the method of sample shipment. The COC also lists a unique description of every sample bottle in the set. If samples are split and sent to different laboratories, a copy of the COC record will be sent with each sample.

The REMARKS space on the COC is used to indicate if the sample is a MS/MSD sample or any other sample information for the laboratory. Since they are not specific to any one sample point, trip and field blanks are indicated on separate rows. Once all bottles are properly accounted for on the form, a sampler will write his or her signature and the date and time on the first RELINQUISHED BY space. The sampler will also write the method of shipment, the shipping cooler identification number, and the shipper airbill number on the top of the COC. Mistakes will be crossed out with a single line in ink and initialed by the author.

One copy of the COC is retained by sampling personnel (notations identifying blind duplicate samples will be added to this copy of the COC but not the others that will go to the laboratory) and the other two copies are put into a sealable plastic bag and taped inside the lid of the shipping cooler. The cooler lid is closed, custody seals provided by the laboratory are affixed to the latch and across the back and front lids of the cooler, and the person relinquishing the samples signs their name across the seal. The seal is taped, and the cooler is wrapped tightly with packing tape. It is then relinquished by field personnel to personnel responsible for shipment, typically an overnight carrier. The COC seal must be broken to open the container. Breakage of the seals before receipt at the laboratory may indicate tampering. If tampering is apparent, the laboratory will contact the Project Manager, and the samples will not be analyzed.

FIGURE 1

SAMPLE CUSTODY

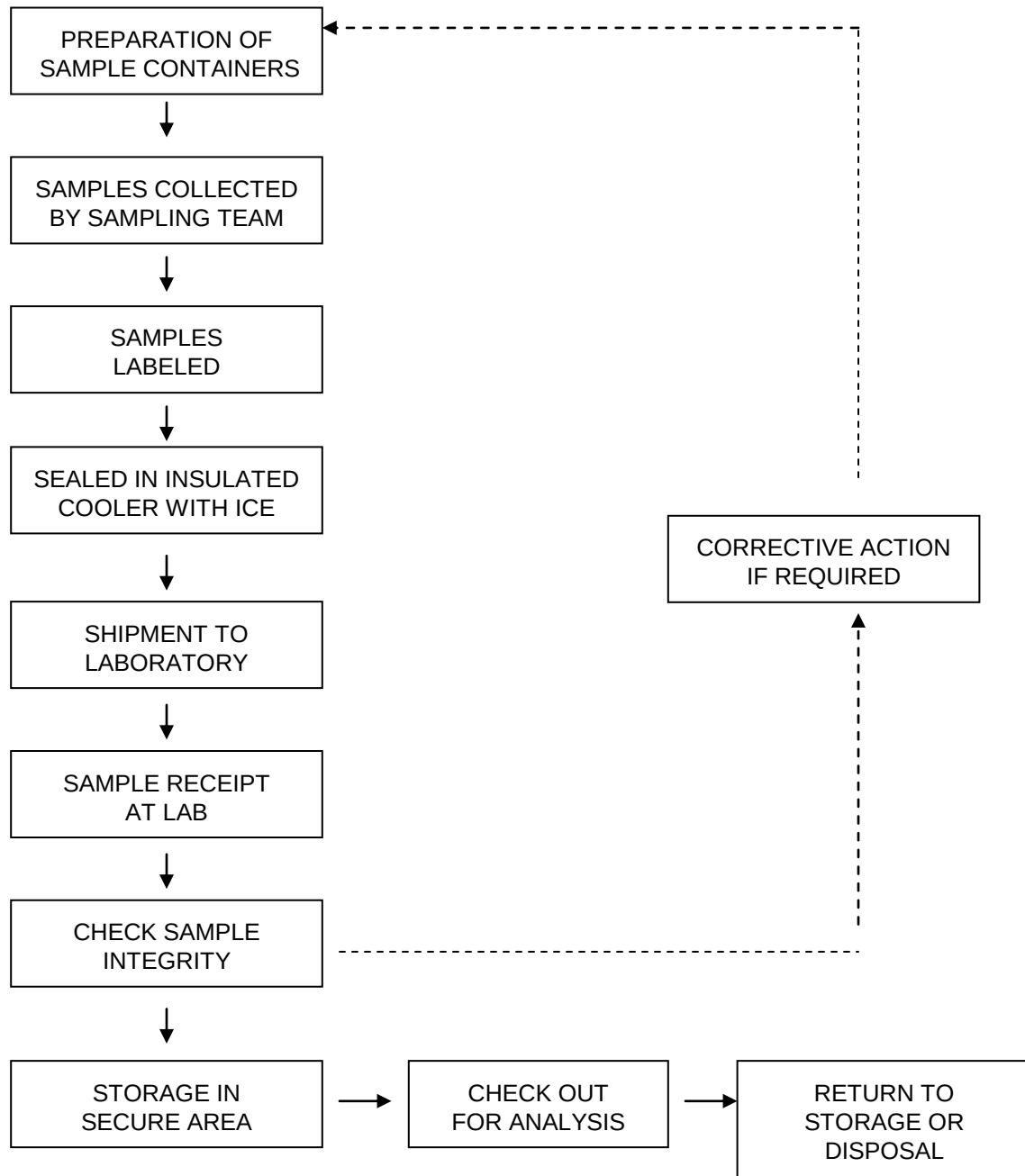
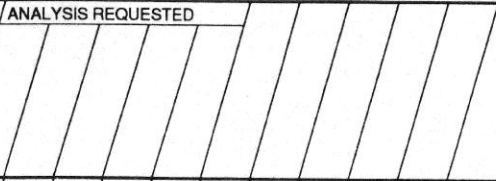


