Interim Remedial Measures Workplan

For:

108 Main Port Chester Steam Laundry Site
108 South Main Street
Port Chester, Westchester County, New York
NYSDEC BCP Site # C360224

Prepared for:

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Project No. 12056

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CERTIFICATIONS

I, Fuad Dahan, certify that I am currently a NYS registered professional engineer as defined in 6 NYCRR Part 375 and that this Interim Remedial Measures 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)

090531		
NYS Professional Engineer #	Date	Signature

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

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LIST OF ACRONYMS

Acronym	Definition
AFFF	Aqueous Firefighting Foams
AWQS	Ambient Water Quality Standards
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
BER	Business Environmental Risk
bgs	Below ground surface
C/D	Construction and Demolition
CAMP	Community Air Monitoring Plan
CCR	Construction Completion Report
COC	Contaminant of Concern
CPP	Citizen Participation Plan
DER	Division of Environmental Remediation
DER-10	NYSDEC Technical Guidance for Site Investigation
DMM	Division of Materials Management
DUSR	Data Usability Summary Report
ELAP	Environmental Laboratory Accreditation Program
ESA	Environmental Site Assessment
FER	Final Engineering Report
HASP	Health and Safety Plan
IRM	Interim Remedial Measures
IRMWP	Interim Remedial Measures Work Plan
MSL	Mean Sea Level
NYSDEC	New York State Department of Environmental
NYSDOH	New York State Department of Health
PAH	Polyaromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PFAS	Per- and poly-fluoroalkyl Substances
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
PHC	Petroleum Hydrocarbon
QA/AC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RA	Remedial Action
RAWP	Remedial Action Work Plan
RECs	Recognized Environmental Concerns
RI	Remedial Investigation
RIR	Remedial Investigation Report
RIWP	Remedial Investigation Work Plan
RRSCO	Restricted Residential Soil Cleanup Objectives

Acronym	**Definition**
SCO	Soil Cleanup Objectives
SESI	SESI Consulting Engineers, DPC
SOE	Support of Excavation
SVOCs	Semi-Volatile Organic Compounds
TAL	Target Analyte List
TCL	Target Compound List
TCE	Trichloroethene
TEAM	TEAM Environmental Consultants
USCO	Unrestricted Use Soil Cleanup Objectives
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

The New York State Department of Environmental Conservation (NYSDEC) entered into a Brownfield Cleanup Program (BCP) Agreement (BCA) with 108 Gateway, LLC (the “Volunteer”), for the 0.5-acre property known as the 108 Main Port Chester Steam Laundry Site (BCP# C360224) (“Site”), 108 South Main Street, Port Chester, Westchester County, New York on April 29, 2022. A Site Location Map is presented as **Figure 1.1**. This document comprises an Interim Remedial Measure Work Plan (IRMWP) to be conducted at the Site, as part of the Site’s planned remediation and redevelopment. It includes a description of the Site, summary of the Site history and previous environmental investigations, a description of the Site’s physical, geologic, hydrogeologic setting and subsurface features and a soil IRMWP.

This IRMWP has been prepared to achieve the following objectives:

- To describe the planned IRM activities at the Site that are proposed with the objective of preparing the Site for construction and the removal of all Site soils exceeding the NYSDEC Unrestricted Use Soil Cleanup Objectives (USCOs).

This IRMWP is developed in general accordance with the Department’s Remediation Technical Guidance for Site Investigation and Remediation (DER-10).

2.0 PROJECT BACKGROUND

2.1 SITE DESCRIPTION

The Site consists of an approximately 0.5-acre property and is located at 108 South Main Street, Port Chester, Westchester County, New York. The Site is identified on local tax maps as Block 1, Lot 57. The Site previously consisted of Lots 35, 37, and part of 28 (including a portion of a demapped undeveloped street called Myneta Place). However, the Village of Port Chester recently merged the Site lots into one (1) parcel, re-designated as Section 142.38, Block 1, Lot 57. The Site also was previously identified with two (2) addresses: 108 Main Street and 112 William Street. Former Lot 35 was previously used for parking before the Volunteer's recent Site acquisition but has been vacant since August 2021. Former Lot 37, once identified as 112 William Street, is a recently demolished residence that is currently vacant. The part of former Lot 28 included in this Site is also vacant. The Site has been developed since at least the 1880s, and historically has been used for residential and a variety of commercial purposes, including, but not limited to, dry cleaners, iron and novelties shop, shirt manufacturer, cobbler, liquor and drug store, steam cleaner, printing store, saloons, and other unidentified commercial operations. **Figure 2.1** presents a Tax Map and **Figure 2.2** presents a Site Plan.

The Site is located in a residential/commercial area and is bounded by East William Street and residences to the north, South Main Street and an auto repair shop and storefronts to the south, South Main Street and commercial office space and storefronts to the east, and a church with additional storefronts to the west. **Figure 2.2** presents a Site Plan.

Adjacent properties are summarized on **Table 2.1** below:

Table 2.1 – Summary of Surrounding Properties

Direction	Adjacent Property Uses
North	East William Street, residences beyond
South	South Main Street, commercial buildings (auto repair shop and storefronts) beyond
East	South Main Street, commercial office space and storefronts beyond
West	Church and commercial buildings

The planned redevelopment of the Site entails the construction of a new nine (9)-story mixed-use building containing residential units, ground floor retail, co-working space, and four (4) levels of parking space. The building will contain a fitness center, a day care center and full outdoor amenity space located on a green roof.

2.2 SITE HISTORY

SESI conducted a Phase I ESA in August 2021. According to the SESI 2021 Phase I ESA, the Site was historically utilized for residential and commercial purposes including, but not limited to: dry cleaners, iron and novelties shop, shirt manufacturer, cobbler, liquor and drug store, steam cleaner, printing store, saloons, and other unidentified commercial operations.

2.3 PREVIOUS ENVIRONMENTAL INVESTIGATIONS

The following environmental reports were included as attachments to the Remedial Investigation Work Plan (RIWP) and are summarized below:

- Phase I Environmental Site Assessment Report (ESA), 108 South Main Street and 112 William Street, Port Chester, New York, TEAM Environmental Consultants (TEAM), April 27, 2020
- Phase I ESA, 108 South Main Street and 112 William Street, Port Chester, New York, SESI Consulting Engineers (SESI), August 2021
- Phase II ESA, 108 South Main Street and 112 William Street, Port Chester, New York, SESI, October 2021

2.3.1 PHASE I ENVIRONMENTAL SITE ASSESSMENT REPORT (APRIL 27, 2020)

TEAM prepared a Phase I ESA for the prior Site owner of 108 South Main Street and 112 William Street, Port Chester, New York, dated April 27, 2020. The report concluded the following:

> *"Based on the property setting and proposed site use, availability of a municipal water supply, review of available historical, regulatory and environmental information, performance of Phase I ESA interviews, and findings of the property walk-through inspection, no significant and immediate liability issues or 'recognized environmental conditions' (RECs) associated with the 108 South Main Street and 112 William Street property locations were identified. No follow-up environmental site investigations are recommended at this time."*

2.3.2 PHASE I ENVIRONMENTAL SITE ASSESSMENT REPORT (AUGUST 2021)

SESI prepared a Phase I ESA for the Volunteer prior to its acquisition of 108 South Main Street and 112 William Street, Port Chester, New York in August 2021. The Phase I ESA identified the following five (5) RECs and one (1) Business Environmental Risk (BER):

- **REC-1 Historic Fill:** Based on the Geotechnical Investigation Report prepared by Whitestone Associates, Inc. (Whitestone), dated December 30, 2019, fill materials were identified within the subsurface of the Site. If future development of the Site requires the excavation and off-Site disposal of soil, soil testing and special handling of soil will be required.
- **REC-2 Potential per- and poly-fluoroalkyl Substances (PFAS) Contamination**: According to the Team Environmental Consultants, Inc. Phase I ESA, the multi-tenanted structures situated in the southwestern portion of the Site were reportedly “gutted by fire” at an unspecified date and subsequently demolished in 1973. PFAS were frequently found in aqueous firefighting foams (AFFF) used in the following industries: chemical plants, merchant marine operations, oil refineries, terminals, tank farms, and military facilities. The type of firefighting foam used at the Site is not known at the time of this report. Based on the known historical operations at the Site, it is unlikely that AFFF were used to put out the recorded fire; however, without further information there is a potential for the presence or discharge of PFAS to have occurred on-Site. **Therefore, further soil and groundwater investigation should be conducted to evaluate this REC.**
- **REC-3 Former Commercial Operations:** Commercial operations were reported to have taken place from 1885 to circa 1985. These operations included an iron and novelties shop, shirt manufacturer, cobbler, liquor and drug store, steam cleaner, printing store and saloons, and other tenants not specified in historical documents. These operations occurred over many years. There is the potential for impacts to the subgrade from these historical operations. **Therefore, further soil and groundwater investigation should be conducted to evaluate this REC.**
- **REC-4 Former Underground Storage Tanks (USTs):** Based on the Phase I ESA conducted by TEAM, a 1,000-gallon home heating oil UST associated with the former residence (on what was formerly identified as Lot 37) was removed by Elite Environmental Services (Elite) in February 2020. The Elite report concluded, “Based on our field screening observations and soil sample analytical results, Elite concludes that no petroleum-contaminated soils were found due to the UST system.” However, the post-

excavation sample locations were not included within the TEAM Phase I ESA nor the Elite Technical Report. Furthermore, groundwater sampling was not conducted as part this investigation; therefore, there is a potential for the former 1,000-gallon heating oil UST to adversely impact the Site. Additionally, there is a potential for additional former heating oil USTs to be present at the Site, as well as potential discharges from these systems, in association with the former buildings present on the Site. **A sub-surface geophysical evaluation across the Site should be considered to identify potential tanks associated with the former buildings as well as additional soil and groundwater sampling associated with the removed UST from former Lot 37.**

- **REC-5 Former Dry Cleaners:** Former dry cleaners operated on the Site in the late 1800s to early 1900s. Historically, chlorinated hydrocarbons were introduced intro dry cleaning processes circa 1930s; however, there is the potential that other chemicals (e.g. kerosene, gasoline, etc.) were used as part of the dry cleaning processes around the time the dry cleaners were present at the Site. Therefore, there is the potential for impacts to the subgrade from these historical operations. **Therefore, further soil and groundwater investigation is warranted at this location**.
- **BER 1: Potential Contamination from Off-Site Sources** – Due to the presence of two (2) open spill cases with known contamination located at side- and up-gradient properties within the vicinity of the Site, there may be an influence on groundwater or soil vapor quality at the Site.

2.3.3 PHASE II ENVIRONMENTAL SITE ASSESSMENT REPORT (OCTOBER 2021)

SESI conducted a Phase II ESA in October 2021 to investigate aforementioned RECs identified in the SESI August 2021 Phase I ESA. The investigation included the following activities:

- Geophysical survey across the Site to locate underground utilities and subsurface anomalies and/or potential USTs.
- Drilling and sampling of ten (10) soil borings:
  - 18 soil samples analyzed for Target Compound List +30 TICs/Target Analyte List (TCL+30/TAL).
- Installation and sampling of three (3) temporary groundwater monitoring wells:
  - Three (3) groundwater samples analyzed for TCL+30/TAL and emerging contaminants (i.e., 21 PFAS compounds and 1,4-dioxane).
- Installation and sampling of four (4) shallow vapor points and one (1) ambient air sample:

  - Five (5) air samples, one (1) from each soil gas point, and one (1) ambient air sample analyzed for volatile organic compounds (VOCs) in accordance with EPA Method TO-15.

The results of the investigation are summarized below:

Soil

Soil sample data indicate no VOCs detected at concentrations above any of the NYSDEC Soil Cleanup Objectives (SCOs). Several polycyclic aromatic hydrocarbons (PAHs) were detected above their respective USCOs and/or Restricted-Residential SCOs (RRSCOs) in nine (9) out of the 18 samples collected. Several pesticides were detected above their respective USCO in 10 samples. These, for the most part, coincide with the samples that contained PAH exceedances. The semi-volatile organic compound (SVOC) dibenzofuran was detected above the USCO in only one (1) sample. The polychlorinated biphenyl (PCB) Aroclor 1242 was detected above the Total PCBs RRSCO in two (2) soil samples, with one (1) of the samples [SB-6 (2-2.5)] detected at nearly 40 times the concentration of the RRSCO. Several metals were detected above the USCO and/or RRSCO across the Site.

Groundwater

In groundwater, trichloroethene (TCE) was detected above the Ambient Water Quality Standards (AWQS) in one (1) sample (along the western boundary of the Site). Several PAHs were detected above the AQWS in TWP-1 and TWP-2. The SVOC bis(2-Ethylhexyl)phthalate was detected above its AQWS in groundwater sample TWP-2. Perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) were detected in all three (3) groundwater samples above the screening level of 10 ng/L, and the total PFAS concentration was above the screening level of 500 ng/L. Additionally, pesticides were detected above AWQS.

Soil Vapor

None of the 12 compounds were detected above any of the lower limits of the soil vapor New York State Department of Health (NYSDOH) Matrices concentrations in the soil gas and ambient air samples. However, several other chlorinated, solvent, and petroleum hydrocarbon (PHC) compounds were detected in across the Site.

Based on the results of this investigation, SESI concluded that the soil, groundwater, and soil vapor exceedances and detections may be related to historical on- and off-Site sources:

- The PAH, metals, and pesticide exceedances in soil and groundwater are likely related to the historical activities on the Site including the presence of USTs. Historic fill may have contributed to the PAHs in soils; however, the levels of exceedances are higher than the typical historic fill PAH levels in soil.
- PCB exceedances are potentially the result of the historical site activities.
- The chlorinated solvent TCE was detected above the AQWS in one (1) groundwater sample located along the western boundary of the Site. There is a potential for the TCE exceedance to be related to historical Site operations, including but not limited to the dry cleaner from the late 1800s to early 1900s or later steam cleaning operations. Moreover, chlorinated VOCs were detected in the soil gas samples.
- According to the SESI 2021 Phase I ESA, the multi-tenanted structures historically situated in the southwestern portion of the Site were reportedly “gutted by fire” at an unspecified date and subsequently demolished in 1973. Whether firefighting foams containing PFAS were utilized during that time is unknown. PFAS exceedances were identified above the screening levels in all of the groundwater samples.

SESI noted that additional investigation is required to fully characterize the soil exceedances and the source of groundwater and soil gas detections and exceedances. Remediation of the soil, groundwater, and soil vapor will be needed prior to Site development.

2.4 GEOGLOGIC SETTING

Regional surface topography slopes to the east. Based on the U.S. Geological Survey – Mamaroneck, NY and Glenville Quadrangle map, the Property is approximately 18 feet above the North American Datum. Based on the Phase II ESA investigation conducted by SESI, the stratigraphy of the Site consists of brown sand and silt with fill material from ground surface to the boring terminus at top of bedrock, which varied from 4.5 to nine (9) feet below ground surface (bgs). Evidence of fill material, including wood, fabric, glass, and brick, was observed. Groundwater was encountered at approximately nine (9) to 12 feet bgs across the Site during the September 2021 Phase II ESA sampling event and is inferred to flow in the east/southeast direction toward the Byram River.

2.5 HYDROGEOLOGY

The closest open surface water to the Site is the Byram River, located approximately 1,200 feet east of the Site. As per the USDA National Cooperative Soil Survey map for the area, the soils at the Site are characterized as UoA (Urban Land outwash substratum), urban land which is surface covered by pavement, concrete, buildings, and other structures underlain by disturbed and natural soil material, till substratum, 0 to 3 percent slopes. Based on the September 2021 Phase II ESA sampling event, groundwater was encountered at approximately 9-12 feet bgs across the Site. Groundwater flow direction is expected to be in the east/southeast direction.

2.6 SUBSURFACE FEATURES

Based on the results of the geophysical survey, conducted as part of the SESI Phase II ESA, no USTs were identified; however, evidence of a former UST excavation area was identified at the former residence on former Lot 37.

2.7 SUMMARY OF ENVIRONMENTAL ASSESSMENT

Based on the investigations conducted to date, the primary contaminants of concern (COCs) are anticipated to be VOCs, SVOCs, metals, PCBs, and pesticides. COCs will be refined based on the Remedial Investigation (RI) results.

Soil: (maximum concentrations, in milligrams per kilogram [mg/kg]).

- **PAHs:** benzo(a)anthrance (51.9 mg/kg), benzo(a)pyrene (44.5 mg/kg), benzo(b)fluoranthene (51.1 mg/kg), benzo(k)fluoranthene (22.7 mg/kg), chrysene (46.6 mg/kg), dibenzo(a,h)anthracene (7.05 mg/kg), and indeno(1,2,3-cd)pyrene (31.4 mg/kg)
- **Pesticides:** 4,4'-DDD (0.0662 mg/kg), 4,4'-DDE (0.0740 mg/kg), 4,4'-DDT (0.0851 mg/kg), aldrin (0.0073 mg/kg), and dieldrin (0.117 mg/kg)
- **PCBs:** Aroclor 1242 (37.4 mg/kg)
- **Metals:** Barium (1,250 mg/kg), lead (6,160 mg/kg), and mercury (1.9 mg/kg)

Groundwater: (maximum concentrations, in micrograms per liter [ug/L] and nanograms per liter [ng/L])

- **VOCs:** TCE (5.5 ug/L)
- **PAHs:** benzo(a)anthracene (17.4 ug/L), benzo(a)pyrene (18.2 ug/L), benzo(b)fluoranthene (24.5 ug/L), benzo(k)fluoranthene (8.2 ug/), chrysene (19.5 ug/L), and indeno(1,2,3-cd)pyrene (15.5 ug/L)
- **SVOCs:** bis(2-Ethylhexyl)phthalate (7.6 ug/L)
- **PFAS:** PFOA (227 ng/l) and PFOS (136 ng/l)

- **Pesticides:** dieldrin (0.22 ug/L), 4,4'-DDT (0.55 ug/L), 4,4'-DDD (0.31 ug/L), and 4,4'-DDE (0.27 ug/L)
- **Metals:** antimony (6.4 ug/L), arsenic (39.2 ug/L), barium (5,920 ug/L), beryllium (20.1 ug/L), cadmium (10.6 ug/L), chromium (306 ug/L), copper (574 ug/L), iron (120,000 ug/L), lead (13,900 ug/L), magnesium (128,000 ug/L), manganese (37,500 ug/L), mercury (6.3 ug/L), nickel (1,110 ug/L), selenium (12 ug/L), sodium (283,000 ug/L), and zinc (3,790)

Soil Vapor:

No compounds were detected above any of the lower limits of the soil vapor NYSDOH Matrices concentrations in the soil gas and ambient air samples. However, several chlorinated, solvent, and PHC compounds were detected across the Site.

3.0 INTERIM REMEDIAL MEASURES (IRM)

3.1 PRE-IRM SITE PREPARATION

The proposed brownfield remediation project will remediate the environmental media at the Site; and then construct a transit-oriented, mixed-use, nine (9) story apartment building with residences, ground floor retail space and four (4) levels of parking space, including a subgrade parking garage.

Support-of-excavation (SOE) will be installed wherever necessary along the excavation perimeter for structural stability and to avoid compromising nearby structures or properties. In addition, fencing will be installed or repaired/maintained along all Site boundaries to secure the Site. Any hard surfaces will be removed and the interim remedial measures (IRM) area will be cleared and grubbed prior to commencing excavation.

3.2 WASTE CHARACTERIZATION SAMPLING

Soil waste characterization samples will be collected in-situ in conjunction with implementation of the remedial investigation for the pre-approval of the disposal facilities, as described in the RIWP. The Site will be subdivided in 50-foot grids, and a soil boring will be advanced in each grid. The borings will be advanced to bedrock using direct-push or other drilling methods as needed. Grab soil samples will be collected from each boring at a minimum of one (1) sample per five (5) foot depth intervals. All waste characterization samples will be analyzed by a NYSDOH ELAP certified laboratory for TCL + 30/TAL including VOCs by EPA Method 8260, SVOCs by EPA Method 8270, pesticides by EPA Method 8081, PCBs by EPA Method 8082, and TAL metals by EPA Methods 6010, 7471, and cyanide via EPA Method 9012. The data will be submitted to permitted disposal facilities for pre-approval. During the excavation remediation, the trucks will be direct loaded for off-Site disposal.

3.3 IRM CONTAMINATED SOIL EXCAVATION

The IRM will consist of excavating the entire Site to remediate soil by removal of the contaminated Site soils to bedrock. The final elevation will be determined based upon results of the soil investigation portion of the RI and post-excavation endpoint sampling. The total estimated excavation volume is approximately 9,075 tons of contaminated soil assuming excavation area of half of the Site to an average excavation depth of 15 ft bgs. However, the actual volume of soil to be excavated will be determined once the RI is completed and the contamination of soil has been delineated to bedrock.

Based on geotechnical borings and SESI's October 2021 Phase II ESA, groundwater is anticipated to be encountered around nine (9) to 12 feet bgs across the Site and bedrock is anticipated to be encountered around 4.5 to nine (9) feet bgs. Therefore, it is possible that groundwater will be encountered during construction for the deeper excavations such as the subgrade parking levels, elevator pits, and at the soil/rock interface during periods of wet weather.

The proposed IRM actions in sequence are listed below:

1. Installation support of excavation (SOE) along the side walls of the entire Site for structural stability of the excavation and to prevent impact to off-Site structures. The SOE will act as a support for the excavation of the on-Site contaminated soil.
2. All the contaminated soils within the property borders (**Figure 3.1**) will be excavated to clean endpoints or bedrock. This excavation will remove all contaminated fill and soil at the Site down to clean endpoints or bedrock.
3. Construction dewatering during excavation, if necessary. The groundwater will be pumped for temporary storage into frac-tanks for off-Site disposal or discharged into the sewer following on-Site treatment.
4. Documentation of all appropriate off-Site disposal of all material removed from the Site in accordance with all Federal, State and local rules and regulations for handling, transport, and disposal.
5. All responsibilities associated with the IRM, including permitting requirements and pretreatment requirements, will be addressed in accordance with all applicable Federal, State and local rules and regulations and overseen and certified by the SESI Remedial Engineer of Record described below.

Figure 3.2 presents the area planned for soil remediation to Track 1 and the proposed post-excavation soil sample locations. A Remedial Action Work Plan (RAWP) for remediation of groundwater and soil vapor will be provided, if required, in a separate RAWP after the completion of the RI and IRM as described in this document.