**FIGURE 2
 CHAIN-OF-CUSTODY RECORD**



CHAIN OF CUSTODY RECORD / ANALYSIS REQUEST

PAGE ____ OF ____

Proj. Name:						Proj. No:			ANALYSIS REQUESTED 										COMMENTS	
Site Location:						Auth. By:														
Sampled By:						Phone No:														
Company:																				
Sample Number	Location	Depth	Date	Time	Matrix	Grab Comp.	Inorg/PHC Preserve.	No. of Cont.												

Metals Filtered (Yes/No)? _____ Total No. of Containers: _____

Aq. VOAs Pres. (Yes/No)? _____

Rush T/A, Report format, Contingent analysis: _____

(1) Relinquished By: _____ DATE: _____ Received By: _____

Company: _____ TIME: _____ Company: _____

(3) Relinquished By: _____ DATE: _____ Received By: _____

Company: _____ TIME: _____ Company: _____

(2) Relinquished By: _____ DATE: _____ Received By: _____

Company: _____ TIME: _____ Company: _____

(4) Relinquished By: _____ DATE: _____ Received By: _____

Company: _____ TIME: _____ Company: _____

Laboratory Name & Address: _____

5.3. Laboratory Sample Custody

The Project Manager or Field Team Leader will notify the laboratory of upcoming field sampling activities, and the subsequent shipment of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped as well as the anticipated date of arrival.

The following laboratory sample custody procedures will be used:

- The laboratory will designate a sample custodian who will be responsible for maintaining custody of the samples and for maintaining all associated records documenting that custody.
- Upon receipt of the samples, the custodian will check cooler temperature, check the original COC documents and compare them with the labeled contents of each sample container for correctness and traceability. The sample custodian will sign the COC record and record the date and time received.
- Care will be exercised to annotate any labeling or descriptive errors. In the event of discrepant documentation, the laboratory will immediately contact the Project Manager or Field Team Leader as part of the corrective action process. A qualitative assessment of each sample container will be performed to note any anomalies, such as broken or leaking bottles. This assessment will be recorded as part of the incoming COC procedure.
- The samples will be stored in a secured area at a temperature of approximately 4°C until analyses commence.
- A laboratory tracking record will accompany the sample or sample fraction through final analysis for control.
- A copy of the tracking record will accompany the laboratory report and will become a permanent part of the project records.
- The laboratory will provide NYSDEC ASP Category B data deliverables.