End point sampling, including bottom and side-wall sampling, will be performed in accordance with DER-10 sample frequency requirements. Side-wall samples, when possible, will be collected a minimum of every 30 linear feet. Bottom samples will be collected at a rate of one (1) for every 900 square feet. A post-excavation sampling plan is shown in **Figure 3.2**, where the grids are 30 by 30 feet. Post-excavation samples will be collected from the center of each grid as the excavation proceeds. The depth of initial endpoint sample collection will be determined by the remedial investigation but is estimated to be up 15 feet below grade. The results will be shared with the NYSDEC in the weekly report. The Construction Completion Report (CCR) will provide a tabular and map summary of all end-point sample results. Chemical laboratories used for all end-point sample results and contingency sampling will be NYSDOH ELAP certified.

3.4 STORM WATER POLLUTION PREVENTION PLAN

A Stormwater Pollution Prevention Plan is not required for the Site as the Site is less than one (1) acre in size. A Soil Erosion and Sediment Control Plan will be prepared for the Site and submitted to Village of Port Chester prior to being implemented at the Site during IRM activities.

3.5 SOIL/MATERIALS MANAGEMENT PLAN

3.5.1 SOIL SCREENING METHODS

Visual, olfactory and photoionization detector soil field screening and assessment will be performed by a qualified environmental professional during all remedial and development excavations into known or potentially contaminated material. Soil screening will be performed regardless of when the invasive work is done and will include all excavation and invasive work performed during the remedy and during development phase, such as excavations for foundations and utility work, prior to issuance of the Certificate of Completion.

3.5.2 STOCKPILE METHODS FOR CONTAMINATED SOILS

It is not anticipated that any soil will be stockpiled. However, if needed, stockpiles of contaminated materials will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by NYSDEC.

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected, and damaged tarp covers will be promptly replaced.

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

3.5.3 MATERIALS EXCAVATION AND LOAD OUT

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

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

The presence of utilities and easements on the Site has been investigated during the remedial investigation work and has been disconnected or removed during the demolition work. It has been determined that no risk or impediment to the planned work under this IRMWP is posed by utilities or easements on the Site.

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

A tracking pad per the soil erosion plan will be installed at the egress of the construction work. A truck wash associated with construction activities will be operational during construction.

The Remediation Engineer will be responsible for ensuring that all outbound trucks are not causing any off-Site tracking of the contaminated soils. A Truck Staging Route will be established prior to commencement of trucking activities.

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

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

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

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

3.5.4 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.

Proposed in-bound and out-bound truck routes to the Site will take into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) limiting total distance to major highways; (d) promoting safety in access to highways; (e) overall safety in transport; and (f) community input, which will be sought via the Citizens Participation Plan (CPP), included in **Appendix A**.

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.

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

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

A tracking pad will be installed at the Site egress to ensure clean-up of the soils from the truck tires. Track tires will be washed. Truck wash waters will be contained on-site with proper sloping of the tracking pad towards the Site.

3.5.5 MATERIALS DISPOSAL OFF-SITE

Approval from appropriate disposal facilities will be received prior to start of work. Approval letters will be provided separately when available. The total quantity of material expected to be disposed off-Site is approximately 9,075 tons of soil and fill. All soil/fill/solid waste excavated and removed from the Site will be treated as contaminated and regulated material and will be disposed in accordance with all local, State (including 6NYCRR Part 360) and Federal regulations. If disposal of soil/fill from this Site is proposed for unregulated disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to NYSDEC’s Project Manager. Unregulated off-Site management of materials from this Site will not be undertaken without formal NYSDEC approval.

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

The following documentation will be obtained and reported by the Remedial Engineer for each disposal location used in this project to fully demonstrate and document that the disposal of material derived from the Site conforms with all applicable laws: (1) a letter from the Remedial Engineer or 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 Remedial Engineer. The letter will include as an attachment a summary of all chemical data for the material being transported (including Site Characterization data); and (2) a letter from all receiving facilities stating it is in receipt of the correspondence (above) and is approved to accept the material. These documents will be included in the CCR.

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

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

Soils that are contaminated but non-hazardous and are being removed from the Site are considered by the Division of Materials Management (DMM) in NYSDEC to be Construction and Demolition (C/D) materials with contamination not typical of virgin soils. These soils may be sent to a permitted Part 360 landfill. They may be sent to a permitted C/D processing facility without permit modifications only upon prior notification of NYSDEC Region 3 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 NYSDEC remediation Site, that the soil material is contaminated and that it must not be redirected to on-site or off-site Soil Recycling Facilities. The letter will provide the project identity and the name and phone number of the Remedial Engineer. The letter will include as an attachment a summary of all chemical data for the material being transported.

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

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

Hazardous wastes, if any, 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 sampling 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 quality assurance/quality control (QA/QC) will be reported in the RI Report. 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.

3.6 FLUIDS MANAGEMENT

If groundwater is encountered, it will be treated as contaminated groundwater. The groundwater will be pumped for temporary storage frac-tanks, which will be discharged either into the sewer or disposed of at an off-Site facility. Appropriate permits will be obtained prior to discharge to the sewer. The off-Site disposal of the groundwater will follow the requirements of disposal facility for sampling and characterization.

3.7 BACKFILL FROM OFF-SITE SOURCES

Backfilling is not expected. However, if necessary, material imported to be used on-Site as backfill will be sampled in accordance with DER-10 Section 5.4 (e).

All materials proposed for import onto the Site, will meet the USCO. A “Soil Reuse/Import” form will be submitted to the NYSDEC for pre-approval prior to importing any soils on -Site. Bills of Lading or equivalent documentation will be obtained to track the amount of soil arriving onto the Site and verify the source of soil being imported.

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

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

Non-compliant soils will not be imported onto the Site without prior approval by NYSDEC. Nothing in the approved IRMWP or its approval by NYSDEC will 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 IRMWP will be construed as an approval for this purpose.

Solid waste will not be imported onto the Site.

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

3.8 CONTINGENCY PLAN

If underground tanks or other previously unidentified contaminant sources are found during the SOE installation, sampling will be performed on product, sediment and surrounding soils, etc. Chemical analytical work will be for full scan parameters (TAL metals; TCL volatiles and semi-volatiles, TCL pesticides and PCBs, and emerging contaminants).

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.

If grossly contaminated media is encountered, it will be separately stockpiled on plastic and covered. Waste characterization sampling of the stockpile will be conducted to determine an appropriate disposal facility. Waste characterization will be performed per the proposed facilities requirements. In addition, remedial investigation sampling or post excavation will be performed within and surrounding the grossly contaminated material to vertically and horizontally to delineate the extent of the contamination. Samples will be analyzed for a combination of full TCL and TAL analytes – which include VOCs (USEPA Method 8260), metals (USEPA Methods 6010/7471), SVOCs (USEPA Method 8270), PCBs and pesticides (USEPA Methods 8081/8082), and PFAS (USEPA Method 537), and 1,4 dioxane (USEPA Method 8270). Duplicates, field blanks, equipment blanks and matrix spike/matrix duplicate samples will be analyzed as required for TCL/TAL PFAS and 1.4 dioxane. Trip blanks will accompany all samples analyzed for VOCs. These QA/QC procedures are provided in **Appendix B**.

3.9 ODOR, DUST, AND NUISANCE CONTROL PLAN

Odor, dust and nuisance control will be in accordance with the Site-specific Health and Safety Plan (HASP) and CAMP. The HASP is discussed in Section 7.0 of this report and provided in **Appendix C**. The CAMP is discussed in Section 8.0 of this report and provided in **Appendix D**.

3.9.1 ODOR CONTROL PLAN

This odor control plan is designed to control emissions of nuisance odors off-Site. 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 within 24 hours. Implementation of all odor controls, including the halt of work, will be the responsibility of the Volunteer's Remediation Engineer, who is responsible for certifying the Final Engineering Report (FER).

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 approved foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-Site disposal; (e) use of chemical deodorants in spray or misting systems; and, (f) use of staff to monitor odors in surrounding neighborhoods.

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

3.9.2 DUST CONTROL PLAN

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

- Dust suppression will be achieved through the use of a dedicated on-Site water truck or water hoses 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.
- Clearing and grubbing will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-Site roads will be limited in total area to minimize the area required for water truck sprinkling.

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 local noise control standards.

4.0 DUSR

Following the completion of the laboratory analysis program, a Data Usability Summary Report (DUSR) will be completed for the lab data and included as part of the RI Report. The DUSR will include available datasets from previous investigations, as well as data from this phase of Site characterization. The DUSR is carried out as specified in DER-10 to evaluate the quality control measures that were implemented during the field and laboratory analytical programs, with the objective of determining whether the reported analytical data are representative and usable for decision making. The DUSR will evaluate whether the data are technically defensible (i.e. were all analytical data requirements met and documented?). Data usability analysis reviews the Site data to determine whether they are adequate to draw conclusions regarding the nature and extent of contamination.

The items that will be reviewed as part of the DUSR will include the following:

- Completeness (number of samples collected and analyzed compared to plans)
- Chains of custody are complete and accurate
- Holding times
- Instrument calibration
- Relative percent difference between field duplicates
- Reasonableness of data (e.g. relationships between total and soluble analytes)
- Blank contamination

The DUSR will be conducted in accordance with guidelines provided under Appendix 2B of DER-10. The Site-specific Quality Assurance Project Plan (QAPP) is included in **Appendix B**.

5.0 CONSTRUCTION COMPLETION REPORT

The reporting of the IRM will be included in a CCR to be completed in accordance with DER-10 following the conclusion of IRM activities and submitted to NYSDEC. The CCR will also be attached to and referenced in the FER for the Site.

The CCR will include the following:

- A comprehensive account of the locations and characteristics of all material removed from the Site including the surveyed map(s) of all sources
- 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 will include records and approvals for receipt of the material
- As-built drawings for all constructed elements, certifications, manifests, and bills of lading
- A description of the changes in the IRM from the elements provided in this IRMWP and associated design documents
- A tabular summary of all performance evaluation sampling results and other sampling and chemical analysis performed as part of the IRM
- Written and photographic documentation of all remedial work performed under the IRM
- A thorough summary of all residual contamination left on the Site after the IRM is complete, if applicable, and an explanation for why the material was not removed as part of the IRM.

6.0 QUALITY ASSURANCE/QUALITY CONTROL

QA/QC is addressed in the QAPP included as **Appendix B**. The QAPP outlines procedures to be followed for sampling and analysis to ensure quality of the results. A DUSR will be prepared with the final reports to document the reliability of the sample results.

7.0 HEALTH AND SAFETY PLAN

A Site-specific HASP has been prepared and is included as **Appendix C**. All on-Site personnel and visitors involved in the RI and IRM will be required to read and sign the HASP prior to entry of the Site.

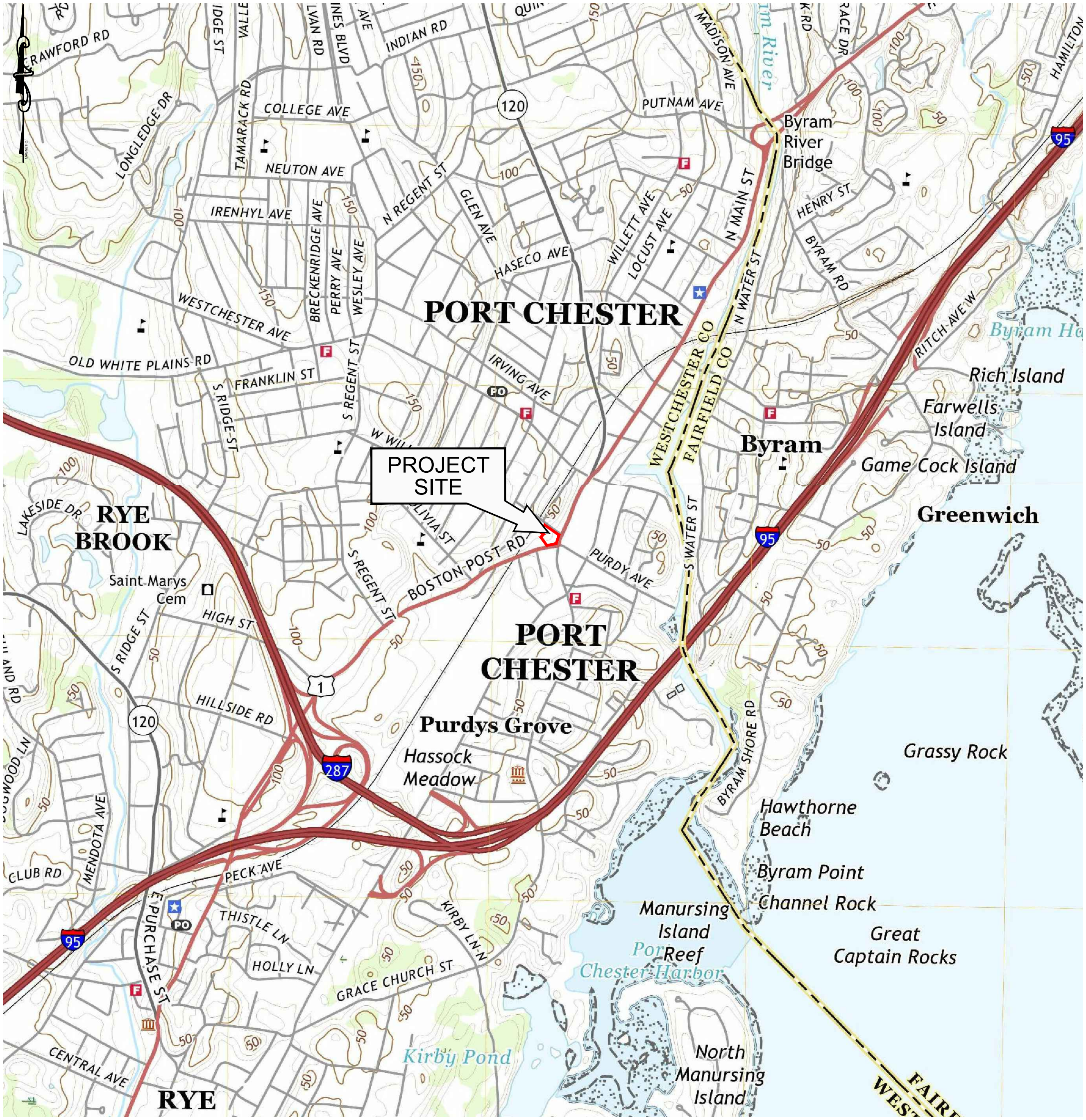
8.0 COMMUNITY AIR MONITORING

A CAMP is provided as **Appendix D**, in accordance with DER-10 requirements for remedial investigation. The CAMP sets forth air monitoring procedures that will be utilized to measure airborne emissions during the RI and IRM, in order to minimize the release of contaminants to off-Site areas.

9.0 CITIZEN PARTICIPATION

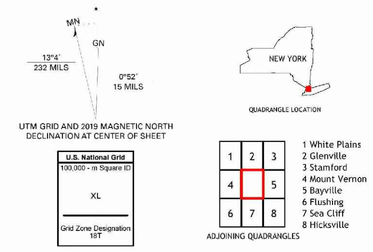
Citizen participation activities will be performed throughout the IRM process to involve and inform the public. The specific citizen participation activities to be performed are outlined in the Citizen Participation Plan (CPP), included as **Appendix A**.

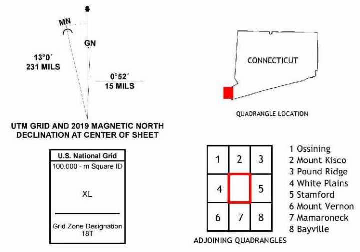
Figures



REFERENCE:

HISTORICAL TOPOGRAPHICAL MAPS PREPARED BY USGS, MAPS DATED 2019.





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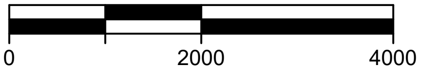


FIG-1.1

108 SOUTH MAIN STREET
PORT CHESTER NY 10801

SITE LOCATION MAP

SESI
CONSULTING
ENGINEERS D.P.C.

SOILS / FOUNDATIONS
SITE DESIGN
ENVIRONMENTAL

12A MAPLE AVE. PINE BROOK, N.J. 07058 PH: 973-808-9050

DRAWN BY: aas
CHECKED BY: JRN
SCALE: AS NOTED
DATE: 09/22/2021
JOB NO.: 12056

N:\ACAD\12056\CAD\12056 – FIG–1.2 – SITE LOCATION MAP.DWG 09/23/21 04:47:50PM, aas, LAYOUT:FIG–1.2

Lots 35, 37, and part of (P/O) Lot 28 and Myneta Place, as outlined in this figure, have been merged into one lot and the new property designation is: Block 1, Lot 57.

LEGEND:

— — — — PROPERTY/BCP SITE BOUNDARY

Scale 1"=50'

0 50 100

REFERENCE

PROPERTY MAP AND TAX INFORMATION TAKEN FROM VILLAGE OF PORT CHESTER TAX MAP, PREPARED JUNE 1, 2019.

N:\ACAD\12056\CAD\12056 – FIG-1.1 – TAX MAP.DWG 09/22/21 01:18:39PM, aas, LAYOUT:FIG-1.1

dwg by: aas
chk by: JRN
scale: AS NOTED
date: 09/22/2021

CERT. OF AUTH. # 24GA27934700
SOILS / FOUNDATIONS
SITE DESIGN
ENVIRONMENTAL

SESI
CONSULTING ENGINEERS

12A MAPLE AVE, PINE BROOK, N.J. 07058 PH: 973-808-9050

project:
108 SOUTH MAIN
STREET PORT CHESTER, NEW YORK

title:
TAX MAP

job no: 12056
drawing no:

FIG-2.1

1 of 1

LOTS 35, 37, AND PART OF (P/O) LOT 28 AND MYNETA PLACE, AS OUTLINED IN THIS FIGURE, HAVE BEEN MERGED INTO ONE LOT AND THE NEW PROPERTY DESIGNATION IS BLOCK 1, LOT 57.

LEGEND:

▬ ▬ ▬ - PROPERTY/ BCP SITE BOUNDARY

REFERENCE

1. EXIST CONDITIONS & BOUNDARY ARE TAKEN FROM NY GIS MAP, DATED 2021 AND SURVEY PREPARED BY GEOLAND LAND SURVEYING PC, DATED SEPTEMBER 22, 2021.

SCALE: 1"=30'

0 30 60

N:\ACAD\12056\CAD\12056 – FIG-2.2 – SITE PLAN.DWG 12/02/21 11:07:42AM, yelena.zolotova, LAYOUT:FIG-2.2

dwg by: yz
chk by: FL
scale: AS NOTED
date: 12/02/2021

SESI
CONSULTING ENGINEERS
CERT. OF AUTH. # 24GA27934700
SOILS / FOUNDATIONS
SITE DESIGN
ENVIRONMENTAL
12A MAPLE AVE, PINE BROOK, N.J. 07058 PH: 973-808-9050

project:
108 SOUTH MAIN STREET
BLOCK 1, LOT 57
PORT CHESTER, NEW YORK 10573

title:
SITE PLAN

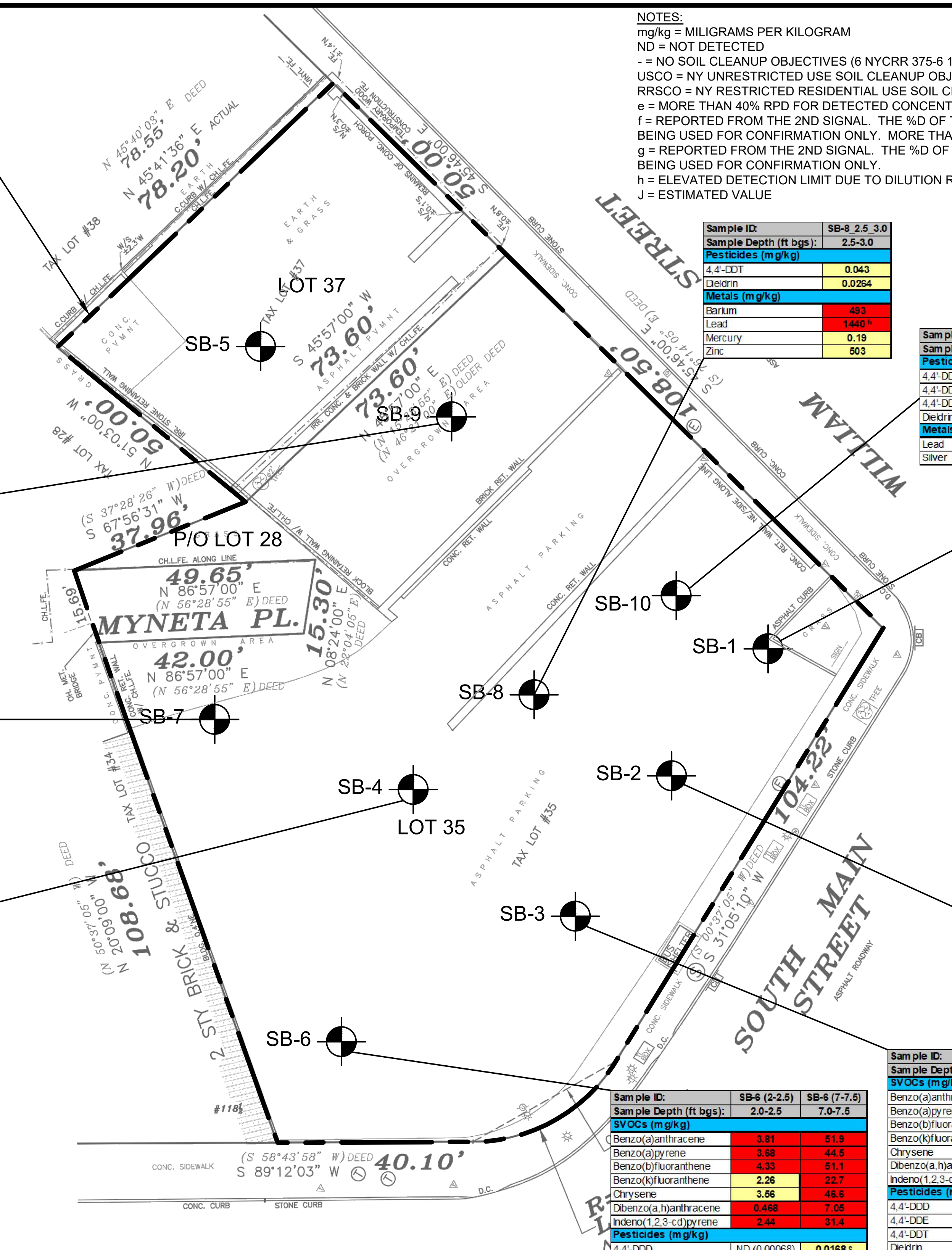
job no: 12056
drawing no:

FIG-2.2

1 of 1

NOTES:
mg/kg = MILIGRAMS PER KILOGRAM
ND = NOT DETECTED
- = NO SOIL CLEANUP OBJECTIVES (6 NYCRR 375-6 12/06)
USCO = NY UNRESTRICTED USE SOIL CLEANUP OBJECTIVES (6 NYCRR 375-6 12/06)
RRSCO = NY RESTRICTED RESIDENTIAL USE SOIL CLEANUP OBJECTIVES w/CP-51 (10/10) (6 NYCRR 375-6 12/06)
e = MORE THAN 40% RPD FOR DETECTED CONCENTRATIONS BETWEEN THE TWO GC COLUMNS.
f = REPORTED FROM THE 2ND SIGNAL. THE %D OF THE CCV ON THE 1ST SIGNAL EXCEEDS THE METHOD CRITERIA OF 20%, SO IT IS BEING USED FOR CONFIRMATION ONLY. MORE THATN 40% RPD FOR DETECTED CONCENTRATIONS
g = REPORTED FROM THE 2ND SIGNAL. THE %D OF THE CCV ON THE 1ST SIGNAL EXCEEDS THE METHOD CRITERIA OF 20%, SO IT IS BEING USED FOR CONFIRMATION ONLY.
h = ELEVATED DETECTION LIMIT DUE TO DILUTION REQUIRED FOR HIGH INTERFERING ELEMENT.
J = ESTIMATED VALUE

LOTS 35, 37, AND PART OF (P/O) LOT 28 AND MYNETA PLACE, AS OUTLINED IN THIS FIGURE, HAVE BEEN MERGED INTO ONE LOT AND THE NEW PROPERTY DESIGNATION IS BLOCK 1, LOT 57.



Sample ID:	SB-9 (2.0-2.5)	SB-9 (9-9.5)
Sample Depth (ft bgs):	2.0-2.5	9.0-9.5
SVOCs (mg/kg)		
Benzo(a)anthracene	5.82	ND (0.036)
Benzo(a)pyrene	4.06	ND (0.036)
Benzo(b)fluoranthene	4.84	ND (0.036)
Benzo(k)fluoranthene	2.16	ND (0.036)
Chrysene	4.92	ND (0.036)
Dibenzo(a,h)anthracene	0.674	ND (0.036)
Indeno(1,2,3-cd)pyrene	3.05	ND (0.036)
Metals (mg/kg)		
Lead	394	3.6
Mercury	0.73	<0.036
Zinc	192	17.3

Sample ID:	SB-7_4.0_4.5
Sample Depth (ft bgs):	4.0-4.5
Metals (mg/kg)	
Lead	112 h
Mercury	0.81
Nickel	48.4
Silver	5.1 h
Zinc	136

Sample ID:	SB-8_2.5_3.0
Sample Depth (ft bgs):	2.5-3.0
Pesticides (mg/kg)	
4,4'-DDT	0.043
Dieldrin	0.0264
Metals (mg/kg)	
Barium	493
Lead	1440 h
Mercury	0.19
Zinc	503

Sample ID:	SB-10 (2-2.5)	SB-10 (7-7.5)
Sample Depth (ft bgs):	2.0-2.5	7.0-7.5
Pesticides (mg/kg)		
4,4'-DDD	0.0031 e	0.0128
4,4'-DDE	0.0012 e	0.0127
4,4'-DDT	0.005	0.0043
Dieldrin	0.0013	0.0087
Metals (mg/kg)		
Lead	97.4 h	183 h
Silver	2.0 h	3.2 h

Analyte	USCO	RRSCO
SVOCs (mg/kg)		
Benzo(a)anthracene	1	1
Benzo(a)pyrene	1	1
Benzo(b)fluoranthene	1	1
Benzo(g,h,i)perylene	100	100
Benzo(k)fluoranthene	0.8	3.9
Chrysene	1	3.9
Dibenzo(a,h)anthracene	0.33	0.33
Dibenzofuran	7	59
Indeno(1,2,3-cd)pyrene	0.5	0.5
Pesticides (mg/kg)		
4,4'-DDD	0.0033	13
4,4'-DDT	0.0033	7.9
Aldrin	0.005	0.097
Dieldrin	0.005	0.2
PCBs (mg/kg)		
Total PCBs	0.1	1
Metals (mg/kg)		
Barium	350	400
Copper	50	270
Lead	63	400
Mercury	0.18	0.81
Nickel	30	310
Silver	2	180
Zinc	109	10000

Sample ID:	SB-1_2.0_2.5	SB-1_7.0_7.5
Sample Depth (ft bgs):	2.0-2.5	7.0-7.5
SVOCs (mg/kg)		
Benzo(a)anthracene	0.855	19.7
Benzo(a)pyrene	0.848	18.1
Benzo(b)fluoranthene	0.999	20.4
Benzo(k)fluoranthene	0.433	5.87
Chrysene	0.841	17.8
Dibenzo(a,h)anthracene	0.14	2.27
Indeno(1,2,3-cd)pyrene	0.653	13.2
Pesticides (mg/kg)		
4,4'-DDD	0.0018	0.0170 e
4,4'-DDE	ND (0.00071)	0.0114 e
4,4'-DDT	0.0016 e	0.0483
Aldrin	ND (0.00071)	0.0073
Dieldrin	0.0027 e	0.117
Metals (mg/kg)		
Barium	90.6	571
Copper	20.6	57.6
Lead	76.8	734
Zinc	67.7	389

Sample ID:	SB-2_2.0_2.5	SB-2_7.0_7.5
Sample Depth (ft bgs):	2.0-2.5	7.0-7.5
SVOCs (mg/kg)		
Benzo(a)anthracene	32.8	43.6
Benzo(a)pyrene	29	36.3
Benzo(b)fluoranthene	33.3	40.5
Benzo(k)fluoranthene	14.7	18
Chrysene	29.3	39.3
Dibenzo(a,h)anthracene	4.78	5.35
Dibenzofuran	1.26	13.7
Indeno(1,2,3-cd)pyrene	21.3	25.1
Pesticides (mg/kg)		
4,4'-DDD	ND (0.00081)	0.0407
4,4'-DDE	0.0079 e	0.0740 f
4,4'-DDT	0.0203 e	ND (0.00082)
Dieldrin	0.0381 e	0.0719
Metals (mg/kg)		
Barium	330	354
Copper	61.5	14.4
Lead	528	434
Mercury	1.5	1.9
Zinc	395	600

Sample ID:	SB-4_2.5_3.0	SB-4_7.5_8.0
Sample Depth (ft bgs):	2.5-3.0	7.5-8.0
SVOCs (mg/kg)		
Benzo(a)anthracene	0.0232 J	4.94
Benzo(a)pyrene	0.0204 J	4.18
Benzo(b)fluoranthene	0.0269 J	5.34
Benzo(k)fluoranthene	ND (0.036)	1.8
Chrysene	0.0230 J	4.52
Dibenzo(a,h)anthracene	ND (0.036)	0.822
Indeno(1,2,3-cd)pyrene	0.0207 J	3.37
Pesticides (mg/kg)		
4,4'-DDD	ND (0.00066)	0.0224
4,4'-DDE	ND (0.00066)	0.194 e
4,4'-DDT	ND (0.00066)	0.165
Aldrin	ND (0.00066)	0.0054
Dieldrin	ND (0.00066)	0.0487
Metals (mg/kg)		
Barium	462	1250
Lead	27.2 h	6160
Mercury	0.032	0.63
Nickel	42.3	7.5
Silver	4.5 h	0.84
Zinc	90.1	1010

Sample ID:	SB-6 (2-2.5)	SB-6 (7-7.5)
Sample Depth (ft bgs):	2.0-2.5	7.0-7.5
SVOCs (mg/kg)		
Benzo(a)anthracene	3.81	51.9
Benzo(a)pyrene	3.68	44.5
Benzo(b)fluoranthene	4.33	51.1
Benzo(k)fluoranthene	2.26	22.7
Chrysene	3.56	46.6
Dibenzo(a,h)anthracene	0.468	7.05
Indeno(1,2,3-cd)pyrene	2.44	31.4
Pesticides (mg/kg)		
4,4'-DDD	ND (0.00068)	0.0168 e
4,4'-DDE	ND (0.00068)	0.0462
4,4'-DDT	ND (0.00068)	0.0379 e
Dieldrin	ND (0.00068)	0.0618 e
PCBs (mg/kg)		
Total PCBs	37.4	2.14
Metals (mg/kg)		
Barium	238	492
Lead	110	269
Silver	2.3 h	0.84
Zinc	123	366

Sample ID:	SB-3_2.0_2.5	SB-3_8.0_8.5
Sample Depth (ft bgs):	2.0-2.5	8.0-8.5
SVOCs (mg/kg)		
Benzo(a)anthracene	4.94	1.43
Benzo(a)pyrene	4.69	1.49
Benzo(b)fluoranthene	5.96	1.76
Benzo(k)fluoranthene	2.06	0.669
Chrysene	4.75	1.42
Dibenzo(a,h)anthracene	0.774	0.278
Indeno(1,2,3-cd)pyrene	3.29	1.12
Pesticides (mg/kg)		
4,4'-DDD	ND (0.00077)	0.0662
4,4'-DDE	0.0135 f	0.110 g
4,4'-DDT	0.0395	0.0851
Dieldrin	0.0125	0.0202
Metals (mg/kg)		
Barium	184	1150
Copper	109	44.3 h
Lead	415	1490 h
Mercury	0.085	0.61
Nickel	109	31.3
Silver	1.2	3.3 h
Zinc	461	490

NYS Education Law
Unauthorized alterations or additions to this plan are a violation of section 7209 (2) of the New York State Education Law. Copies of this map not having the seal of the engineer shall not be valid.

LEGEND:

▬	-	PROPERTY BOUNDARY
SB-2 ⊕	-	SOIL BORING LOCATION
🟥 43.6	-	CONCENTRATION EXCEEDS RRSCO'S
🟨 0.117	-	CONCENTRATION EXCEEDS USCO'S

REFERENCE
1. EXIST CONDITIONS & BOUNDARY ARE TAKEN FROM NY GIS MAP, DATED 2021 AND SURVEY PREPARED BY GEOLAND LAND SURVEYING PC, DATED SEPTEMBER 22, 2021.

Scale 1"=30'
0 30 60

dwg by: AG
chk by: MKN
scale: AS NOTED
date: 06/20/2022

SESI
CONSULTING
ENGINEERS
CERT. OF AUTH. # 24GA27934700
SOILS / FOUNDATIONS
SITE DESIGN
ENVIRONMENTAL
12A MAPLE AVE. PINE BROOK, N.J. 07058 PH: 973-808-9050

project:
108 MAIN STREET & 112 WILLIAM STREET
PORT CHESTER, NEW YORK

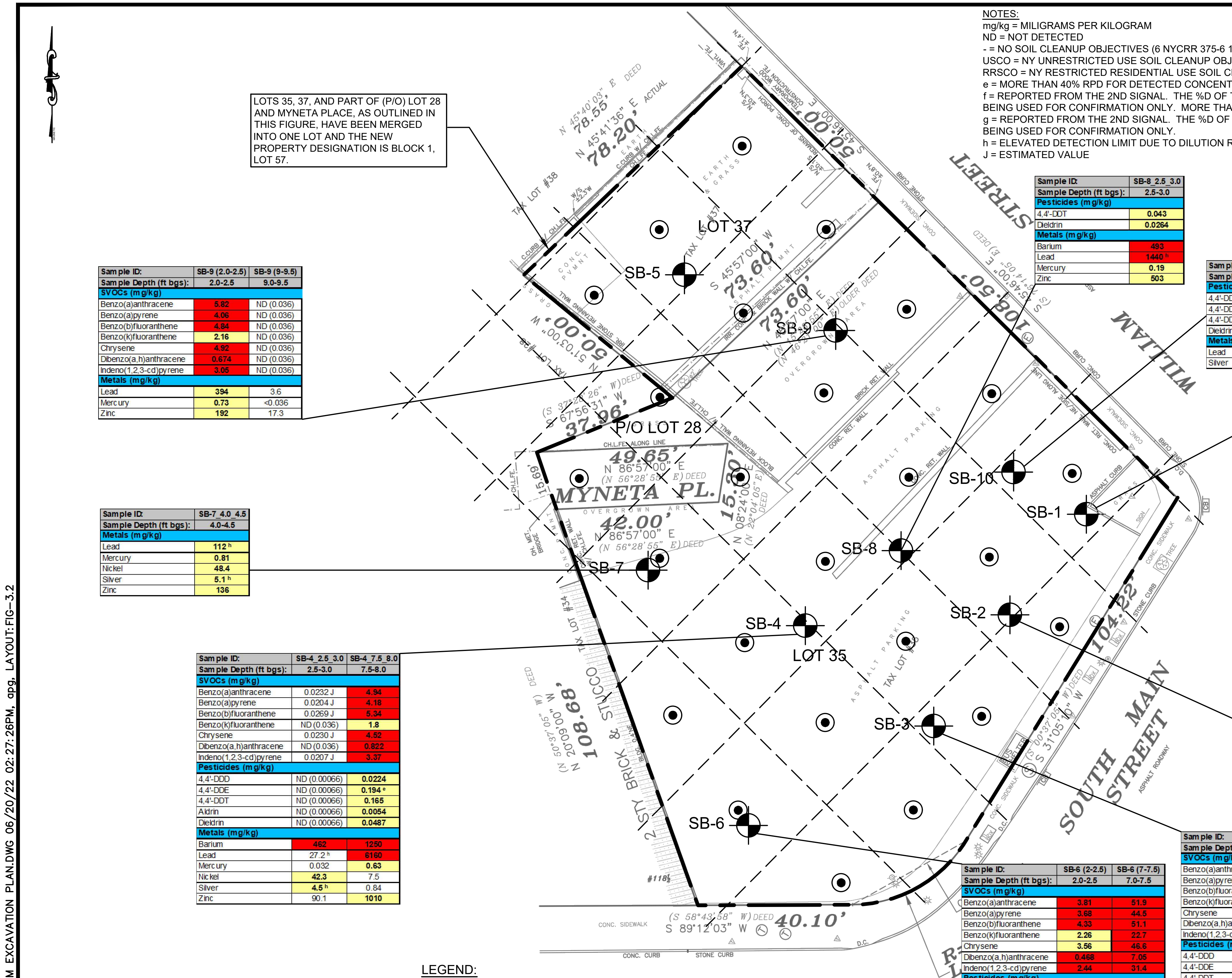
title:
SOIL EXCEEDANCES MAP

job no: 12056
drawing no:
FIG-3.1
1 of 1

N:\ACAD\12056\CAD\12056 – SAMPLE LOCATIONS_2.DWG 06/20/22 02:18:28PM, apg, LAYOUT:FIG–3.1

NOTES:
mg/kg = MILIGRAMS PER KILOGRAM
ND = NOT DETECTED
- = NO SOIL CLEANUP OBJECTIVES (6 NYCRR 375-6 12/06)
USCO = NY UNRESTRICTED USE SOIL CLEANUP OBJECTIVES (6 NYCRR 375-6 12/06)
RRSCO = NY RESTRICTED RESIDENTIAL USE SOIL CLEANUP OBJECTIVES w/CP-51 (10/10) (6 NYCRR 375-6 12/06)
e = MORE THAN 40% RPD FOR DETECTED CONCENTRATIONS BETWEEN THE TWO GC COLUMNS.
f = REPORTED FROM THE 2ND SIGNAL. THE %D OF THE CCV ON THE 1ST SIGNAL EXCEEDS THE METHOD CRITERIA OF 20%, SO IT IS BEING USED FOR CONFIRMATION ONLY. MORE THATN 40% RPD FOR DETECTED CONCENTRATIONS
g = REPORTED FROM THE 2ND SIGNAL. THE %D OF THE CCV ON THE 1ST SIGNAL EXCEEDS THE METHOD CRITERIA OF 20%, SO IT IS BEING USED FOR CONFIRMATION ONLY.
h = ELEVATED DETECTION LIMIT DUE TO DILUTION REQUIRED FOR HIGH INTERFERING ELEMENT.
J = ESTIMATED VALUE

LOTS 35, 37, AND PART OF (P/O) LOT 28 AND MYNETA PLACE, AS OUTLINED IN THIS FIGURE, HAVE BEEN MERGED INTO ONE LOT AND THE NEW PROPERTY DESIGNATION IS BLOCK 1, LOT 57.



Sample ID:	SB-9 (2.0-2.5)	SB-9 (9-9.5)
Sample Depth (ft bgs):	2.0-2.5	9.0-9.5
SVOCs (mg/kg)		
Benzo(a)anthracene	🟥 5.82	ND (0.036)
Benzo(a)pyrene	🟥 4.06	ND (0.036)
Benzo(b)fluoranthene	🟥 4.84	ND (0.036)
Benzo(k)fluoranthene	🟨 2.16	ND (0.036)
Chrysene	🟥 4.92	ND (0.036)
Dibenzo(a,h)anthracene	🟥 0.674	ND (0.036)
Indeno(1,2,3-cd)pyrene	🟥 3.05	ND (0.036)
Metals (mg/kg)		
Lead	🟨 394	3.6
Mercury	🟨 0.73	<0.036
Zinc	🟨 192	17.3

Sample ID:	SB-7_4.0_4.5
Sample Depth (ft bgs):	4.0-4.5
Metals (mg/kg)	
Lead	🟨 112 h
Mercury	🟨 0.81
Nickel	🟨 48.4
Silver	🟨 5.1 h
Zinc	🟨 136

Sample ID:	SB-4_2.5_3.0	SB-4_7.5_8.0
Sample Depth (ft bgs):	2.5-3.0	7.5-8.0
SVOCs (mg/kg)		
Benzo(a)anthracene	0.0232 J	🟥 4.94
Benzo(a)pyrene	0.0204 J	🟥 4.18
Benzo(b)fluoranthene	0.0269 J	🟥 5.34
Benzo(k)fluoranthene	ND (0.036)	🟨 1.8
Chrysene	0.0230 J	🟥 4.52
Dibenzo(a,h)anthracene	ND (0.036)	🟥 0.822
Indeno(1,2,3-cd)pyrene	0.0207 J	🟥 3.37
Pesticides (mg/kg)		
4,4'-DDD	ND (0.00066)	🟨 0.0224
4,4'-DDE	ND (0.00066)	🟨 0.194 e
4,4'-DDT	ND (0.00066)	🟨 0.165
Aldrin	ND (0.00066)	🟨 0.0054
Dieldrin	ND (0.00066)	🟨 0.0487
Metals (mg/kg)		
Barium	🟥 462	🟥 1250
Lead	27.2 h	🟥 6160
Mercury	0.032	🟨 0.63
Nickel	🟨 42.3	7.5
Silver	🟨 4.5 h	0.84
Zinc	90.1	🟨 1010

Sample ID:	SB-8_2.5_3.0
Sample Depth (ft bgs):	2.5-3.0
Pesticides (mg/kg)	
4,4'-DDT	🟨 0.043
Dieldrin	🟨 0.0264
Metals (mg/kg)	
Barium	🟥 493
Lead	🟥 1440 h
Mercury	🟨 0.19
Zinc	🟨 503

Sample ID:	SB-10 (2-2.5)	SB-10 (7-7.5)
Sample Depth (ft bgs):	2.0-2.5	7.0-7.5
Pesticides (mg/kg)		
4,4'-DDD	0.0031 e	🟨 0.0128
4,4'-DDE	0.0012 e	🟨 0.0127
4,4'-DDT	🟨 0.005	🟨 0.0043
Dieldrin	0.0013	🟨 0.0087
Metals (mg/kg)		
Lead	🟨 97.4 h	🟨 183 h
Silver	2.0 h	🟨 3.2 h

Analyte	USCO	RRSCO
SVOCs (mg/kg)		
Benzo(a)anthracene	1	1
Benzo(a)pyrene	1	1
Benzo(b)fluoranthene	1	1
Benzo(g,h,i)perylene	100	100
Benzo(k)fluoranthene	0.8	3.9
Chrysene	1	3.9
Dibenzo(a,h)anthracene	0.33	0.33
Dibenzofuran	7	59
Indeno(1,2,3-cd)pyrene	0.5	0.5
Pesticides (mg/kg)		
4,4'-DDD	0.0033	13
4,4'-DDT	0.0033	7.9
Aldrin	0.005	0.097
Dieldrin	0.005	0.2
PCBs (mg/kg)		
Total PCBs	0.1	1
Metals (mg/kg)		
Barium	350	400
Copper	50	270
Lead	63	400
Mercury	0.18	0.81
Nickel	30	310
Silver	2	180
Zinc	109	10000

Sample ID:	SB-1_2.0_2.5	SB-1_7.0_7.5
Sample Depth (ft bgs):	2.0-2.5	7.0-7.5
SVOCs (mg/kg)		
Benzo(a)anthracene	0.855	🟥 19.7
Benzo(a)pyrene	0.848	🟥 18.1
Benzo(b)fluoranthene	0.999	🟥 20.4
Benzo(k)fluoranthene	0.433	🟥 5.87
Chrysene	0.841	🟥 17.8
Dibenzo(a,h)anthracene	0.14	🟥 2.27
Indeno(1,2,3-cd)pyrene	🟥 0.653	🟥 13.2
Pesticides (mg/kg)		
4,4'-DDD	0.0018	🟨 0.0170 e
4,4'-DDE	ND (0.00071)	🟨 0.0114 e
4,4'-DDT	0.0016 e	🟨 0.0483
Aldrin	ND (0.00071)	🟨 0.0073
Dieldrin	0.0027 e	🟨 0.117
Metals (mg/kg)		
Barium	90.6	🟥 571
Copper	20.6	🟨 57.6
Lead	🟨 76.8	🟥 734
Zinc	67.7	🟨 389