6.0 CALIBRATION PROCEDURES

6.1. Field Instruments

All field analytical equipment will be calibrated immediately prior to each day's use. The calibration procedures will conform to manufacturer's standard instructions and are described in the RAWP. This calibration will ensure that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. Records of all instrument calibration will be maintained by the Field Team Leader. Copies of all the instrument manuals will be maintained on-site by the Field Team Leader.

Calibration procedures for instruments used for monitoring health and safety hazards (e.g., photoionization detector (PID) and explosimeter) are provided in the Health and Safety Plan (HASP).

6.2. Laboratory Instruments

The laboratory will follow all calibration procedures and schedules as specified in the sections of the USEPA SW-846 and subsequent updates that apply to the instruments used for the analytical methods given in Section 7.

7.0 ANALYTICAL METHODS

Samples will be analyzed according to the USEPA SW-846 "Test Methods for Evaluating Solid Waste," November 1986, 3rd edition and subsequent updates. Specific analytical methods are listed in Table 3.

8.0 DATA VALIDATING, REDUCTION, AND REPORTING

8.1. Introduction

Data collected during the field investigation will be reduced and reviewed by the laboratory quality assurance (QA) personnel and a report on the findings will be tabulated in a standard format. The criteria used to identify and quantify the analytes will be those specified for the applicable methods in the USEPA SW-846 and subsequent updates. The data package provided by the laboratory will contain all items specified in the USEPA SW-846 appropriate for the analyses to be performed, and be reported in NYSDEC ASP Category B format.

The completed copies of the COC records (both external and internal) accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the analytical reports.

8.2. Data Reduction

One copy of the final analytical data packages and an electronic disk deliverable will be provided by the laboratory approximately 7 or 8 days after receipt of a complete sample delivery group. The Project Manager will arrange for data validation of the data package. The disk deliverable will be used to generate summary tables. These tables will form the database for assessment of the site contamination condition.

Each electronic deliverable will be formatted and copied using an operating system compatible to both Langan and the laboratory. To avoid transcription errors, data will be loaded directly from the laboratory information management system (LIMS). If this can not be accomplished, Langan should be notified via letter of transmittal indicating that manual entry of data is required for a particular method of analysis. All electronic deliverables must also undergo a QC check by the laboratory before delivery. The original data, tabulations, and electronic media are stored in a secure and retrievable fashion.

The Project Associate or Project Manager will maintain close contact with the QA reviewer to ensure all non-conformance issues are acted upon prior to data manipulation and assessment routines. Once the QA review has been completed, the Project Manager may direct the Team Leaders or others to initiate and finalize the analytical data assessment.

8.3. Data Validation

Data validation will be performed in accordance with the USEPA validation guidelines for organic and inorganic data review. Validation will include the following:

- Verification of QC sample results (both qualitative and quantitative);
- Verification of the identification of sample results (both positive hits and non-detects);

- Recalculation of 10% of all investigative sample results; and,
- DUSRs generation.

A DUSR will be prepared by a third party validator and reviewed by the Program Quality Assurance Monitor (PQAM) before issuance. The DUSR will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and COC procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method. A detailed assessment of each sample delivery group (SDG) will follow. The DUSR will also contain copies of results forms with any changes made to the results by the data validator. For each of the organic analytical methods, the following will be assessed:

- Holding times;
- Instrument tuning;
- Instrument calibrations;
- Blank results;
- System monitoring compounds or surrogate recovery compounds (as applicable);
- Internal standard recovery results;
- MS/ MSD results;
- Target compound identification;
- Chromatogram quality;
- Pesticide cleanup (if applicable);
- Compound quantitation and reported detection limits;
- System performance; and,
- Results verification.