Sample ID:	SB-2_2.0_2.5	SB-2_7.0_7.5
Sample Depth (ft bgs):	2.0-2.5	7.0-7.5
SVOCs (mg/kg)		
Benzo(a)anthracene	🟥 32.8	🟥 43.6
Benzo(a)pyrene	🟥 29	🟥 36.3
Benzo(b)fluoranthene	🟥 33.3	🟥 40.5
Benzo(k)fluoranthene	🟥 14.7	🟥 18
Chrysene	🟥 29.3	🟥 39.3
Dibenzo(a,h)anthracene	🟥 4.78	🟥 5.35
Dibenzofuran	1.26	🟨 13.7
Indeno(1,2,3-cd)pyrene	🟥 21.3	🟥 25.1
Pesticides (mg/kg)		
4,4'-DDD	ND (0.00081)	🟨 0.0407
4,4'-DDE	🟨 0.0079 e	🟨 0.0740 f
4,4'-DDT	🟨 0.0203 e	ND (0.00082)
Dieldrin	🟨 0.0381 e	🟨 0.0719
Metals (mg/kg)		
Barium	330	🟨 354
Copper	🟨 61.5	14.4
Lead	🟥 528	🟥 434
Mercury	🟥 1.5	🟥 1.9
Zinc	🟨 395	🟨 600

Sample ID:	SB-3_2.0_2.5	SB-3_8.0_8.5
Sample Depth (ft bgs):	2.0-2.5	8.0-8.5
SVOCs (mg/kg)		
Benzo(a)anthracene	🟥 4.94	🟥 1.43
Benzo(a)pyrene	🟥 4.69	🟥 1.49
Benzo(b)fluoranthene	🟥 5.96	🟥 1.76
Benzo(k)fluoranthene	🟨 2.06	0.669
Chrysene	🟥 4.75	🟨 1.42
Dibenzo(a,h)anthracene	🟥 0.774	0.278
Indeno(1,2,3-cd)pyrene	🟥 3.29	🟥 1.12
Pesticides (mg/kg)		
4,4'-DDD	ND (0.00077)	🟨 0.0662
4,4'-DDE	🟨 0.0135 f	🟨 0.110 g
4,4'-DDT	🟨 0.0395	🟨 0.0851
Dieldrin	🟨 0.0125	🟨 0.0202
Metals (mg/kg)		
Barium	184	🟥 1150
Copper	🟨 109	44.3 h
Lead	🟥 415	🟥 1490 h
Mercury	0.085	🟨 0.61
Nickel	🟨 109	🟨 31.3
Silver	1.2	🟨 3.3 h
Zinc	🟨 461	🟨 490

Sample ID:	SB-6 (2-2.5)	SB-6 (7-7.5)
Sample Depth (ft bgs):	2.0-2.5	7.0-7.5
SVOCs (mg/kg)		
Benzo(a)anthracene	🟥 3.81	🟥 51.9
Benzo(a)pyrene	🟥 3.68	🟥 44.5
Benzo(b)fluoranthene	🟥 4.33	🟥 51.1
Benzo(k)fluoranthene	🟨 2.26	🟥 22.7
Chrysene	🟨 3.56	🟥 46.6
Dibenzo(a,h)anthracene	🟥 0.468	🟥 7.05
Indeno(1,2,3-cd)pyrene	🟥 2.44	🟥 31.4
Pesticides (mg/kg)		
4,4'-DDD	ND (0.00068)	🟨 0.0168 e
4,4'-DDE	ND (0.00068)	🟨 0.0462
4,4'-DDT	ND (0.00068)	🟨 0.0379 e
Dieldrin	ND (0.00068)	🟨 0.0618 e
PCBs (mg/kg)		
Total PCBs	🟥 37.4	🟥 2.14
Metals (mg/kg)		
Barium	238	🟥 492
Lead	🟨 110	🟨 269
Silver	🟨 2.3 h	0.84
Zinc	🟨 123	🟨 366

LEGEND:

▬ ▬ ▬ ▬	-	PROPERTY BOUNDARY AND IRM EXCAVATION EXTENT
SB-2 ⊕	-	SOIL BORING LOCATION
🟥 43.6	-	CONCENTRATION EXCEEDS RRSCO'S
🟨 0.117	-	CONCENTRATION EXCEEDS USCO'S
— — — — — —	-	POST-EXCAVATION SAMPLING 30'X30 GRIDS
◉	-	PROPOSED POST-EXCAVATION SAMPLE LOCATIONS

NYS Education Law
Unauthorized alterations or additions to this plan are a violation of section 7209 (2) of the New York State Education Law. Copies of this map not having the seal of the engineer shall not be valid.

REFERENCE
1. EXIST CONDITIONS & BOUNDARY ARE TAKEN FROM NY GIS MAP, DATED 2021 AND SURVEY PREPARED BY GEOLAND LAND SURVEYING PC, DATED SEPTEMBER 22, 2021.

Scale 1"=30'
0 30 60

dwg by: AG
chk by: MKN
scale: AS NOTED
date: 06/20/2022

CERT. OF AUTH. # 24GA27934700
SOILS / FOUNDATIONS
SITE DESIGN
ENVIRONMENTAL
SESI CONSULTING ENGINEERS
12A MAPLE AVE, PINE BROOK, N.J. 07058 PH: 973-808-9050

project:
108 MAIN STREET & 112 WILLIAM STREET
PORT CHESTER, NEW YORK

title:
IRM EXCAVATION PLAN AND
PROPOSED POST-EXCAVATION
SAMPLE LOCATIONS

job no: 12056
drawing no:

FIG-3.2

1 of 1

N:\ACAD\12056\CAD\12056 – IRM EXCAVATION PLAN.DWG 06/20/22 02:27:26PM, apg, LAYOUT:FIG-3.2

Appendix A:

Citizen Participation Plan (Pending)

Appendix B:
Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN

108 Main Port Chester Steam Laundry Site
108 South Main Street and 112 William Street
Port Chester, Westchester County, New York
NYSDEC BCP Site # C360224

Prepared for:
BCP Volunteer 108 Gateway, LLC
c/o RMA Development, LLC
92 North Avenue, Suite 204
New Rochelle, New York, 10801

Prepared by:

SESI CONSULTING ENGINEERS, D.P.C.
12A Maple Avenue
Pine Brook, New Jersey 07058

Project No.: 12056

DECEMBER 2021

REVISED JUNE 2022

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LIST OF ACRONYMS

Acronym	**Definition**
AAS	Absorption Spectroscopy
ASP	Analytical Service Protocol
BCP	Brownfield Cleanup Program
DUSR	Data Usability Summary Report
ELAP	Environmental Laboratory Accreditation Program
GC/MS	Gas Chromatography/Mass Spectrometry
HAS	Hollow-stem Auger
HDPE	High-Density Polyethylene
IRMWP	Interim Remedial Measures Work Plan
LDPE	Low-density Polyethylene
LFPS	Low Flow Purging Sampling
MDL	Method Detection Limit
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PCB	Polychlorinated Biphenyls
PFAS	Per- and polyfluoroalkyl substances
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
PPE	Personal Protective Equipment
PTFE	Polytetrafluoroethylene
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RIWP	Remedial Investigation Work Plan
SESI	SESI Consulting Engineers, Inc.
TIC	Tentatively Identified Compound
TCL	Target Compound List
VOC	Volatile Organic Compound
USEPA	United States Environmental Protection Agency

1.0 PROJECT DESCRIPTION

This document presents the Quality Assurance Project Plan (QAPP) for the Interim Remedial Measures Workplan (IRMWP) for the proposed development at 108 South Main Street, Port Chester, New York (the "Site"). The Site is identified on local tax maps as Block 1, Lot 57. The Site previously consisted of Lots 35, 37, and part of 28 (including a portion of a demapped undeveloped street called Myneta Place). However, the Village of Port Chester recently merged the Site lots into one (1) parcel, re-designated as Section 142.38, Block 1, Lot 57. The Site also was previously identified with two (2) addresses - 108 Main Street and 112 William Street. Former Lot 35 was previously used for parking before the Volunteer's recent Site acquisition, but has been vacant since August 2021. Former Lot 37, once identified as 112 William Street, is a recently demolished residence that is currently vacant. The part of former Lot 28 included in this Site is also vacant.

SESI Consulting Engineers (SESI) prepared the IRMWP for 108 South Main Street, Port Chester, New York, dated June 2022, which describes the investigation activities to be conducted at the Site, as part of the Site's planned remedial investigation and remediation.

The remedial investigations selected for the Site include the following:

- Installation of 15 soil borings to evaluate and delineate contamination;
- Installation of four (4) permanent groundwater monitoring wells to delineate the nature and extent of Recognized Environmental Condition-specific contaminants in the Site groundwater; identify actual or potential impacts to sensitive receptors, e.g. surface water; determine whether a contaminant plume exists; gather sufficient data to determine groundwater flow direction and contour map and evaluate groundwater remedial alternatives, including, as appropriate, monitored natural attenuation, and provide information on the background quality of the groundwater flowing into the Site; and
- Collection of five (5) vapor/air samples for analysis of volatile organic compounds.

2.0 PROJECT ORGANIZATION

The IRMWP activities will be conducted by SESI and their qualified subcontractors, on behalf of 108 Gateway, LLC and RMA Development, LLC. The organization of SESI's key project management and field staff, and respective areas of responsibility, is presented below **(Table 2.1)** along with the names of subcontractors.

Table 2.1—SESI Personnel and Subcontractors

Role	Name	Telephone No.
Project Principal	Fuad Dahan, P.E., PhD	973-808-9050 x249
Project Manager (PM)	Monica Norton	973-808-9050 x272
Principal Engineer	Fuad Dahan, P.E., PhD	973-808-9050 x249
Interim Remedial Measures Project Manager	Monica Norton	973-808-9050 x272
Field Team Leader	TBD	
Quality Assurance Officer	Monica Norton	973-808-9050 x272
Field Personnel	TBD	
Analytical Laboratory	Alpha Analytical	201-972-6356
Data Validator	Laboratory Data Consultants	760-827-1100
Driller	AARCO	631-586-5900

2.1 PROJECT PRINCIPAL

Provides technical and administrative oversight and guidance throughout the project, assists in securing company resources, participates in technical review of deliverables, and attends key meetings as needed.

2.2 PRINCIPAL ENGINEER

Provides technical guidance and review of reports and analytical data. Will have key involvement in screening and development of remedial alternatives.

2.3 PROJECT MANAGER

Responsible for maintaining the day-to-day schedule for completing the fieldwork and deliverables according to BCP program requirements and client expectations.

2.4 INTERIM REMEDIAL MEASURES PROJECT MANAGER

Responsible for coordinating and directing field efforts of SESI staff and subcontractors, and for maintaining that work is done according to QAPP specifications.

2.5 FIELD TEAM LEADER

Responsible for overseeing field work during the implementation of the IRMWP, including observing subcontractors, maintaining field notes, and collecting samples of various environmental media.

2.6 QUALITY ASSURANCE OFFICER

Responsible for reviewing sampling procedures and certify that the data was collected and analyzed using the appropriate procedures.

3.0 QA/QC OBJECTIVES FOR MEASUREMENT OF DATA

In cases where New York State Department of Health (NYSDOH) ELAP Certification exists for a specific group or category of parameters, the laboratory performing analysis in connection with this project will have appropriate NYSDOH Environmental Laboratory Accreditation Program (ELAP) Certification. Alpha Analytical Laboratories of Westborough, MA, an ELAP-certified lab, will be performing the sample analyses for the project. Analytical Service Protocol (ASP, June 2000) Category B deliverables are required for all samples. All data will be sent to a third party, Laboratory Data Consultants of Carlsbad, CA, for validation in accordance with NYSDEC BCP requirements. Resumes and Qualifications from LDC are included in Appendix C of the RIWP.

Detection limits set by NYSDEC-ASP will be used for all sample analyses unless otherwise noted. If NYSDEC-ASP-dictated detection limits prove insufficient to assess project goals (i.e., comparison to drinking water standards or attainment of Applicable or Relevant and Appropriate Requirements [ARARs]), then ASP Special Analytical Services (SAS) or other appropriate methods will be utilized.

The quality assurance/quality control objectives for all measurement data include completeness, representativeness, comparability, precision, and accuracy.

3.1 COMPLETENESS

The analyses performed must be appropriate and inclusive. The parameters selected for analysis are chosen to meet the objectives of the study.

Completeness of the analyses will be assessed by comparing the number of parameters intended to be analyzed with the number of parameters successfully determined and validated. Data must meet QC acceptance criteria for 100 percent or more of requested determinations.

3.2 REPRESENTATIVENESS

Samples must be taken of the population and, where appropriate, the population will be characterized statistically to express the degree to which the data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process, or environmental condition.

Non-dedicated sampling devices will be cleaned between sampling points by washing and rinsing with pesticide-grade methanol, followed by a thorough rinse with distilled water. Specific cleaning techniques are described in the Field Sampling Procedure. Two (2) types of blank samples will accompany each sample set where Target Compound List (TCL) volatiles are to be analyzed (water matrix only). A trip blank, consisting of a 40 ml VOA vial of organic-free water prepared by the laboratory, will accompany each set of sample bottles from the laboratory to the field and back. This bottle will remain sealed throughout the shipment and sampling process. This blank will be analyzed for TCL volatile organic compounds (VOCs) along with the groundwater samples to ensure that contamination with TCL VOCs has not occurred during the bottle preparation, shipment and sampling phase of the project. In order to check for contaminant carryover when non-dedicated sampling equipment is used, a rinsate blank will be submitted to the laboratory. This blank will also be analyzed for TCL VOCs. The TCL compounds are identified in the United States Environmental Protection Agency (USEPA) Contract Laboratory Program dated 10/2016 or as periodically updated.

The analysis results obtained from the determination of identical parameters in field duplicate samples can be used to further assess the representativeness of the sample data.

3.3 COMPARABILITY

Consistency in the acquisition, preparation, handling and analysis of samples is necessary in order for the results to be compared where appropriate. Additionally, the results obtained from analyses of the samples will be compared with the results obtained in previous studies, if available.

To ensure the comparability of analytical results with those obtained in previous or future testing, all samples will be collected and analyzed by NYSDEC-approved methods. The NYSDEC-ASP mandated holding times for various analyses will be strictly adhered to.

3.4 PRECISION AND ACCURACY

The validity of the data produced will be assessed for precision and accuracy. Analytical methods which will be used include gas chromatography/mass spectrometry (GC/MS), gas chromatography (GC), colorimetry, atomic spectroscopy, gravimetric, and titrimetric techniques. The following outlines the procedures for evaluating precision and accuracy, routine monitoring procedures, and corrective actions to maintain analytical quality control. All data evaluations will be consistent with NYSDEC-ASP procedures (June 2000). Data will be 100 percent compliant with NYSDEC-ASP requirements. Matrix spike and matrix spike duplicates will be collected to confirm accuracy and precision at a rate of one (1) per 20 soil and/or groundwater samples taken.

The number of duplicate, spiked, and blank samples analyzed will be a minimum of one (1) duplicate for every 20 samples per each medium of groundwater and soil. The inclusion and frequency of analysis of field blanks will be on the order of one (1) per every 20 samples (soil). For the aqueous matrix, field blanks will be collected at a frequency of one (1) per day. Samples to be analyzed for VOCs will be accompanied by a trip blank for each shipment and field blanks (water matrix) or field blanks (soil). An equipment blank for PFAS will be collected once per day per matrix, regardless of whether equipment being used is disposable at a frequency of one (1) per 20 samples taken for both soil and groundwater.

Quality assurance audit samples will be prepared and submitted by the laboratory QA manager for each analytical procedure used. The degree of accuracy and the recovery of analyte to be expected for the analysis of QA samples and spiked samples is dependent upon the matrix, method of analysis, and compound or element being determined. The concentration of the analyte relative to the detection limit is also a major factor in determining the accuracy of the measurement. The lower end of the analytical range for most analyses is generally accepted to be five (5) times the detection limit. At or above this level, the determination and spike recoveries for metals in water samples will be expected to range from 75 to 125 percent. The recovery of organic surrogate compounds and matrix spiking compounds determined by GC/MS will be compared to the guidelines for recovery of individual compounds as established by the United States Environmental Protection Agency Contract Laboratory Program dated 7/85 or as periodically updated.

The quality of results obtained for inorganic ion and demand parameters will be assessed by comparison of QC data with laboratory control charts for each test.

4.0 SAMPLING PROCEDURES

4.1 SAMPLING PROGRAM

The sampling program for this project will include soil, groundwater, and soil vapor. Soil samples will be collected from split spoon sampling or macrocore devices retrieved from soil borings. Groundwater samples will be collected from groundwater monitoring wells using low flow purging techniques. A description of this method is shown on **Table 4.1**. Soil vapor samples will be collected from vapor points screened in the vadose zone using Summa Canisters. A summary of the sample containers, bottle types, preservatives and holding times is shown on **Table 4.2.** The sampling to be conducted for this project is shown on **Table 4.3.**

4.1.1 DRILLING/SAMPLING PROCEDURES

Soil and groundwater samples will be collected by means of a soil boring program. Soil borings shall be completed using the hollow stem auger drilling methods, direct push methods, or rotary drilling methods, whichever methods are determined to be best suited to Site conditions by the SESI project manager and SESI field team leader.

Soil samples will be collected from soil borings and analyzed in accordance with the NYSDEC-approved Work Plan. Monitoring wells for groundwater sample collection will be installed in select completed soil borings. Either hollow stem auger (HSA) or direct push drilling methods may be utilized for monitoring well completion.

Soil samples shall be collected continuously during drilling so that a complete soil profile is examined and described by the SESI field geologist. The sampling method employed shall be ASTM D-1586/Split Barrel Sampling using a standard 2-foot long, 2-inch outside diameter split- spoon sampler with a 140-pound hammer, in cases where HSA methods are used. Upon retrieval of the sampling barrel, the collected sample shall be placed in glass jars and labeled, stored on site (on ice in a cooler if necessary), and transmitted to the appropriate testing laboratory or storage facility. Chain-of-custody procedures will be practiced following Section 15, EPA-600/4-82-029, Handbook for Sampling and Sample Preservation of Water and Waste Waters.

A geologist or engineer will be on Site during the drilling operations to fully describe each soil sample, following the New York State Soil Description Procedure, and to retain representative portions of each sample.

The drilling contractor will be responsible for obtaining accurate and representative samples, informing the geologist of changes in drilling pressure, keeping a separate general log of soils encountered including blow counts [i.e., the number of blows from a soil sampling drive weight (140 pounds)] required to drive the split-spoon sampler in six (6)-inch increments and installing monitoring wells to levels directed by the supervising geologist following specifications further outlined in this protocol.

4.1.2 MONITORING WELL COMPLETION

Monitoring wells will be constructed of 0.010-inch slot size PVC well screen and riser casing. Other materials utilized for completion will be washed silica sand (Q-Rock No. 4 or approved equivalent) bentonite grout, Portland cement, and a protective steel locking well casing and cap with locks. The depth of the wells will be determined based on the depth to water, type of contaminant and field conditions encountered.

The monitoring well installation method for wells installed within unconsolidated sediments shall be to place the screen and riser assembly into the casing once the screen interval has been selected. At that time, a washed silica sand pack will be placed around the well screen if required to prevent screen plugging. If a sand pack is not warranted, the auger string will be pulled back to allow the native aquifer material to collapse 2 to 3 feet above the top of the screen. Bentonite pellets will then be added to the annulus between the casing and the inside auger to insure proper sealing. Cement/bentonite grout will continue to be added during the extraction of the augers until the entire aquifer thickness has been sufficiently sealed off from horizontal and/or vertical flow above the screened interval. During placement of sand and bentonite pellets, frequent measurements will be made to check the height of the sand pack and thickness of bentonite layers by a weighted drop tape measure.

A bolt-down protective curb box will be installed, flush with the ground, or steel “stick-up” protective casing and secured by a Portland cement seal. The cement seal shall extend laterally at least one (1) foot in all directions from the protective casing and shall slope gently away to drain water away from the well.

4.1.3 WELL DEVELOPMENT

All monitoring wells will be developed or cleared of all fine-grained materials and sediments that have settled in or around the well during installation so that the screen is transmitting representative portions of the groundwater. The development will be by one (1) of two (2) methods, pumping or bailing groundwater from the well until it yields relatively sediment-free water.

A decontaminated pump or bailer will be used and subsequently decontaminated after each use following procedures outlined in the Decontamination Protocol. Pumping or bailing will cease when the turbidity falls below 50 NTUs or until specific conductivity, pH, and temperature are stable (i.e., consecutive readings are within 10 percent with no overall upward or downward trends in measurements). Well development water will be disposed of on the ground surface at each well location.

4.1.4 DECONTAMINATION

All drilling equipment and associated tools including augers, drill rods, sampling equipment, wrenches and any other equipment or tools that have come in contact with contaminated materials will be decontaminated before any drilling on Site begins, between each well, and prior to removing any equipment from the Site. The preferred decontamination procedure will be to scrape the equipment from any residual soils and then rinse with water and Alconox®. Every effort will be made to minimize the generation of contaminated water. Any contaminated water generated will be drummed. The contaminated water drums will be disposed of at an appropriate facility after approval and sampling in accordance with the specific facility requirements.

4.1.5 PFAS SAMPLING CONSIDERATIONS

This section contains the materials limitations for Per- and polyfluoroalkyl substances (PFAS) sampling in accordance with the NYSDEC Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (June 2021).

The groundwater samples will be analyzed for PFAS using Modified USEPA Method 537. Reporting limits for PFOA and PFOS will not exceed 2 nanograms per liter (ng/L). Category B deliverables and an electronic data deliverable will be completed.

PFAS are very persistent in the environment and in the human body. Due to their presence in a variety of products, persistence in the environment and very low drinking water standards, care must be used when groundwater sampling for PFAS to avoid cross contamination from the sampling equipment and personal protective equipment (PPE).

No fabric softener will be used on clothing to be worn in field. Cosmetics, moisturizers, hand cream, unauthorized sunscreen, insect repellant or other related products will not be used the morning of sampling. The field samplers will wear powder-free nitrile gloves while filling and sealing the sample bottles. The sampling equipment components and sample containers will not come in contact with material that may potentially contain PFAS such as aluminum foil, low density polyethylene (LDPE), glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials will be avoided. Food and drink packaging materials will be avoided, as well.