For each of the inorganic compounds, the following will be assessed:

- Holding times;
- Calibrations;
- Blank results;
- Interference check sample;
- Laboratory check samples;
- Duplicates;
- MS results;
- Furnace atomic absorption analysis QC;

- Instrument-specific quality control procedures (ICP) serial dilutions; and,
- Results verification and reported detection limits.

Based on the results of data validation, the validated analytical results reported by the laboratory will be assigned one of the following usability flags:

- "U" – Not detected at given value;
- "UJ" – Estimated not detected at given value;
- "J" – Estimated value;
- "N" – Presumptive evidence at the value given;
- "R" – Result not useable; and,
- No Flag – Result accepted without qualification.

8.4. Reporting

Upon receipt of validated analytical results, NYSDEC format electronic data deliverables (EDD), compatible with the Environmental Quality Information System (EQulS), will be prepared and submitted to the NYSDEC.

9.0 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

9.1. Quality Assurance Batching

Each set of samples will be analyzed concurrently with calibration standards, method blanks, MS/MSD samples or laboratory duplicates, and QC check samples (if required by the protocol). The MS/MSD samples will be designated by the field personnel. If no MS/MSD samples have been designated, the laboratory will contact the Langan Project Manager for corrective action.

9.2. Calibration Standards and Surrogates

All organic standard and surrogate compounds are checked by the method of mass spectrometry for correct identification and gas chromatography for degree of purity and concentration. All standards are traceable to a source of known quality certified by the USEPA or NIST, or other similar program. When the compounds pass the identity and purity tests, they are certified for use in standard and surrogate solutions. Concentrations of the solutions are checked for accuracy before release for laboratory use. Standard solutions are replaced monthly or more frequently, based upon data indicating deterioration.

9.3. Organic Blanks and MS

Analysis of blank samples verifies that the analytical method does not introduce contaminants or detect "false positives". The blank water can be generated by reverse osmosis and Super-Q filtration systems, or distillation of water containing KMnO_4 . The MS is generated by addition of surrogate standard to each sample.

9.4. Trip and Field Blanks

Trip blanks and field blanks will be utilized in accordance with the specifications in Section 4. These blanks will be analyzed to provide a check on sample bottle preparation and to evaluate the possibility of atmospheric or cross contamination of the samples.

10.0 QA PERFORMANCE AUDITS & SYSTEM AUDITS

10.1. Introduction

QA audits may be performed by the project quality assurance group under the direction and approval of the PQAM. These audits will be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). Functioning as an independent body and reporting directly to corporate quality assurance management, the PQAM may plan, schedule, and approve system and performance audits based upon procedures customized to the project requirements. At times, the PQAM may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits. However, these personnel will not have responsibility for the project work associated with the performance audit.

10.2. System Audits

System audits may be performed by the PQAM or designated auditors, and encompass a qualitative evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be system audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected or if the Project Manager requests, additional audits may occur.

10.3. Performance Audits

The laboratory may be required to conduct an analysis of Performance Evaluation (PE) samples or provide proof that PE samples submitted by USEPA or a state agency have been analyzed within the past twelve months.

10.4. Formal Audits

Formal audits refer to any system or performance audit that is documented and implemented by the QA group. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that QA requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by auditors who have performed the site audit after gathering and evaluating all data. Items, activities, and documents determined by lead auditors to be in noncompliance shall be identified at exit interviews conducted with the involved management. Non-compliances will be logged, and documented through audit findings which are attached to

and are a part of the integral audit report. These audit finding forms are directed to management to satisfactorily resolve the noncompliance in a specified and timely manner.

The Project Manager has overall responsibility to ensure that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Project Manager within fifteen days of completion of the audit. Serious deficiencies will be reported to the Project Manager within 24 hours. All audit checklists, audit reports, audit findings, and acceptable resolutions are approved by the PQAM prior to issue. Verification of acceptable resolutions may be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the PQAM will close out the audit report and findings.