Sampling will be performed using certified PFAS-free sampling materials such as stainless steel, high density polyethylene (HDPE), PVC, silicone, acetate or polypropylene pump and tubing. Rinse water must be laboratory-provided certified PFAS-free distilled or de-ionized water. Standard two (2)-step decontamination using Alconox® detergent and clean certified PFAS-free water rinse will be performed for equipment that does come in contact with PFAS materials.

No waterproof field books, plastic clipboards, binders, or spiral hard cover will be used for PFAS containers. No adhesives (i.e. Post-It® Notes), sharpies, or permanent markers will be used for PFAS containers. The PFAS containers will be labeled with ball point pens. PFAS samples will be stored in separate cooler filled with regular ice only with no chemical (blue) ice packs.

Pre-cleaned sample bottles with closures, coolers, sample labels and a chain of custody form will be provided by the laboratory.

4.2 GROUNDWATER SAMPLING PROGRAM

4.2.1 WELL EVACUATION

Prior to sampling a monitoring well, the static water level will be recorded. All well data will be recorded on a field sampling record. The wells will be sampled in accordance with the USEPA guidelines for the Low Flow Purging Sampling (LFPS). The purpose of LFPS is to collect groundwater samples from monitoring wells that are representative of ambient groundwater conditions in the aquifer. The LFPS method reduces turbidity which is needed particularly when sampling for metals.

4.2.2 SAMPLING PROCEDURE

The wells will be sampled using the USEPA LFPS technique. A flow rate of 100 ml to 250 ml per minute is used to purge the wells. Drawdown should not exceed 0.3 feet. The pump intake is lowered to the mid-point of the water column or as subsurface features such as bedrock fractures or more permeable zones warrant. At the initiation of low flow purging a water level is recorded as well as field parameters. Field parameters are then monitored every five (5) minutes during low flow purging using a flow through cell. When three (3) consecutive measurements of pH differ by 0.1 units or less, with ORP within 10 mv or less, turbidity varies 10 percent or less, conductivity differs by three (3) percent or less and dissolved oxygen by 10 percent or less, sampling may begin. Flow through cells are used so continuous real time readings are made. When the parameters stabilize the flow through cell is disconnected and sample bottles are filled directly from the tubing. Low-flow sampling procedures are summarized on **Table 4.1.**

4.3 SOIL VAPOR SAMPLING

Soil vapor sampling will be conducted in accordance with NYSDOH Guidance for Evaluating Soil Vapor Intrusion in New York State (October 2006). Soil vapor samples will be collected in the vadose zone from shallow (five [5] feet) vapor points. Each vapor point will be installed in a shallow boring drilled either by hand-operated equipment (e.g.

hand auger or percussion hammer drill), or by a small truck-mounted drill rig. Drilling equipment used shall be based on soil conditions, and the method that provides the most practical approach.

Each vapor point will consist of an inert sampling tube (polyethylene, stainless steel, or Teflon®) with a six (6)-inch screened section at the bottom through which soil vapors can be sampled. The screen slot size will be 0.0075 inches. A sampling zone will be created around the screened section by backfilling with one (1) to two (2) feet of porous coarse sand or glass beads, and at least three (3) feet of bentonite will be placed above the porous sampling zone to form a seal from the surface. Native clean soil will be packed around the remaining annulus to the ground surface.

The regulator will be set to collect a soil vapor sample at a flow rate of less than 0.2 liters per minute. After the summa canister is filled, the valve will be closed.

Each canister will be listed according to a specific sample I.D. on a chain of custody form. Sample canisters will be delivered to the laboratory within 24 hours and analyzed for VOCs by method TO-15. The detection limit for VOCs will be 1 µg/m3 or less.

The soil vapor sampling effort will include the use of inert helium tracer gas to verify that the soil vapor samples are not diluted by ambient air. The atmosphere around the sampling tube will be enriched with the tracer gas, and the soil vapor sample will be collected in the presence of the enriched tracer atmosphere. This will be accomplished by placing an inverted plastic pail over the sampling point and filling the pail with the tracer gas via a small tube penetrating the site of the pail. Refer to NYSDOH Guidance for Evaluating Indoor Air Intrusion in New York State (October 2006) and the subsequent May 2017 updates to the Soil Vapor/Indoor Air Decision Matrices.

Weather conditions in the 48 hours prior to the test, and during the test, will be noted, including average wind speed, precipitation, temperature, and barometric pressure.

4.4 SAMPLE PRESERVATION AND SHIPMENT

Since all bottles will contain the necessary preservatives as shown in **Table 4.2**, they need only be filled. The 40 ml VOA vials must be filled brim full with no air bubbles. The other bottles should be filled to within about one (1) inch from the top.

The bottles will be sent from the laboratory in coolers which will be organized on a per site basis. Following sample collection, the bottles should be placed on ice in the shipping cooler. The samples will be cooled to 4°C, but not frozen.

Final packing and shipment of coolers will be performed in accordance with guidelines outlined in the ASP.

5.0 SAMPLE CUSTODY

The program for sample custody and sample transfer is in compliance with the NYSDEC-ASP, as periodically updated. If samples may be needed for legal purposes, chain-of-custody procedures, as defined by NEIC Policies and Procedures (USEPA-330/9-78-001-R, Revised June 1988) will be used. Sample chain-of-custody is initiated by the laboratory with selection and preparation of the sample containers. To reduce the chance for error, the number of personnel handling the samples should be minimized.

5.1 FIELD SAMPLE CUSTODY

A chain-of-custody record accompanies the samples from initial sample container selection and preparation at the laboratory, shipment to the field for sample containment and preservation, and return to the laboratory. Two (2) copies of this record follow the samples to the laboratory. The laboratory maintains one (1) file copy and the completed original is returned to the site inspection team. Individual sample containers provided by the laboratory are used for shipping samples. The shipping containers are insulated and ice is used to maintain samples at approximately 4°C until samples are returned and in the custody of the laboratory. All sample bottles within each shipping container are individually labeled and controlled. Samples are to be shipped to the laboratory within 24-48 hours of the day of collection depending on parameter holding times.

Each sample shipping container is assigned a unique identification number by the laboratory. This number is recorded on the chain-of-custody record and is marked with indelible ink on the outside of the shipping container. The field sampler will indicate the sample designation/location number in the space provided on the appropriate chain-of-custody form for each sample collected. The shipping container is closed and a seal provided by the laboratory is affixed to the latch. This seal must be broken to open the container, and this indicates possible tampering if the seal is broken before receipt at the laboratory. The laboratory will contact the site investigation team leader and the sample will not be analyzed if tampering is apparent.

5.2 LABORATORY SAMPLE CUSTODY

The site interim remedial measure team leader or Project Quality Assurance Officer notifies the laboratory of upcoming field sampling activities and the subsequent transfer 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 laboratory sample program meets the following criteria:

- The laboratory has designated a sample custodian who is 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 the original chain-of-custody documents and compare them with the labeled contents of each sample container for correctness and traceability. The sample custodian signs the chain-of-custody record and records the date and time received.
- Care is exercised to annotate any labeling or descriptive errors. In the event of discrepant documentation, the laboratory will immediately contact the site investigation team leader as part of the corrective action process. A qualitative assessment of each sample container is performed to note any anomalies, such as broken or leaking bottles.

This assessment is recorded as part of the incoming chain-of-custody procedure:

1. The samples are stored in a secured area at a temperature of approximately 4°C until analyses are to commence.
2. A laboratory chain-of-custody record accompanies the sample or sample fraction through final analysis for control.
3. A copy of the chain-of-custody form will accompany the laboratory report and will become a permanent part of the project records.

5.3 FINAL EVIDENCE FILES

Final evidence files include all originals of laboratory reports and are maintained under documented control in a secure area.

A sample or an evidence file is under custody if:

- It is in your possession; it is in your view, after being in your possession.
- It was in your possession and you placed it in a secure area.
- It is in a designated secure area.

6.0 CALIBRATION PROCEDURES

Instruments and equipment used to gather, generate or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the appropriate manufacturer's specifications or project specific requirements. The procedures for instrument calibration, calibration verification, and the frequency of calibrations are described in the ASP. The calibration of instruments used for the determination of metals will be as described in the appropriate CLP standard operating procedures.

Calibration of other instruments required for measurements associated with these analyses will be in accordance with the manufacturer's recommendations and the standard operating procedures of the laboratory.

7.0 ANALYTICAL PROCEDURES

Analytical procedures shall conform to the most recent revision of the NYSDEC-ASP (June 2005) and are summarized on **Table 7.1.** In the absence of USEPA or NYSDEC guidelines, appropriate procedures shall be submitted for approval by NYSDEC prior to use.

The procedures for the sample preparation and analysis for organic compounds are as specified in the NYSDEC-ASP. Analytical cleanups are mandatory where matrix interferences are noted. No sample shall be diluted any more than a factor of five. The sample shall be either re-extracted, re-sonicated, re-stream distilled, etc. or be subjected to any one analytical cleanup noted in SW846 or a combination thereof. The analytical laboratory shall expend such effort and discretion to demonstrate good laboratory practice and demonstrate an attempt to best achieve the method detection limit.

7.1 VOLATILE ORGANICS

For the analysis of water samples for Target Compound List (TCL), VOCs, no sample preparation is required. The analytical procedure for volatiles is detailed in NYSDEC-ASP (Volume I, Section D-I). A measured portion of the sample is placed in the purge and trap apparatus and the sample analysis is performed by gas chromatography/mass spectrometry for the first round. USEPA Method 8260 will be used, plus tentatively identified compounds (TICs). USEPA Methods 8010 or 8020 (gas chromatography with different detectors) will be used if subsequent rounds with lower limits of detection are warranted.

7.2 SEMI-VOLATILE ORGANIC COMPOUNDS

The extraction and analytical procedures used for preparation of water, soil, and sediment samples for the analysis of the TCL semi-volatile organic compounds are described in NYSDEC-ASP Volume I, Section D-III. USEPA Method 8270 will be used, plus tentatively identified compounds (TICs).

Instrument calibration, compound identification, and quantitation are performed as described in Section 6 of this document and in the NYSDEC-ASP.

The reporting limit for 1,4-dioxane is 0.1 mg/kg in soil and 0.35 ug/L in groundwater.

7.3 PESTICIDE AND PCB COMPOUNDS

The sample preservation procedures for gas chromatography for pesticides and PCB's will be as described in the NYSDEC-ASP methods (Section D-IV). The analysis of standard mixes, blanks and spiked samples will be performed at the prescribed frequency with adherence to the 72-hour requirement described in the method.

7.4 METALS

Water, soil and waste samples will be analyzed for the metals listed in Table 7.1. The detection limits for these metals are as specified in the NYSDEC-ASP, Section D-V. The instrument detection limits will be determined using calibration standards and procedures specified in the NYSDEC-ASP. The detection limits for individual samples may be higher due to the sample matrix. The procedures for these analyses will be as described in the NYSDEC-ASP.

The analyses for metals will be performed by atomic absorption spectroscopy (AAS) or inductively-coupled plasma emission spectroscopy (ICPES), as specified in the ASP with regard to AAS flame analysis.

7.5 PER- AND POLYFLUOROALKYL SUBSTANCES

The NYSDEC has developed a list of 21 PFAS Analytes List on Table 7.1 for remedial programs. These are:

- Perfluorobutanesulfonic acid
- Perfluorohexanesulfonic acid
- Perfluoroheptanesulfonic acid
- Perfluorooctanesulfonic acid
- Perfluorodecanesulfonic acid
- Perfluorobutanoic acid
- Perfluoropentanoic acid
- Perfluorohexanoic acid
- Perfluoroheptanoic acid

- Perfluorooctanoic acid
- Perfluorononanoic acid
- Perfluorodecanoic acid
- Perfluoroundecanoic acid
- Perfluorododecanoic acid
- Perfluorotridecanoic acid
- Perfluorotetradecanoic acid
- 6:2 Fluorotelomer sulfonate
- 8:2 Fluorotelomer sulfonate
- Perfluroroctanesulfonamide
- N-methyl perfluorooctanesulfonamidoacetic acid
- N-ethyl perfluorooctanesulfonamidoacetic acid

Currently, ELAP does not offer certification for Per- and polyfluoroalkyl substances (PFAS) compounds in matrices other than finished drinking water. Per the NYSDEC June 2019 memo on emergent contaminant sampling, the analytical procedure for soil and groundwater sampling of PFAS is Modified EPA Method 537. The reporting limit for PFAS in soil samples is 0.5 ug/kg. Reporting limits for PFOA and PFOS in groundwater should not exceed 2 ng/L.

7.6 SITE SPECIFICITY OF ANALYSES

Work plans prepared for remedial actions for sites contain recommendations for the chemical parameters to be determined for each site. Thus, some or all of the referenced methods will apply to the analysis of samples collected at the individual waste sites. Analyses of TCL analytes will be performed on all samples.

To ensure that the field sampling and laboratory analytical practices are acceptable, the data associated with the samples will be validated by a third party (in accordance with requirements of DER-10). The validation approach and results will be presented in a data usability summary report to be included in the Report.

TABLES

TABLE 4.1--SAMPLING PROCEDURE FOR MONITORING WELLS USING LOW-STESS (LOW-FLOW) METHODS

Step	Description	Details
1	Record initial static water level.	**Device:** electric contact probe accurate to the nearest 0.1 foot.
2	Lower sampling device into well. Slowly lower the pump, safety cable, tubing and electrical lines into the well to the depth specified for that well.	Pump intake must be no less than 2 feet from the bottom of the well to prevent disturbance and resuspension of sediments which may be at the bottom of the well.
3	Measure water level again: Before starting the pump, measure the water level again with the pump in the well. Leave the water level measuring device in the well.	
4	Purge Well	Start pumping the well at 200 to 500 milliliters per minute (ml/min). The water level should be monitored approximately every five minutes. Ideally, a steady flow rate should be maintained that results in a stabilized water level (drawdown of 0.3 ft or less). Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to ensure stabilization of the water level. As noted above, care should be taken to maintain pump suction and to avoid entrainment of air in the tubing.
5	Record each adjustment made to the pumping rate and the water level measured immediately after each adjustment.	
6	Monitor Indicator Parameters	1. During purging of the well, monitor and record the field indicator parameters (turbidity, temperature, specific conductance, pH, Eh, and DO) approximately every five minutes. The well is considered stabilized and ready for sample collection when the indicator parameters have stabilized for three consecutive readings as follows (Puls and Barcelona, 1996): a. 0.1 for pH b. 3% for specific conductance

Step	Description	Details
		(conductivity) c. 10 mv for redox potential d. 10% for DO and turbidity
7	The pump must not be removed from the well between purging and sampling.	Dissolved oxygen and turbidity usually require the longest time to achieve stabilization.
8	Collect Samples	Collect samples at a flow rate between 100 and 250 ml/min and such that drawdown of the water level within the well does not exceed the maximum allowable drawdown of 0.3 ft. VOC samples must be collected first and directly into sample containers. All sample containers should be filled with minimal turbulence by allowing the ground water to flow from the tubing gently down the inside of the container.
9	Ground water samples to be analyzed for volatile organic compounds (VOCs) require pH adjustment. The appropriate EPA Program Guidance should be consulted to determine whether pH adjustment is necessary.	If pH adjustment is necessary for VOC sample preservation, the amount of acid to be added to each sample vial prior to sampling should be determined, drop by drop, on a separate and equal volume of water (e.g., 40 ml). Groundwater purged from the well prior to sampling can be used for this purpose.
10	Remove Pump and Tubing	After collection of the samples, the tubing, unless permanently installed, must be properly discarded or dedicated to the well for resampling by hanging the tubing inside the well.
11	Measure and record well depth.	
12	Close and lock the well.	
13	Samples are capped, labeled and placed in laboratory coolers with ice packs or bagged ice.	
14	All equipment is cleaned with successive rinses of pesticide-grade methanol and distilled water.	Dedicated line is disposed of or left at well site.

Step	Description	Details
15	Equipment/wash blanks are collected when non-dedicated sampling equipment is used.	
16	Chain-of-custody forms are completed in triplicate.	The original and one carbon copy are put into a zip-lock bag and placed into the cooler. The original will be returned following sample analysis. A second carbon copy is kept on file.
17	Cooler is sealed with strapping tape and chain-of-custody seals to assure integrity and to prevent tampering of sample.	

TABLE 4.2--SAMPLE CONTAINERIZATION

PARAMETER & ANALYTICAL METHOD	NO.	BOTTLE TYPE	PRESERVATIVE[(1)]	HOLDING TIME
Aqueous Samples				
VOCs – USEPA 8260C	3	40 mL, glass vial with septum cap	Hydrochloric Acid to pH <2 Ice to 4°C	14 days
SVOCs (BNAs) and 1,4-Dioxane – USEPA 8270 SIM	2	1-liter amber glass bottle	Ice to 4°C	7 days (until extraction) 40 days (extracted)
Pesticides – USEPA 8081B	2	1-liter amber glass bottle	Ice to 4°C	7 days (until extraction) 40 days (extracted)
PCBs – USEPA 8082A	2	1-liter amber glass bottle	Ice to 4°C	7 days (until extraction) 40 days (extracted)
Metals[(2)]	1	1-liter, plastic bottle	Nitric acid to pH <2 NaOH for cyanide Ice to 4°C	180 days Cyanide: 14 days Mercury: 28 days
Cyanide – USEPA 9010C/9012B	1	1-liter, plastic	Sodium Hydroxide to pH >12 Ice to 4°C	14 days
PFAS Compounds – USEPA Modified Method 537	2	500 ml HDPE or Polypropylene with non-Teflon lid	None	14 days
Soil, Sediment, Solid Waste Samples:				
VOCs – USEPA 8260C	3	5-gram EnCore samplers	Chilled to 0 - 6°C	14 days
SVOCs (BNAs) and 1,4-Dioxane – USEPA 8270D SIM if RL cannot be reached	1	4-oz. glass jar with Teflon lid	Chilled to 0 - 6°C	14 days (until extraction, 40 days extracted)
Pesticides – USEPA 8081B	1	4-oz. glass jar with Teflon lid	Chilled to 0 - 6°C	14 days (until extraction) 40 days (extracted)
PCBs – USEPA 8082A	1	4-oz. glass jar with Teflon lid	Chilled to 0 - 6°C	None
Metals[(3)]	1	4-oz. glass jar with Teflon lid	Chilled to 0 - 6°C	180 days Cyanide: 14 days Mercury: 28 days
PFAS Compounds – USEPA Modified Method 537	2	500 ml HDPE or Polypropylene with non-Teflon lid	None	28 days
Soil Vapor / Indoor Air Samples:				
VOCs – USEPA TO-15	1	Summa Canister	None	30 days

(1) All samples will be preserved with ice during collection and shipment.
(2) Metals refers to the 24 metals and cyanide in the Target Compound List (NYSDEC-CLP 11/87). Metals will be analyzed by Method 6020B, 7470A for mercury, and 9010C/9012B for cyanide
(3) Metals refers to the 24 metals and cyanide in the Target Compound List (NYSDEC-CLP 11/87). Metals will be analyzed by Method 6010D, 7471B for mercury, and 9010C/9012B for cyanide
(4) A complete list of compounds is provided on Table 7.1.

Table 4.3--Sampling Overview

Matrix	Samples Collected	Field and Trip Blanks	Matrix Spike Matrix Spike Duplicates (number and type)	Duplicate Samples (number and type)
Groundwater	None Anticipated	N/A	N/A	N/A
Soil	Approx. 71-75 (inside building footprint) Approx. 33-35 outside building footprint	1 per 20 samples or 1 per day	1 per 20 samples	1 duplicate for every 20 samples
Soil Vapor*	None Anticipated	N/A	N/A	N/A

* If soil vapor samples are to be collected 1 ambient air sample will be taken per 20 samples

TABLE 7.1–CONTRACT-REQUIRED QUANTITATION LEVELS AND ANALYTICAL METHODS FOR ASP INORGANICS, ASP VOLATILES, ASP SEMI-VOLATILES, ASP PESTICIDES, PCBs, AND PFAS

Target Analyte List (TAL) and Contract-Required Quantitation Limit

SECTION 1 - ASP INORGANICS Method: NYSDEC-ASP-91-4			
METAL	**CONTRACT-REQUIRED DETECTION LEVEL* (µg/L)**	**METAL**	**CONTRACT-REQUIRED DETECTION LEVEL* (µg/L)**
1. Aluminum	200	13. Magnesium	5,000
2. Antimony	60	14. Manganese	15
3. Arsenic	15	15. Mercury	0.2
4. Barium	200	16. Nickel	40
5. Beryllium	5	17. Potassium	5,000
6. Cadmium	5	18. Selenium	35
7. Calcium	5,000	19. Silver	10
8. Chromium	10	20. Sodium	5,000
9. Cobalt	50	21. Thallium	25
10. Copper	25	22. Vanadium	50
11. Iron	100	23. Zinc	60
12. Lead	10	24. Cyanide	10

Target Compound List (TCL) and Contract-Required Quantitation Limit

SECTION 2 – ASP ORGANICS (VOLATILES) Method: NYSDEC-ASP-91-1			
VOLATILE	**CONTRACT-REQUIRED QUANTITATION LIMIT** (µg/L)**	**VOLATILE**	**CONTRACT-REQUIRED QUANTITATION LIMIT** (µg/L)**
1. Chloromethane	5.0	18. 1,2-Dichloropropane	5.0
2. Bromomethane	5.0	19. cis-1,3-Dichloropropene	5.0
3. Vinyl Chloride	5.0	20. Trichloroethene	5.0
4. Chloroethane	5.0	21. Dibromochloromethane	5.0
5. Methylene Chloride	5.0	22. 1,1,2-Trichloroethane	5.0
6. Acetone	10.0	23. Benzene	5.0
7. Carbon Disulfide	5.0	24. Trans-1.3-Dichloropropene	5.0
8. 1,1-Dichloroethylene	5.0	25. Bromoform	5.0
9. 1,1-Dichloroethane	5.0	26. 2-Hexanone	10.0
10. 1,2-Dichloroethylene (total)	5.0	27. 4-Methyl, 1,2-Pentanone	10.0
11. Chloroform	5.0	28. Tetrachloroethylene	5.0
12. 1,2-Dichloroethane	5.0	29. Toluene	5.0
13. 2-Butanone	10.0	30. Chlorobenzene	5.0
14. 1,1,1-Trichloroethane	5.0	31. Ethylbenzene	5.0
15. Carbon Tetrachloride	5.0	32. Styrene	5.0
16. Bromodichloromethane	5.0	33. Total Xylenes	5.0
17. 1,1,2,2-Tetrachloroethane	5.0		

SECTION 3 - ASP ORGANICS (SEMI-VOLATILES) Method: NYSDEC-ASP-91-2			
SEMI-VOLATILE	**CONTRACT-REQUIRED QUANTITATION LIMIT (µg/l)**	**SEMI-VOLATILE**	**CONTRACT-REQUIRED QUANTITATION LIMIT (µg/l)**
1. Phenol	5.0	33. Acenaphthene	5.0
2. Bis(2-chloroethyl)ether	5.0	34. 2,4-Dinitrophenol	10.0
3. 2-Chlorophenol	5.0	35. 4-Nitrophenol	10.0
4. 1,3-Dichlorobenzene	5.0	36. Dibenzofuran	5.0
5. 1,4-Dichlorobenzene	5.0	37. Dinitrotoluene	5.0
6. 1,2-Dichlorobenzene	5.0	38. Diethylphthalate	5.0
7. 2-Methylphenol	5.0	39. 4-Chlorophenyl phenyl ether	5.0
8. 2,2'oxybis(1-Chloropropane)	5.0	40. Fluorene	5.0
9. 4-Methylphenol	5.0	41. 4-Nitroanile	10.0
10. N-Nitroso-dipropylamine	5.0	42. 4,6-Dinitro-2-methylphenol	10.0
11. Hexachloroethane	5.0	43. N-nitrosodiphenyl amine	5.0
12. Nitrobenzene	5.0	44. 4-Bromophenyl phenyl ether	5.0
13. Isophorone	5.0	45. Hexachlorobenzene	5.0
14. 2-Nitrophenol	5.0	46. Pentachlorophenol	10.0
15. 2,4-Dimethylphenol	5.0	47. Phenanthrene	5.0
16. Bis(2-Chloroethoxy) methane	5.0	48. Anthracene	5.0
17. 2,4-Dichlorophenol	5.0	49. Carbazole	5.0
18. 1,2,4-Trichlorobenzene	5.0	50. Di-n-butyl phthalate	5.0
19. Naphthalene	5.0	51. Fluoranthene	5.0
20. 4-Chloroaniline	5.0	52. Pyrene	5.0
21. Hexachlorobutadiene	5.0	53. Butyl benzyl phthalate	5.0
22. 4-Chloro-3-methylphenol	5.0	54. 3,3'-Dichloro benzidine	5.0
23. 2-Methylnaphthalene	5.0	55. Benz(a)anthracene	5.0
24. Hexachlorocyclopentadiene	5.0	56. Chrysene	5.0
25. 2,4,6-Trichlorophenol	5.0	57. Bis(2-ethylhexyl) phthalate	5.0
26. 2,4,5-Trichlorophenol	10.0	58. Di-n-octyl phthalate	5.0
27. 2-Chloronapthalene	5.0	59. Benzo(b)fluoranthene	5.0
28. 2-Nitroananiline	10.0	60. Benzo(k)fluoranthene	5.0
29. Dimethyl phthalate	5.0	61. Benzo(a)pyrene	5.0
30. Acenaphthylene	5.0	62. Indeno(1,2,3-cd) pyrene	5.0
31. 2,6-Dinitrotoluene	5.0	63. Dibenz(a,h) anthracene	5.0
32. 3-Nitroaniline	10.0	64. Benzo(g,h,i)perylene	5.0

SECTION 3 - ASP ORGANICS (PESTICIDES/PCBS) Method: NYSDEC-ASP-91-3			
PESTICIDE/PCB	CONTRACT-REQUIRED QUANTITATION LIMIT (µg/l)	PESTICIDE/PCB	CONTRACT-REQUIRED QUANTITATION LIMIT (µg/l)
1. Alpha-BHC	0.05	15. 4,4’-DDT	0.10
2. Beta-BHC	0.05	16. Methoxychlor	0.5
3. Delta-BHC	0.05	17. Endrin ketone	0.10
4. Gamma-BHC (lindane)	0.05	18. Endrin aldehyde	0.10
5. Heptachlor	0.05	19. Alpha-Chlordane	0.05
6. Aldrin	0.05	20. Gamma-Chlordane	0.05
7. Heptachlor epoxide	0.05	21. Toxaphene	5.0
8. Endosulfan I	0.05	22. AROCHLOR-1016	1.0
9. Dieldrin	0.10	23. AROCHLOR-1221	1.0
10. 4,4’-DDE	0.10	24. AROCHLOR-1232	1.0
11. Endrin	0.10	25. AROCHLOR-1242	1.0
12. Endosulfan II	0.10	26. AROCHLOR-1248	1.0
13. 4,4’-DDD	0.10	27. AROCHLOR-1254	1.0
14. Endosulfan sulfate	0.10	28. AROCHLOR-1260	1.0

*Matrix: groundwater. For soil matrix, multiply CRDL by 100.
**Quantitation limit for medium-level soil is 1,200 µg/kg (wet weight basis).

PFAS Compound List and Reporting and Method Detection Limits for Soil and Groundwater

Method: EPA Modified 537 Perfluorinated Alkyl Acids by Isotope Dilution			
	PFAS	Reporting Limit—Groundwater (ng/l)	Method Detection Limit—Groundwater (ng/l)
1	Perfluorobutanoic Acid (PFBA)	2.00	0.408
2	Perfluoropentanoic Acid (PFPeA)	2.00	0.396
3	Perfluorobutanesulfonic Acid (PFBS)	2.00	0.238
4	Perfluorohexanoic Acid (PFHxA)	2.00	0.328
5	Perfluoroheptanoic Acid (PFHpA)	2.00	0.225
6	Perfluorohexanesulfonic Acid (PFHxS)	2.00	0.376
7	Perfluorooctanoic Acid (PFOA)	2.00	0.236
8	1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2 FTS)	2.00	1.33
9	Perfluoroheptanesulfonic Acid (PFHpS)	2.00	0.688
10	Perfluorononanoic Acid (PFNA)	2.00	0.312
11	Perfluorooctanesulfonic Acid (PFOS)	2.00	0.504
12	Perfluorodecanoic Acid (PFDA)	2.00	0.304
13	1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	2.00	1.21
14	N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	2.00	0.648
15	Perfluoroundecanoic Acid (PFUnA)	2.00	0.260
16	Perfluorodecanesulfonic Acid (PFDS)	2.00	0.980
17	Perfluorooctanesulfonamide (FOSA)	2.00	0.580
18	N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2.00	0.804

Method: EPA Modified 537 Perfluorinated Alkyl Acids by Isotope Dilution			
19	Perfluorododecanoic Acid (PFDoA)	2.00	0.372
20	Perfluorotridecanoic Acid (PFTrDA)	2.00	0.327
21	Perfluorotetradecanoic Acid (PFTA)	2.00	0.248

Method: EPA Modified 537 Perfluorinated Alkyl Acids by Isotope Dilution		
PFAS	**Reporting Limit—Soil (ng/g)**	**Method Detection Limit—Soil (ng/g)**
Perfluorobutanoic Acid (PFBA)	0.500	0.023
Perfluoropentanoic Acid (PFPeA)	0.500	0.046
Perfluorobutanesulfonic Acid (PFBS)	0.250	0.039
Perfluorohexanoic Acid (PFHxA)	0.500	0.053
Perfluoroheptanoic Acid (PFHpA)	0.250	0.045
Perfluorohexanesulfonic Acid (PFHxS)	0.250	0.061
Perfluorooctanoic Acid (PFOA)	0.250	0.042
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2 FTS)	0.500	0.180
Perfluoroheptanesulfonic Acid (PFHpS)	0.500	0.137
Perfluorononanoic Acid (PFNA)	0.250	0.075
Perfluorooctanesulfonic Acid (PFOS)	0.250	0.130
Perfluorodecanoic Acid (PFDA)	0.250	0.067
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	0.500	0.287
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	0.500	0.202
Perfluoroundecanoic Acid (PFUnA)	0.500	0.047
Perfluorodecanesulfonic Acid (PFDS)	0.500	0.153
Perfluorooctanesulfonamide (FOSA)	0.500	0.098
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	0.500	0.085
Perfluorododecanoic Acid (PFDoA)	0.500	0.070
Perfluorotridecanoic Acid (PFTrDA)	0.500	0.205
Perfluorotetradecanoic Acid (PFTA)	0.500	0.054

Appendix C:

Health and Safety Plan

SESI
CONSULTING ENGINEERS

SITE-SPECIFIC HEALTH AND SAFETY PLAN

108 Main Port Chester Steam Laundry Site
108 South Main Street
Port Chester, Westchester County, New York
NYSDEC BCP Site # C360224

Prepared For:

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Prepared By:

SESI CONSULTING ENGINEERS
12A Maple Avenue
Pine Brook, New Jersey 07058

Project No.: 12056

DECEMBER 2021
REVISED JUNE 2022

Disclaimer: *This Health and Safety Plan (HASP) is based upon information provided [and, if applicable, conditions discovered during a site visit], and is limited by the project scope.*

The HASP should be periodically reviewed and updated based on a number of factors, including but not limited to: (1) changes in applicable governmental requirements; (2) changes in procedures at the site; and (3) site conditions which were unknown to SESI Consulting Engineers (SESI) as of the time the HASP was prepared.

This HASP has been prepared for the sole and exclusive use of Client listed above, and may not be relied upon by any other person without the express written consent and authorization of SESI.

SITE-SPECIFIC HEALTH AND SAFETY PLAN

For

108 Main Port Chester Steam Laundry Site
108 South Main Street
Port Chester, Westchester County, New York
NYSDEC BCP Site # C360224

Prepared by: ______________________ Date: TBD

____

Monica K. Norton
SESI- Project Manager

Approved by: __________ Date: TBD

____

Fuad Dahan. P.E., PhD.
SESI-Principal

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LIST OF ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
COC	Constituent(s) of Concern
CRZ	Contamination Reduction Zone
EZ	Exclusion Zone
FS	Field Supervisor
GFCI	Ground Fault Circuit Interrupter
HASP	Health and Safety Plan
HSM	Health and Safety Manager
LEL	Lower Explosive Limit
MSDS	Material Safety Data Sheet
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated Biphenyls
PEL	Permissible Exposure Limit
PID	Photoionization Detector
PM	Project Manager
PO	Project Officer
PPE	Personal Protective Equipment
SESI	SESI Consulting Engineers
SSO	Site Safety Officer
SVOC	Semi-Volatile Organic Compound
SZ	Support Zone
TLV	Threshold Limit Value
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1.0 INTRODUCTION

1.1 OBJECTIVE

The objective of this Health and Safety Plan (HASP) is to provide a mechanism for establishing safe working conditions during activities at the 108 Main Port Chester Steam Laundry Site, located at 108 South Main Street, Port Chester, New York (the Site). The safety organization, procedures, and protective equipment have been established based on an analysis of potential physical, chemical, and biological hazards. Specific hazard control methodologies have been evaluated and selected to minimize the potential of injury, illness, or other hazardous incidents.

The HASP was written to meet the requirements of all applicable Federal, State, and local health and safety regulations, including 29 CFR 1910.120. The HASP is based on current knowledge regarding the specific chemical and physical hazards that are known or anticipated at the Site. This HASP is a dynamic document, for which changes and/or revisions may be realized as changes in scope and/or Site conditions are encountered. Should revised documents be produced, said revised documents will refer to the specific changes and why they were made.

1.2 SITE AND FACILITY DESCRIPTION

The Site is located at 108 South Main Street, Port Chester, New York. The Site is identified on local tax maps as Block 1, Lot 57. The Site previously consisted of Lots 35, 37, and part of 28 (including a portion of a demapped undeveloped street called Myneta Place). However, the Village of Port Chester recently merged the Site lots into one (1) parcel, re-designated as Section 142.38, Block 1, Lot 57. The Site also was previously identified with two (2) addresses - 108 Main Street and 112 William Street. Former Lot 35 was previously used for parking before the Volunteer’s recent Site acquisition but has been vacant since August 2021. Former Lot 37, once identified as 112 William Street, is a recently demolished residence that is currently vacant. The part of former Lot 28 included in this Site is also vacant.

The Site is in a residential/commercial setting and is surrounded by residences and commercial properties, including a church. The Site is bound by residences to the north, a church with additional storefronts to the west, an auto repair shop and storefronts to the south, and commercial office space and storefronts to the east.

1.3 POLICY STATEMENT

The policy of SESI Consulting Engineers (SESI) is to provide a safe and healthful work environment. No aspect of operations is of greater importance than injury and illness prevention. A fundamental principle of safety management is that all injuries, illnesses, and incidents are preventable. SESI will take every reasonable step to eliminate or control hazards in order to minimize the possibility of injury, illness, or incident.

This HASP prescribes the procedures that must be followed by SESI personnel during activities at the site. Operational changes that could affect the health and safety of personnel, the community, or the environment will not be made without the prior approval of the Project Manager (PM) and the Health and Safety Manager (HSM). This document will be reviewed periodically by the HSM to ensure that it is current and technically correct. Any changes in site conditions and/or the scope of work will require a review and modification to this HASP. Such changes will be completed in the form of an addendum or a revision to the plan.

The provisions of this plan are mandatory for all SESI personnel and are advisory for all contractors, and subcontractors assigned to the project. ***Subcontractors will be responsible for preparing their own site-specific HASPs that meet the basic requirements outlined in this HASP.*** All visitors to SESI work areas at the Site must abide by the requirements of this plan.

1.4 REFERENCES

This HASP complies with applicable Occupational Safety and Health Administration (OSHA) regulations, United States Environmental Protection Agency (USEPA) regulations, and SESI health and safety policies and procedures. This plan follows the guidelines established in the following:

- *Standard Operating Safety Guides*, USEPA (Publication 9285.1-03, June 1992).
- *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, NIOSH, OSHA, USCG, USEPA (86116, October 1985).
- *Title 29 of the Code of Federal Regulations* (CFR), Part 1910.
- *Title 29 of the Code of Federal Regulations* (CFR), Part 1926.
- *Pocket Guide to Chemical Hazards*, DHHS, PHS, CDC, NIOSH (2004).
- *Threshold Limit Values*, ACGIH (2005).
- *Guide to Occupational Exposure Values*, ACGIH (2005).

- *Quick Selection Guide to Chemical Protective Clothing*, Forsberg, K. and S.Z. Mansdorf, 2nd Ed. (1993).

1.5 DEFINITIONS

The following definitions (listed alphabetically) are applicable to this HASP:

- *Contamination Reduction Zone (CRZ)* - Area between the exclusion zone and support zone that provides a transition between contaminated and clean areas. Decontamination stations are located in this zone.
- *Exclusion Zone (EZ)* - Any portions of the site where hazardous substances are, or are reasonably suspected to be present, and pose an exposure hazard to on-site personnel.
- *Incident* - All losses, including first aid cases, injuries, illnesses, spills/leaks, equipment and property damage, motor vehicle accidents, regulatory violations, fires, and business interruptions.
- *On-Site Personnel* - All SESI and subcontractors involved with the project.
- *Project* - All on-site work performed under the scope of work.
- *Site* - The area described in Section 1.2, Site and Facility Description, where the work is to be performed by SESI personnel and subcontractors.
- *Support Zone (SZ)* - All areas of the site except the EZ and CRZ. The SZ surrounds the CRZ and EZ. Support equipment and break areas are located in this zone.
- *Subcontractor* - Includes contractor personnel hired by SESI.
- *Visitor* - All other personnel, except the on-site personnel.
- *Work Area* - The portion of the site where work activities are actively being performed. This area may change daily as work progresses and includes the SZ, CRZ, and EZ. If the work area is located in an area on the site that is not contaminated, or suspected of being contaminated, the entire work area may be a SZ.

2.0 PROJECT SCOPE OF WORK

This HASP contains information for the following tasks that SESI is anticipated to conduct at the Site. Should additional and/or different tasks be identified, amendments to this HASP will be required to address these changed items.

- Mobilization;
- Soil Boring Advancement and Soil Sampling;
- Monitoring Well Installation and Groundwater Sampling;
- Soil Vapor Point Installation and Soil Vapor Sampling;
- Investigation Derived Waste Characterization and Disposal;
- Excavation of contaminated soils;
- Earthwork and grading; and
- Decontamination and Demobilization.

3.0 ROLES AND RESPONSIBILITIES

3.1 ALL PERSONNEL

All SESI project personnel must adhere to the procedures outlined in this HASP during the performance of their work. Each person is responsible for completing tasks safely and reporting any unsafe acts or conditions to their supervisor. No person may work in a manner that conflicts with these procedures. After due warnings, the PM will dismiss from the site any SESI employee or subcontractor who violates safety procedures.

All SESI project personnel will receive training in accordance with applicable regulations and be familiar with the requirements and procedures contained in this HASP prior to initiating site activities. In addition, all SESI personnel will attend an initial hazard briefing prior to beginning work at the Site.

The roles of key safety personnel and subcontractors are outlined in the following sections. Key project personnel and contacts are summarized in **Table 3.1**.

3.2 KEY SAFETY PERSONNEL

3.2.1 PROJECT OFFICER (PO)

The PO is responsible for providing resources to assure project activities are completed in accordance with this HASP, and for meeting all regulatory and contractual requirements.

3.2.2 PROJECT MANAGER (PM)

The PM is responsible for verifying that project activities are completed in accordance with the requirements of this HASP. The PM is responsible for confirming that the Field Supervisor (FS) has the equipment, materials, and qualified personnel to fully implement the safety requirements of this HASP, and/or that subcontractors assigned to this project meet the requirements established by SESI. It is also the responsibility of the PM to:

- Consult with the HSM on site health and safety issues;
- Verify that subcontractors meet health and safety requirements prior to commencing work;
- Verify that all incidents are thoroughly investigated;
- Approve, in writing, addenda or modifications of this HASP; and
- Suspend work or modify work practices, as necessary, for personal safety, protection of property, and regulatory compliance.

3.2.3 HEALTH AND SAFETY MANAGER (HSM)

The HSM or his designee, the health and safety manager (HSM), has overall responsibility for the technical health and safety aspects of the project, including review and approval of this HASP. Inquiries regarding health and safety procedures, project procedures, and other technical or regulatory issues should be addressed to this individual. The HSM or his designee must approve changes or addenda to this HASP.

3.2.4 SITE SAFETY OFFICER (SSO)

The SSO is responsible for field health and safety issues, including the execution of this HASP. Questions in the field regarding health and safety procedures, project procedures, and other technical or regulatory issues should be addressed to this individual. The SSO will advise the PM on health and safety issues and will establish and coordinate the project air-monitoring program if one is deemed necessary (see Section 5.1, Air Monitoring). The SSO is the primary site contact on health and safety matters. It is the responsibility of the SSO to:

- Provide on-site technical assistance, if necessary;
- Participate in all accident/incident reports and ensure that they are reported to the HSM, client, and PM within 24 hours;
- Coordinate site and personal air monitoring as required, including equipment maintenance and calibration;
- Conduct site safety orientation training and safety meetings;
- Verify that project personnel have received the required physical examinations and medical certifications;
- Review site activities with respect to compliance with this HASP;
- Maintain required health and safety documents and records; and
- Assist the FS in instructing field personnel on project hazards and protective procedures.

3.2.5 FIELD SUPERVISOR (FS)

The FS is responsible for implementing this HASP, including communicating requirements to on-Site personnel and subcontractors. The FS will be responsible for informing the PM of changes in the work plan, procedures, or Site conditions so that those changes may be addressed in this HASP. Other responsibilities are to:

- Consult with the SSO on site health and safety issues;
- Stop work, as necessary, for personal safety, protection of property, and regulatory compliance;

- Obtain a site map and determine and post routes to medical facilities and emergency telephone numbers;
- Notify local public emergency representatives (as appropriate) of the nature of the site operations, and post their telephone numbers (i.e., local fire department personnel who would respond for a confined space rescue);
- Observe on-Site project personnel for signs of ill health effects;
- Investigate and report any incidents to the SSO;
- Verify that all on-Site personnel have had applicable training;
- Verify that on-Site personnel are informed of the physical, chemical, and biological hazards associated with the Site activities, and the procedures and protective equipment necessary to control the hazards; and
- Issue/obtain any required work permits (hot work, confined space, etc.).

3.2.6 FIELD PERSONNEL (FP)

All SESI field personnel are responsible for following the Health and Safety procedures specified in this HASP and work practices specified in applicable operation procedures. Some specific responsibilities include, but are not limited to:

- Reading and understanding the HASP;
- Reporting all accidents, incidents, injuries, or illnesses to the FS;
- Complying with the requests of the SSO;
- Immediately communicating newly identified hazards or noncompliance issues to the FS or SSO; and
- Stopping work in cases of immediate danger.

3.3 SUBCONTRACTORS

Subcontractors and their personnel must understand and comply with applicable regulations and Site requirements established in this HASP. Subcontractors will prepare their own Site-specific HASP that must be consistent with the requirements of this HASP.

All subcontractor personnel will receive training in accordance with applicable regulations and be familiar with the requirements and procedures contained in this HASP prior to initiating site activities. All subcontractor personnel will attend an initial hazard briefing prior to beginning work at the Site. Additionally, on-Site subcontractor personnel must conduct daily Site safety meetings.

Subcontractors must designate individuals to function as the PM, HSM, SSO, and FS. In some firms the HSM to be carried out by the PM. This is acceptable provided the PM has the required knowledge, training, and experience to properly address all hazards associated with the work, and to prepare, approve, and oversee the execution of the Site-specific HASP. A subcontractor may designate the same person to perform the duties of both the SSO and the FS. However, depending on the level of complexity of a contractor's scope of work, it may be infeasible for one person to perform both functions satisfactorily.

3.4 STOP WORK AUTHORITY

Every SESI employee and subcontractor is empowered, expected, and has the responsibility to stop the work of another co-worker if the working conditions or behaviors are considered unsafe.