11.0 PREVENTATIVE MAINTENANCE PROCEDURES AND SCHEDULES

11.1. Preventive Maintenance Procedures

Equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedure developed by the operators.

A list of critical spare parts will be established by the operator. These spare parts will be available for use in order to reduce the downtime. A service contract for rapid instrument repair or backup instruments may be substituted for the spare part inventory.

11.2. Schedules

Written procedures will establish the schedule for servicing critical items in order to minimize the downtime of the measurement system. The laboratory will adhere to the maintenance schedule, and arrange any necessary and prompt service. Required service will be performed by qualified personnel.

11.3. Records

Logs shall be established to record and control maintenance and service procedures and schedules. All maintenance records will be documented and traceable to the specific equipment, instruments, tools, and gauges. Records produced shall be reviewed, maintained, and filed by the operators at the laboratories. The PQAM may audit these records to verify complete adherence to these procedures.

12.0 CORRECTIVE ACTION

12.1. Introduction

The following procedures have been established to ensure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

12.2. Procedure Description

When a significant condition adverse to quality is noted at the Site, laboratory, or subcontractor location, the cause of the condition will be determined and corrective action will be taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the PQAM, Project Manager, Field Team Leader and involved contractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action.

All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality. Corrective actions will be initiated as follows:

- When predetermined acceptance standards are not attained;
- When procedure or data compiled are determined to be deficient;
- When equipment or instrumentation is found to be faulty;
- When samples and analytical test results are not clearly traceable;
- When QA requirements have been violated;
- When designated approvals have been circumvented;
- As a result of system and performance audits;
- As a result of a management assessment;
- As a result of laboratory/field comparison studies; and
- As required by USEPA SW-846, and subsequent updates, or by the NYSDEC ASP.

Project management and staff, such as field investigation teams, remedial response planning personnel, and laboratory groups, monitor on-going work performance in the normal course of daily responsibilities. Work may be audited at the Site, laboratories, or contractor locations. Activities or documents ascertained to be noncompliant with QA requirements will be

documented. Corrective actions will be mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the Task Manager.

Personnel assigned to QA functions will have the responsibility to issue and control Corrective Action Request (CAR) Forms (Figure 3 or similar). The CAR identifies the out-of-compliance condition, reference document(s), and recommended corrective action(s) to be administered. The CAR is issued to the personnel responsible for the affected item or activity. A copy is also submitted to the Project Manager. The individual to whom the CAR is addressed returns the requested response promptly to the QA personnel, affixing his/her signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The QA personnel maintain the log for status of CARs, confirms the adequacy of the intended corrective action, and verifies its implementation. CARs will be retained in the project file for the records.

Any project personnel may identify noncompliance issues; however, the designated QA personnel are responsible for documenting, numbering, logging, and verifying the close out action. The Project Manager will be responsible for ensuring that all recommended corrective actions are implemented, documented, and approved.

FIGURE 3

CORRECTIVE ACTION REQUEST					
Number: _____			Date: _____		
TO: _____ You are hereby requested to take corrective actions indicated below and as otherwise determined by you to (a) resolve the noted condition and (b) to prevent it from recurring. Your written response is to be returned to the project quality assurance manager by _____					
CONDITION:					
REFERENCE DOCUMENTS:					
RECOMMENDED CORRECTIVE ACTIONS:					
_____	_____	_____	_____	_____	_____
Originator	Date	Approval	Date	Approval	Date
RESPONSE					
CAUSE OF CONDITION					
CORRECTIVE ACTION					
(A) RESOLUTION					
(B) PREVENTION					
(C) AFFECTED DOCUMENTS					
C.A. FOLLOWUP:					
CORRECTIVE ACTION VERIFIED BY: _____ DATE: _____					

13.0 REFERENCES

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