3.5 ALL ON-SITE PERSONNEL

All on-Site SESI personnel (including SESI subcontractors) must read and acknowledge their understanding of their respective HASPs before commencing work and abide by the requirements of the plans. All on-Site SESI personnel shall sign their HASP Acknowledgement Form following their review of their HASP.

All SESI project personnel will receive training in accordance with applicable regulations and be familiar with the requirements and procedures contained in this HASP prior to initiating site activities. In addition, all on-Site personnel will attend an initial hazard briefing provided by the SSO prior to beginning work at the site and conduct daily safety meetings thereafter.

On-Site personnel will immediately report the following to the FS or SSO:

- Personal injuries and illnesses no matter how minor;
- Unexpected or uncontrolled release of chemical substances;
- Symptoms of chemical exposure;
- Unsafe or hazardous situations;
- Unsafe or malfunctioning equipment;
- Changes in site conditions that may affect the health and safety of project personnel;
- Damage to equipment or property; and
- Situations or activities for which they are not properly trained.

3.6 VISITORS

All SESI personnel and subcontractors visiting the Site must check in with the FS. Visitors will be cautioned to avoid skin contact with surfaces, soils, groundwater, or other materials that may impacted or be suspected to be impacted by COCs.

Visitors requesting to observe work at the site must don appropriate personal protective equipment (PPE) prior to entry to the work area and must have the appropriate training and medical clearances to do so. If respiratory protective devices are necessary, visitors who wish to enter the work area must have been respirator-trained and fit tested for a respirator within the past 12 months.

Table 3.1 – Key Safety Personnel

SESI Personnel		
Role	**Name**	**Telephone No.**
Project Principal	Fuad Dahan, P.E., PhD	973-808-9050 x249
Project Manager (PM)	Monica Norton	973-808-9050 x272
Principal Engineer	Fuad Dahan, P.E., PhD	973-808-9050 x249
Interim Remedial Measures Project Manager	Monica Norton	973-808-9050 x272
Field Team Leader	TBD	973-600-7630
Quality Assurance Officer	Monica Norton	973-808-9050 x272
Field Personnel	TBD	

4.0 PERSONAL PROTECTIVE EQUIPMENT

4.1 LEVELS OF PROTECTION

PPE is required to safeguard site personnel from various hazards. Varying levels of protection may be required depending on the levels of COCs and the degree of physical hazard. This section presents the various levels of protection and defines the conditions of use for each level. A summary of the levels is presented in **Table 4.1**.

4.1.1 LEVEL D PROTECTION

The minimum level of protection that will be required of project personnel at the site will be Level D, which will be worn when site conditions or air monitoring indicates no inhalation hazard exists. The following equipment will be used:

- Work clothing as prescribed by weather;
- Steel toe work boots, meeting American National Standards Institute (ANSI) Z41;
- Safety glasses or goggles, meeting ANSI Z87;
- Leather work gloves and/or nitrile surgical gloves;
- Hard hat, meeting ANSI Z89, when falling object hazards are present;
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used); and
- PFD if working on or near the water.

4.1.2 MODIFIED LEVEL D PROTECTION

Modified Level D will be used when airborne contaminants are not present at levels of concern, but site activities present an increased potential for skin contact with contaminated materials. Modified Level D consists of:

- Nitrile gloves worn over nitrile surgical gloves;
- Latex/polyvinyl chloride (PVC) overboots when contact with COC-impacted media is anticipated;
- Steel toe work boots, meeting ANSI Z41;
- Safety glasses or goggles, meeting ANSI Z87;
- Face shield in addition to safety glasses or goggles when projectiles or splash hazards exist (e.g. during Power Washing activities);
- Hard hat, meeting ANSI Z89, when falling object hazards are present;
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used);
- Tyvek® suit (polyethylene coated Tyvek® suits for handling liquids) when body contact with COC-impacted media is anticipated; and
- PFD if working on or near the water.

4.1.3 LEVEL C PROTECTION

Level C protection will be required when the airborne concentration of COC reaches one-half of the OSHA Permissible Exposure Limit or ACGIH TLV. The following equipment will be used for Level C protection:

- Full-face, air-purifying respirator with combination organic vapor/HEPA cartridges;
- Polyethylene-coated Tyvek® suit, with ankles and cuffs taped to boots and gloves;
- Nitrile gloves worn over nitrile surgical gloves;
- Steel toe work boots, meeting ANSI Z41;
- Chemical-resistant boots with steel toes or latex/PVC overboots over steel toe boots;
- Hard hat, meeting ANSI Z89;
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used); and
- PFD if working on or near the water.

4.2 SELECTION OF PPE

Equipment for personal protection will be selected based on the potential for contact, site conditions, ambient air quality, and the judgment of supervising Site personnel and health and safety professionals. The PPE used will be chosen to be effective against the COCs present on the Site.

4.3 SITE RESPIRATORY PROTECTION PROGRAM

Respiratory protection is an integral part of employee health and safety at the Site due to potentially hazardous concentrations of airborne COCs. The Site respiratory protection program will consist of the following (as a minimum):

- All on-Site personnel who may use respiratory protection will have an assigned respirator.
- All on-Site personnel who may use respiratory protection will have been fit tested and trained in the use of a full-face air-purifying respirator within the past 12 months. Documentation of the fit test must be provided to the SSO prior to commencement of work.
- All on-Site personnel who may use respiratory protection must within the past year have been medically certified as being capable of wearing a respirator. Documentation of the medical certification must be provided to the SSO, prior to commencement of Site work.
- Only cleaned, maintained, NIOSH-approved respirators will be used.
- If respirators are used, the respirator cartridge is to be properly disposed of at the end of each work shift, or when load-up or breakthrough occurs.
- Contact lenses are not to be worn when a respirator is worn.

- All on-Site personnel who may use respiratory protection must be clean-shaven. Mustaches and sideburns are permitted, but they must not touch the sealing surface of the respirator.
- Respirators will be inspected, and a negative pressure test performed prior to each use.
- After each use, the respirator will be wiped with a disinfectant, cleansing wipe. When used, the respirator will be thoroughly cleaned at the end of the work shift. The respirator will be stored in a clean plastic bag, away from direct sunlight in a clean, dry location, in a manner that will not distort the face piece.

4.4 USING PPE

Depending upon the level of protection selected, specific donning and doffing procedures may be required. The procedures presented in this section are mandatory if Modified Level D or Level C PPE is used. All personnel entering the EZ must put on the required PPE in accordance with the requirements of this HASP. When leaving the EZ, PPE will be removed in accordance with the procedures listed, to minimize the spread of COCs.

4.4.1 DONNING PROCEDURES

These procedures are mandatory only if Modified Level D or Level C PPE is used on the Site:

- Remove bulky outerwear. Remove street clothes and store in clean location;
- Put on work clothes or coveralls;
- Put on the required chemical protective coveralls;
- Put on the required chemical protective boots or boot covers;
- Tape the legs of the coveralls to the boots with duct tape;
- Put on the required chemical protective gloves;
- Tape the wrists of the protective coveralls to the gloves;
- Don the required respirator and perform appropriate fit check (Level C);
- Put hood or head covering over-head and respirator straps and tape hood to facepiece (Level C); and
- Don remaining PPE, such as safety glasses or goggles and hard hat.

When these procedures are instituted, one person must remain outside the work area to ensure that each person entering has the proper protective equipment.

4.4.2 DOFFING PROCEDURES

The following procedures are only mandatory if Modified Level D or Level C PPE is required for the Site. Whenever a person leaves the work area, the following decontamination sequence will be followed:

- Upon entering the CRZ, rinse contaminated materials from the boots or remove contaminated boot covers;
- Clean reusable protective equipment;
- Remove protective garments, equipment, and respirator (Level C). All disposable clothing should be placed in plastic bags, which are labeled with contaminated waste labels;
- Wash hands, face, and neck (or shower if necessary);
- Proceed to clean area and dress in clean clothing; and
- Clean and disinfect respirator for next use.

All disposable equipment, garments, and PPE must be bagged in plastic bags, labeled for disposal. See Section 6.2, Decontamination, for detailed information on decontamination stations.

4.5 SELECTION MATRIX

The level of personal protection selected will be based on air monitoring of the work environment and an assessment by the FS and SSO of the potential for skin contact with COCs. The PPE selection matrix is presented in **Table 4.1** below. This matrix is based on information available at the time this plan was written. The Airborne Contaminant Action Levels in **Table 5.1**, Airborne Contaminant Action Levels, should be used to verify that the PPE prescribed in these matrices is appropriate.

Table 4.1 – PPE Selection Matrix

Task	Anticipated Level of Protection
Mobilization	Level D
Subsurface Intrusive Activities (Excavation, Drilling)	Modified Level D/Level C
Earthwork/Grading	Level D
Chemical Sampling / Delineation	Modified Level D/Level C
Decontamination	Modified Level D
Demobilization	Level D

5.0 AIR AND NOISE MONITORING

5.1 AIR MONITORING

Air monitoring, sampling, and testing will be conducted to determine employee exposure to airborne constituents. The monitoring results will dictate work procedures and the selection of PPE. The SESI SSO will be responsible for defining appropriate air monitoring procedures and for utilizing the air monitoring results to determine appropriate procedures and PPE for project personnel. Air monitoring results should be recorded in field notebooks or on an air monitoring log (see Attachment 1 for a copy of the Air Monitoring Log). Any deviations from the procedures listed here should be documented and explained in the Air Monitoring Log.

The monitoring devices to be used are a PDR1000 particulate monitor (or equivalent) and a Rae Systems MultiRAE detector (PID with a 11.7 eV lamp/oxygen/LEL/hydrogen sulfide sensors). Colorimetric detector tubes may be utilized to estimate airborne concentrations of benzene and should be onsite during any activities that may result in elevated PID readings including drilling, excavating, and groundwater sampling.

Air monitoring will be conducted continuously with the LEL/Oxygen meter during drilling in areas where flammable vapors or gases are suspect. All work activity must stop where tests indicate the concentration of flammable vapors exceeds 10% of the LEL at a location with a potential ignition source. Such an area must be ventilated to reduce the concentration to an acceptable level.

5.2 NOISE MONITORING

Noise monitoring may be conducted as required. Hearing protection is mandatory for all employees in noise hazardous areas, such as around heavy equipment. As a general rule, sound levels that cause speech interference at normal conversation distance should require the use of hearing protection.

5.3 MONITORING EQUIPMENT MAINTENANCE AND CALIBRATION

All direct-reading instrumentation calibrations should be conducted under the approximate environmental conditions the instrument will be used. Instruments must be calibrated before and after use, noting the reading(s) and any adjustments that are necessary. All air monitoring equipment calibrations, including the standard used for calibration, must be documented on a calibration log or in the field notebook. All completed health and safety documentation/forms must be reviewed by the SSO and maintained by the FS.

All air monitoring equipment will be maintained and calibrated in accordance with the specific manufacturer's procedures. Preventive maintenance and repairs will be conducted in accordance with the respective manufacturer's procedures. When applicable, only manufacturer-trained and/or authorized personnel will be allowed to perform instrument repairs or preventive maintenance.

If an instrument is found to be inoperative or suspected of giving erroneous readings, the SSO must be responsible for immediately removing the instrument from service and obtaining a replacement unit. If the instrument is essential for safe operation during a specific activity, that activity must cease until an appropriate replacement unit is obtained. The SSO will be responsible for ensuring a replacement unit is obtained and/or repairs are initiated on the defective equipment.

5.4 ACTION LEVELS

Table 5.1 below presents airborne contaminant action levels that will be used to determine the procedures and protective equipment necessary based on conditions as measured at the Site.

Table 5.1 – Airborne Contaminant Action Levels

Parameter	Reading	Action
Total Hydrocarbons	0 ppm to ≤ 1 ppm	Normal operations; continue hourly breathing zone monitoring
	> 1 ppm to 5 ppm	Increase monitoring frequency to every 15 minutes and use benzene detector tube to screen for the presence of benzene
	≥ 5 ppm to ≤ 50 ppm	Upgrade to Level C PPE; continue screening for benzene
	> 50 ppm	Stop work; investigate cause of reading
	At any reading > 5 ppm	Monitor perimeter per CAMP
Benzene	≥ 1 ppm to 5 ppm	Upgrade to Level C PPE
	> 5 ppm	Stop work; investigate cause of reading
Dust	0 to .05 mg/m3	Normal operations
	0.05 to 0.1 mg/m3	Begin soil wetting procedure (Level C protection would be needed beyond this point)
	> 0.15 mg/m3	Stop work, fully implement dust control plan

Parameter	Reading	Action
Oxygen	≤ 19.5%	Stop work, evacuate confined spaces/work area, investigate cause of reading, and ventilate area
	> 19.5% to < 23.5%	Normal operations
	≥ 23.5%	Stop work, evacuate confined spaces/work area, investigate cause of reading, and ventilate area
Carbon Monoxide	0 ppm to ≤ 20 ppm	Normal operations
	> 20 ppm	Stop work, evacuate confined spaces/work area, investigate cause of reading, and ventilate area
Hydrogen Sulfide	0 ppm to ≤ 5 ppm	Normal operations
	> 5 ppm	Stop work, evacuate confined spaces/work area, investigate cause of reading, and ventilate area
Flammable Vapors (LEL)	< 10% LEL	Normal operations
	≥ 10% LEL	Stop work, ventilate area, investigate source of vapors

6.0 WORK ZONES AND DECONTAMINATION

6.1 WORK ZONES

6.1.1 AUTHORIZATION TO ENTER

Only personnel with the appropriate training and medical certifications (if respirators are required) will be allowed to work at the project Site. The FS will maintain a list of authorized persons; only personnel on the authorized persons list will be allowed to enter the site work areas.

6.1.2 SITE ORIENTATION AND HAZARD BRIEFING

No person will be allowed in the work area during Site operations without first being given a Site orientation and hazard briefing. This orientation will be presented by the FS or SSO and will consist of a review of this HASP. This review must cover the chemical, physical, and biological hazards, protective equipment, safe work procedures, and emergency procedures for the project. Following this initial meeting, daily safety meetings will be held each day before work begins.

All people entering the Site work areas, including visitors, must document their attendance at this briefing, as well as the daily safety meetings on the forms included with this plan.

6.1.3 CERTIFICATION DOCUMENTS

A training and medical file may be established for the project and kept on Site during all Site operations. Specialty training, such as first aid/cardiopulmonary resuscitation (CPR) certificates, as well as current medical clearances for all project field personnel required to wear respirators, will be maintained within that file. All project personnel must provide their training and medical documentation to the SSO prior to starting work.

6.1.4 ENTRY LOG

A log-in/log-out sheet will be maintained at the Site by the FS. Personnel must sign in and out on a log sheet as they enter and leave the work area, and the FS may document entry and exit in the field notebook.

6.1.5 ENTRY REQUIREMENTS

In addition to the authorization, hazard briefing, and certification requirements listed above, no person will be allowed in any SESI work area unless they are wearing the minimum PPE as described in Section 4.0.

6.1.6 EMERGENCY ENTRANCE AND EXIT

People who must enter the work area on an emergency basis will be briefed of the hazards by the FS or SSO. All activities will cease in the event of an emergency. People exiting the work area because of an emergency will gather in a designated safe area for a head count. The FS is responsible for ensuring that all people who entered the work area have exited in the event of an emergency.

6.1.7 CONTAMINATION CONTROL ZONES

Contamination control zones are maintained to prevent the spread of contamination and to prevent unauthorized people from entering hazardous areas.

6.1.8 EXCLUSION ZONE (EZ)

An EZ may consist of a specific work area or may be the entire area of potential contamination. All employees entering an EZ must use the required PPE and must have the appropriate training and medical clearance for hazardous waste work. The EZ is the defined area where there is a possible respiratory and/or contact health hazard. Cones, caution tape, or a posted site diagram will identify the location of each EZ.

6.1.9 CONTAMINATION REDUCTION ZONE

The CRZ or transition area will be established, if necessary, to perform decontamination of personnel and equipment. All personnel entering or leaving the EZ will pass through this area to prevent any cross-contamination. Tools, equipment, and machinery will be decontaminated in a specific location. The decontamination of all personnel will be performed on Site adjacent to the EZ. Personal protective outer garments and respiratory protection will be removed in the CRZ and prepared for cleaning or disposal. This zone is the only appropriate corridor between the EZ and the support zone (SZ) discussed below.

6.1.10 SUPPORT ZONE (SZ)

The SZ is a clean area outside the CRZ located to prevent employee exposure to hazardous substances. Eating and drinking will be permitted in the support area only after proper decontamination. Smoking may be permitted in the SZ, subject to Site requirements.

6.1.11 POSTING

Work areas will be prominently marked and delineated using cones, caution tape, or a posted Site diagram.

6.1.12 SITE INSPECTIONS

The FS will conduct a daily inspection of Site activities, equipment, and procedures to verify that the required elements are in place.

6.2 DECONTAMINATION

6.2.1 PERSONNEL DECONTAMINATION

All personnel wearing Modified Level D or Level C protective equipment in the EZ must undergo personal decontamination prior to entering the SZ. The personnel decontamination area will consist of the following stations at a minimum:

- *Station 1*: Personnel leaving the contaminated zone will remove the gross contamination from their outer clothing and boots.
- *Station 2*: Personnel will remove their outer garment and gloves and dispose of it in properly labeled containers. Personnel will then decontaminate their hard hats, and boots with an aqueous solution of detergent or other appropriate cleaning solution. These items are then hand carried to the next station.
- *Station 3*: Personnel will thoroughly wash their hands and face before leaving the CRZ. Respirators will be sanitized and then placed in a clean plastic bag.

6.2.2 EQUIPMENT DECONTAMINATION

All vehicles that have entered the EZ will be decontaminated at the decontamination pad prior to leaving the zone. If the level of vehicle contamination is low, decontamination may be limited to rinsing of tires and wheel wells with water. If the vehicle is significantly contaminated, steam cleaning or pressure washing of vehicles and equipment may be required.

6.2.3 PERSONAL PROTECTIVE EQUIPMENT DECONTAMINATION

Where and whenever possible, single-use, external protective clothing must be used for work within the EZ or CRZ. This protective clothing must be disposed of in properly labeled containers. Reusable protective clothing will be rinsed at the site with detergent and water. The rinsate will be collected for disposal.

When removed from the CRZ, the respirator will be thoroughly cleaned with soap and water. The respirator face piece, straps, valves, and covers must be thoroughly cleaned at the end of each work shift, and ready for use prior to the next shift. Respirator parts may be disinfected with a solution of bleach and water (mixed at 2% bleach by volume), or by using a spray disinfectant.

7.0 TRAINING AND MEDICAL SURVEILLANCE

7.1 TRAINING

7.1.1 GENERAL

All on-Site project personnel who work in areas where they may be exposed to Site contaminants must be trained as required by OSHA Regulation 29 CFR 1910.120 (HAZWOPER). Field employees also must receive a minimum of three (3) days of actual field experience under the direct supervision of a trained, experienced supervisor. Personnel who completed their initial training more than 12 months prior to the start of the project must have completed an eight (8)-hour refresher course within the past 12 months. The FS must have completed an additional eight (8) hours of supervisory training and must have a current first-aid/CPR certificate (See Attachment 2).

7.1.2 BASIC 40-HOUR COURSE

The following is a list of the topics typically covered in a 40-hour HAZWOPER training course:

- General safety procedures;
- Physical hazards (fall protection, noise, heat stress, cold stress);
- Names and job descriptions of key personnel responsible for site health and safety;
- Safety, health, and other hazards typically present at hazardous waste sites;
- Use, application, and limitations of PPE;
- Work practices by which employees can minimize risks from hazards;
- Safe use of engineering controls and equipment on site;
- Medical surveillance requirements;
- Recognition of symptoms and signs which might indicate overexposure to hazards;
- Worker right-to-know (Hazard Communication OSHA 1910.1200);
- Routes of exposure to contaminants;
- Engineering controls and safe work practices;
- Components of a health and safety program and a site-specific HASP;
- Decontamination practices for personnel and equipment;
- Confined-space entry procedures; and
- General emergency response procedures.

7.1.3 SUPERVISOR COURSE

Management and supervisors must receive an additional eight (8) hours of training, which typically includes:

- General site safety and health procedures;
- PPE programs; and
- Air monitoring techniques.

7.1.4 SITE-SPECIFIC TRAINING

Site-specific training will be accomplished by on-site personnel reading this HASP, and through a thorough site briefing by the PM, FS, or SSO on the contents of this HASP before work begins. The review must include a discussion of the chemical, physical, and biological hazards; the protective equipment and safety procedures; and emergency procedures.

7.1.5 DAILY SAFETY MEETINGS

Daily safety meetings will be held to cover the work to be accomplished, the hazards anticipated, the PPE and procedures required to minimize site hazards, and emergency procedures. The FS or SSO should present these meetings prior to beginning the day's fieldwork. No work will be performed in an EZ before a daily safety meeting has been held. An additional safety meeting must also be held prior to new tasks, or if new hazards are encountered. The daily safety meetings will be logged in the field notebook.

7.1.6 FIRST AID AND CPR

At least one (1) employee current in first aid/CPR will be assigned to the work crew and will be on the Site during operations. Site records will document the presence of this individual. Refresher training in first aid (triennially) and CPR (annually) is required to keep the certificate current. These individuals must also receive training regarding the precautions and protective equipment necessary to protect against exposure to blood-borne pathogens.

7.2 MEDICAL SURVEILLANCE

7.2.1 MEDICAL EXAMINATION

All personnel who are potentially exposed to Site contaminants must participate in a medical surveillance program as defined by OSHA at 29 CFR 1910.120 (f).

7.2.2 PRE-PLACEMENT MEDICAL EXAMINATION

All potentially exposed personnel must have completed a comprehensive medical examination prior to assignment, and periodically thereafter as defined by applicable regulations. The pre-placement and periodic medical examinations typically include the following elements:

- Medical and occupational history questionnaire;
- Physical examination;
- Complete blood count, with differential;
- Liver enzyme profile;

- Chest X-ray, at a frequency determined by the physician;
- Pulmonary function test;
- Audiogram;
- Electrocardiogram for persons older than 45 years of age, or if indicated during the physical examination;
- Drug and alcohol screening, as required by job assignment;
- Visual acuity; and
- Follow-up examinations, at the discretion of the examining physician or the corporate medical director.

The examining physician provides the employee with a letter summarizing his findings and recommendations, confirming the worker's fitness for work and ability to wear a respirator. Documentation of medical clearance will be available for each employee during all project Site work.

Subcontractors will certify that all their employees have successfully completed a physical examination by a qualified physician. The physical examinations must meet the requirements of 29 CFR 1910.120 and 29 CFR 1910.134. Subcontractors will supply copies of the medical examination certificate for each on-site employee.

7.2.3 OTHER MEDICAL EXAMINATIONS

In addition to pre-employment, annual, and exit physicals, personnel may be examined:

- At employee request after known or suspected exposure to toxic or hazardous materials; and
- At the discretion of the SSO, HSM, or occupational physician in anticipation of, or after known or suspected exposure to toxic or hazardous materials.

7.2.4 PERIODIC EXAM

Following the placement examination, all employees must undergo a periodic examination, similar in scope to the placement examination. For employees potentially exposed over 30 days per year, the frequency of periodic examinations will be annual. For employees potentially exposed less than 30 days per year, the frequency for periodic examinations will be 24 months.

7.2.5 MEDICAL RESTRICTION

When the examining physician identifies a need to restrict work activity, the employee's supervisor must communicate the restriction to the employee and the SSO. The terms of the restriction will be discussed with the employee and the supervisor.

8.0 GENERAL SAFETY PRACTICES

8.1 GENERAL SAFETY RULES

General safety rules for site activities include, but are not limited to, the following:

- At least one copy of this HASP must be in a location at the site that is readily available to personnel, and all project personnel shall review the plan prior to starting work.
- Consume or use food, beverages, chewing gum, and tobacco products only in the SZ or other designated area outside the EZ and CRZ. Cosmetics shall not be applied in the EZ or CRZ.
- Wash hands before eating, drinking, smoking, or using toilet facilities.
- Wear all PPE as required and stop work and replace damaged PPE immediately.
- Secure disposable coveralls, boots, and gloves at the wrists and legs and ensure closure of the suit around the neck.
- Upon skin contact with materials that may be impacted by COCs, remove contaminated clothing and wash the affected area immediately. Contaminated clothing must be changed. Any skin contact with materials potentially impacted by COCs must be reported to the FS or SSO immediately. If needed, medical attention should be sought.
- Practice contamination avoidance. Avoid contact with surfaces either suspected or known to be impacted by COCs, such as standing water, mud, or discolored soil. Equipment must be stored on elevated or protected surfaces to reduce the potential for incidental contamination.
- Remove PPE as required in the CRZ to limit the spread of COC-containing materials.
- At the end of each shift or as required, dispose of all single-use coveralls, soiled gloves, and respirator cartridges in designated receptacles designated for this purpose.
- Removing soil containing site COCs from protective clothing or equipment with compressed air, shaking, or any other means that disperses contaminants into the air is prohibited.
- Inspect all non-disposable PPE for contamination in the CRZ. Any PPE found to be contaminated must be decontaminated or disposed of appropriately.
- Recognize emergency signals used for evacuation, injury, fire, etc.
- Report all injuries, illnesses, and unsafe conditions or work practices to the FS or SSO.
- Use the “buddy system” during all operations requiring Level C PPE, and when appropriate, during Modified Level D operations.
- Obey all warning signs, tags, and barriers. Do not remove any warnings unless authorized to do so.
- Use, adjust, alter, and repair equipment only if trained and authorized to do so, and in accordance with the manufacturer’s directions.
- Personnel are to perform only tasks for which they have been properly trained and will advise their supervisor if they have been assigned a task for which they are not trained.
- The presence or consumption of alcoholic beverages or illicit drugs during the workday, including breaks, is strictly prohibited. Notify your supervisor if you must

take prescription or over-the-counter drugs that indicate they may cause drowsiness or, that you should not operate heavy equipment.
- Remain upwind during site activities whenever possible.

8.2 BUDDY SYSTEM

On-Site personnel must use the buddy system as required by operations. Use of the "buddy system" is required during all operations requiring Level C to Level A PPE, and when appropriate, during Level D operations. Crewmembers must observe each other for signs of chemical exposure, and heat or cold stress. Indications of adverse effects include, but are not limited to:

- Changes in complexion and skin coloration;
- Changes in coordination;
- Changes in demeanor;
- Excessive salivation and pupillary response; and
- Changes in speech pattern.

Crewmembers must also be aware of the potential exposure to possible safety hazards, unsafe acts, or non-compliance with safety procedures.

Field personnel must inform their partners or fellow crewmembers of non-visible effects of exposure to toxic materials that they may be experiencing. The symptoms of such exposure may include, but are not limited to:

- Headaches;
- Dizziness;
- Nausea;
- Blurred vision;
- Cramps; and
- Irritation of eyes, skin, or respiratory tract.

If protective equipment or noise levels impair communications, prearranged hand signals must be used for communication. Personnel must stay within line of sight of another team member.

8.3 HEAT STRESS

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, etc., as well as the physical and conditioning characteristics of the individual. Since heat stress is one of the most common illnesses associated with heavy outdoor work conducted with direct solar load and, in particular, because wearing PPE can increase the risk of developing heat stress, workers must be capable of recognizing the signs and symptoms of heat-related illnesses. Personnel must be aware of the types and causes of heat-related illnesses and be able to recognize the signs and symptoms of these illnesses in both themselves and their co-workers.

Heat rashes are one of the most common problems in hot work environments. Commonly known as prickly heat, a heat rash is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by unevaporated sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

Heat cramps are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused both by too much or too little salt.

Cramps appear to be caused by the lack of water replenishment. Because sweat is a hypotonic solution (plus or minus 0.3% NaCl), excess salt can build up in the body if the water lost through sweating is not replaced. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Under extreme conditions, such as working for six (6) to eight (8) hours in heavy protective gear, a loss of sodium may occur. Drinking commercially available carbohydrate electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

Heat exhaustion occurs from increased stress on various body organs due to inadequate blood circulation, cardiovascular insufficiency, or dehydration. Signs and symptoms include pale, cool, moist skin; heavy sweating; dizziness; nausea; headache, vertigo, weakness, thirst, and giddiness. Fortunately, this condition responds readily to prompt treatment.

Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended;

moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, which is a medical emergency.

Workers suffering from heat exhaustion should be removed from the hot environment, be given fluid replacement, and be encouraged to get adequate rest.

Heat stroke is the most serious form of heat stress. Heat stroke occurs when the body's system of temperature regulation fails and the body's temperature rises to critical levels. This condition is caused by a combination of highly variable factors, and its occurrence is difficult to predict. Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are confusion; irrational behavior; loss of consciousness; convulsions; a lack of sweating (usually); hot, dry skin; and an abnormally high body temperature, e.g., a rectal temperature of 41°C (105.8°F). If body temperature is too high, it causes death. The elevated metabolic temperatures caused by a combination of workload and environmental heat load, both of which contribute to heat stroke, are also highly variable and difficult to predict.

If a worker shows signs of possible heat stroke, professional medical treatment should be obtained immediately. The worker should be placed in a shady area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker should be increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as soon as possible. The medical outcome of an episode of heat stroke depends on the victim's physical fitness and the timing and effectiveness of first aid treatment.

Regardless of the worker's protestations, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat stroke or exhaustion, that person may be predisposed to additional heat injuries.

8.4 HEAT STRESS SAFETY PRECAUTIONS

Heat stress monitoring and work rest cycle implementation should commence when the ambient adjusted temperature exceeds 72°F. A minimum work rest regimen and procedures for calculating ambient adjusted temperature are described in **Table 8.1** below.

Table 8.1 – Work/Rest Schedule

Adjusted Temperature[b]	Work/Rest Regimen Normal Work Ensemble[c]	Work/Rest Regimen Impermeable Ensemble
90ºF (32.2ºC) or above	After each 45 minutes of work	After each 15 minutes of work
87.5º - 90ºF (30.8º-32.2ºC)	After each 60 minutes of work	After each 30 minutes of work
82.5º - 87.5ºF (28.1º - 30.8ºC)	After each 90 minutes of work	After each 60 minutes of work
77.5º - 82.5ºF (25.3º - 28.1ºC)	After each 120 minutes of work	After each 90 minutes of work
72.5º - 77.5ºF (30.8º - 32.2ºC)	After each 150 minutes of work	After each 120 minutes of work

a. For work levels of 250 kilocalories/hour (Light-Moderate Type of Work)
b. Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F = ta °F + (13 x % sunshine). Measure air temperature (ta) with a standard 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.
d. The information presented above was generated using the information provided in the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV) Handbook.

In order to determine if the work rest cycles are adequate for the personnel and specific Site conditions, additional monitoring of individual heart rates will be conducted during the rest cycle. To check the heart rate, count the radial pulse for 30 seconds at the beginning of the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one third and maintain the same rest period.

Additionally, one or more of the following control measures can be used to help control heat stress and are mandatory if any Site worker has a heart rate (measure immediately prior to rest period) exceeding 115 beats per minute:

- Site workers will be encouraged to drink plenty of water and electrolyte replacement fluids throughout the day.
- On-site drinking water will be kept cool (50 to 60°F).
- A work regimen that will provide adequate rest periods for cooling down will be established, as required.
- All personnel will be advised of the dangers and symptoms of heat stroke, heat exhaustion, and heat cramps.
- Cooling devices, such as vortex tubes or cooling vests, should be used when personnel must wear impermeable clothing in conditions of extreme heat.
- Employees should be instructed to monitor themselves and co-workers for signs of heat stress and to take additional breaks as necessary.

- A shaded rest area must be provided. All breaks should take place in the shaded rest area.
- Employees must not be assigned to other tasks during breaks.
- Employees must remove impermeable garments during rest periods. This includes white Tyvek-type garments.

All employees must be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress disorders.

8.5 COLD STRESS

Cold stress normally occurs in temperatures at or below freezing, or under certain circumstances, in temperatures of 40°F. Extreme cold for a short time may cause severe injury to exposed body surfaces or result in profound generalized cooling, causing death. Areas of the body that have high surface area-to-volume ratio, such as fingers, toes, and ears, are the most susceptible. Two (2) factors influence the development of a cold weather injury: ambient temperature and the velocity of the wind. For instance, 10°F with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at -18°F. An equivalent chill temperature chart relating the actual dry bulb temperature and wind velocity is presented in **Table 8.2** below.

Table 8.2– Wind Chill Temperature Chart

Estimated Wind Speed (in mph)	**Actual Temperature Reading (ºF)**											
	50	**40**	**30**	**20**	**10**	**0**	**-10**	**-20**	**-30**	**-40**	**-50**	**-60**
	Equivalent Chill Temperature (ºF)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	**LITTLE DANGER** **Maximum danger of false sense of security.**				**INCREASING DANGER** **Danger from freezing of exposed flesh within one minute.**			**GREAT DANGER** **Flesh may freeze within 30 seconds.**				
	Trench foot and immersion foot may occur at any point on this chart.											

[This chart was developed by the U.S. Army Research Institute of Environmental Medicine, Natick, MA (Source: ACGIH Threshold Limit Values for Chemical Substances and Physical Agents)].

Local injury resulting from cold is included in the generic term frostbite. There are several degrees of tissue damage associated with frostbite. Frostbite of the extremities can be categorized into:

- *Frost Nip or Incipient Frostbite* - characterized by sudden blanching or whitening of skin.
- *Superficial Frostbite* - skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- *Deep Frostbite* - tissues are cold, pale, and solid; extremely serious injury.

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature. It can be fatal. Its symptoms are usually exhibited in five stages: 1) shivering; 2) apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95°F; 3) unconsciousness, glassy stare, slow pulse, and slow respiratory rate; 4) freezing of the extremities; and 5) death. Trauma sustained in freezing or sub-zero conditions requires special attention because an injured worker is predisposed to secondary cold injury. Special provisions must be made to prevent hypothermia and secondary freezing of damaged tissues in addition to providing for first aid treatment. To avoid cold stress, site personnel must wear protective clothing appropriate for the level of cold and physical activity. In addition to protective clothing, preventive safe work practices, additional training, and warming regimens may be utilized to prevent cold stress.

8.6 SAFETY PRECAUTIONS FOR COLD STRESS PREVENTION

For air temperature of 0°F or less, mittens should be used to protect the hands. For exposed skin, continuous exposure should not be permitted when air speed and temperature results in a wind chill temperature of -25°F.

At air temperatures of 36°F or less, field personnel who become immersed in water or whose clothing becomes wet must be immediately provided with a change of clothing and be treated for hypothermia.

If work is done at normal temperature or in a hot environment before entering the cold, the field personnel must ensure that their clothing is not wet as a consequence of sweating. Wet field personnel must change into dry clothes prior to entering the cold area.

If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work must be modified or suspended until adequate clothing is made available or until weather conditions improve.

Field personnel handling evaporative liquid (e.g., gasoline, alcohol, or cleaning fluids) at air temperatures below 40°F must take special precaution to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling.

8.7 SAFE WORK PROCEDURES

Direct contact between bare skin and cold surfaces (< 20°F) should be avoided. Metal tool handles and/or equipment controls should be covered by thermal insulating material.

For work performed in a wind chill temperature at or below 10°F, workers should be under constant protective observation (buddy system). The work rate should be established to prevent heavy sweating that will result in wet clothing. For heavy work, rest periods must be taken in heated shelters and workers should be provided with an opportunity to change into dry clothing if needed.

Field personnel should be provided the opportunity to become accustomed to cold-weather working conditions and required protective clothing. Work should be arranged in such a way that sitting or standing still for long periods is minimized.

During the warming regimen (rest period), field personnel should be encouraged to remove outer clothing to permit sweat evaporation or to change into dry work clothing. Dehydration, or loss of body fluids, occurs insidiously in the cold environment and may increase susceptibility to cold injury due to a significant change in blood flow to the extremities. Fluid replacement with warm, sweet drinks and soups is recommended. The intake of coffee should be limited because of diuretic and circulatory effects.

8.8 BIOLOGICAL HAZARDS

Biological hazards may include poison ivy, snakes, thorny bushes and trees, ticks, mosquitoes, spiders, and other pests.

8.8.1 TICK BORNE DISEASES

Lyme Disease - The disease commonly occurs in summer and is transmitted by the bite of infected ticks. “Hot spots” in the United States include New York, New Jersey, Pennsylvania, Massachusetts, Connecticut, Rhode Island, Minnesota, and Wisconsin.

Erlichiosis - The disease also commonly occurs in summer and is transmitted by the bite of infected ticks. “Hot spots” in the United States include New York, Massachusetts, Connecticut, Rhode Island, Minnesota, and Wisconsin.

These diseases are transmitted primarily by the deer tick, which is smaller and redder than the common wood tick. The disease may be transmitted by immature ticks, which are small and hard to see. The tick may be as small as a period on this page.

Symptoms of Lyme disease include a rash or a peculiar red spot, like a bull’s eye, which expands outward in a circular manner. The victim may have headache, weakness, fever, a stiff neck, and swelling and pain in the joints, and eventually, arthritis. Symptoms of erlichiosis include muscle and joint aches, flu-like symptoms, but there is typically no skin rash.

Rocky Mountain Spotted Fever (RMSF) - This disease is transmitted via the bite of an infected tick. The tick must be attached 4 to 6 hours before the disease-causing organism (Rickettsia rickettsii) becomes reactivated and can infect humans. The primary symptom of RMSF is the sudden appearance of a moderate-to-high fever. The fever may persist for two to three weeks. The victim may also have a headache, deep muscle pain, and chills. A rash appears on the hands and feet on about the third day and eventually spreads to all parts of the body. For this reason, RMSF may be confused with measles or meningitis. The disease may cause death, if untreated, but if identified and treated promptly, death is uncommon.

Control - Tick repellant containing diethyltoluamide (DEET) should be used when working in tick-infested areas, and pant legs should be tucked into boots. In addition, workers should search the entire body every three or four hours for attached ticks. Ticks should be removed promptly and carefully without crushing, since crushing can squeeze the disease-causing organism into the skin. A gentle and steady pulling action should be used to avoid leaving the head or mouth parts in the skin. Hands should be protected with surgical gloves when removing ticks.

8.8.2 POISONOUS PLANTS

Poisonous plants may be present in the work area. Personnel should be alerted to its presence and instructed on methods to prevent exposure.

Control - The main control is to avoid contact with the plant, cover arms and hands, and frequently wash potentially exposed skin. Particular attention must be given to avoiding skin contact with objects or protective clothing that have touched the plants. Treat every surface that may have touched the plant as contaminated, and practice contamination avoidance. If skin contact is made, the area should be washed immediately with soap and water and observed for signs of reddening.

8.8.3 SNAKES

The possibility of encountering snakes exists, specifically for personnel working in wooded/vegetated areas. Snake venoms are complex and include proteins, some of which have enzymatic activity. The effects produced by venoms include neurotoxic effects with sensory, motor, cardiac, and respiratory difficulties; cytotoxic effects on red blood cells, blood vessels, heart muscle, kidneys, and lungs; defects in coagulation; and effects from local release of substances by enzymatic actions. Other noticeable effects of venomous snakebites include swelling, edema, and pain around the bite, and the development of ecchymosis (the escape of blood into tissues from ruptured blood vessels).

Control - To minimize the threat of snakebites, all personnel walking through vegetated areas must be aware of the potential for encountering snakes, and the need to avoid actions potentiating encounters, such as turning over logs, etc. If a snakebite occurs, an attempt should be made to safely identify the snake via size and markings. The victim must be transported to the nearest hospital within 30 minutes; first aid consists of applying a constriction band and washing the area around the wound to remove any unabsorbed venom.

8.8.4 SPIDERS

Personnel may encounter spiders during work activities.

Two spiders are of concern: the black widow and the brown recluse. Both prefer dark sheltered areas such as basements, equipment sheds and enclosures, and around woodpiles or other scattered debris. The black widow is shiny black, approximately one inch long, and has a distinctive red hourglass marking on the underside of its body. The black widow is found throughout the United States. The bite of a black widow is seldom fatal to healthy adults, but effects include respiratory distress, nausea, vomiting, and muscle spasms. The brown recluse is smaller than the black widow and gets its name from its brown coloring and behavior. It has a distinctive violin shape on the top of its body. The brown recluse is more prevalent in the southern United States. The bite of the brown recluse is painful and the bite site ulcerates and takes many weeks to heal completely.

Control - To minimize the threat of spider bites, all personnel walking through vegetated areas must be aware of the potential for encountering these arachnids. Personnel need to avoid actions that may result in encounters, such as turning over logs, and placing hands in dark places such as behind equipment or in corners of equipment sheds or enclosures. If a spider bite occurs, the victim must be transported to the nearest hospital as soon as possible; first aid consists of applying ice packs and washing the area around the wound to remove any unabsorbed venom.

8.9 NOISE

Exposure to noise over the OSHA action level can cause temporary impairment of hearing; prolonged and repeated exposure can cause permanent damage to hearing. The risk and severity of hearing loss increases with the intensity and duration of exposure to noise. In addition to damaging hearing, noise can impair voice communication, thereby increasing the risk of accidents on site.

Control - All personnel must wear hearing protection, with a Noise Reduction Rating (NRR) of at least 20, when noise levels exceed 85 dBA. When it is difficult to hear a co-worker at normal conversation distance, the noise level is approaching or exceeding 85 dBA, and hearing protection is necessary. All site personnel who may be exposed to noise must also receive baseline and annual audiograms and training as to the causes and prevention of hearing loss. Noise monitoring is discussed in Section 5.2, Noise Monitoring.

Whenever possible, equipment that does not generate excessive noise levels will be selected for this project. If the use of noisy equipment is unavoidable, barriers or increased distance will be used to minimize worker exposure to noise, if feasible.

8.10 SPILL CONTROL

All personnel must take every precaution to minimize the potential for spills during site operations. All on-site personnel shall immediately report any discharge, no matter how small, to the FS.

Spill control equipment and materials will be located on the Site at locations that present the potential for discharge. All sorbent materials used for the cleanup of spills will be containerized and labeled appropriately. In the event of a spill, the FS will follow the provisions in Section 10.0, Emergency Procedures, to contain and control released materials and to prevent their spread to off-Site areas.

8.11 SANITATION

Site sanitation will be maintained according to OSHA requirements.

8.11.1 BREAK AREA

Breaks must be taken in the SZ, away from the active work area after Site personnel go through decontamination procedures. There will be no smoking, eating, drinking, or chewing gum or tobacco in any area other than the SZ.

8.11.2 POTABLE WATER

The following rules apply to all field operations:

- An adequate supply of potable water will be provided at each project site. Potable water must be kept away from hazardous materials or media, and contaminated clothing or equipment.
- Portable containers used to dispense drinking water must be capable of being tightly closed and must be equipped with a tap dispenser. Water must not be consumed directly from the container (drinking from the tap is prohibited) nor may it be removed from the container by dipping.
- Containers used for drinking water must be clearly marked and shall not be used for any other purpose.

- Disposable drinking cups must be provided. A sanitary container for dispensing cups and a receptacle for disposing of used cups is required.

8.11.3 SANITARY FACILITIES

Access to facilities for washing before eating, drinking, or smoking, or alternate methods such as waterless hand-cleaner and paper towels will be provided.

8.11.4 LAVATORY

If permanent toilet facilities are not available, an appropriate number of portable chemical toilets will be provided. This requirement does not apply to mobile crews or to normally unattended Site locations so long as employees at these locations have transportation immediately available to nearby toilet facilities.

8.12 EMERGENCY EQUIPMENT

Adequate emergency equipment for the activities being conducted on site and as required by applicable sections of 29 CFR 1910 and 29 CFR 1926 will be on site prior to the commencement of project activities. Personnel will be provided with access to emergency equipment, including, but not limited to, the following:

- Fire extinguishers of adequate size, class, number, and location as required by applicable sections of 29 CFR 1910 and 1926;
- Industrial first aid kits of adequate size for the number of personnel on site; and
- Emergency eyewash and/or shower if required by operations being conducted on Site.

8.13 LOCKOUT/TAGOUT PROCEDURES

Only fully qualified and trained personnel will perform maintenance procedures. Before maintenance begins, lockout/tagout procedures per OSHA 29 CFR 1910.147 will be followed.

Lockout is the placement of a device that uses a positive means, such as lock, to hold an energy or material-isolating device such that the equipment cannot be operated until the lockout device is removed. If a device cannot be locked out, a tagout system shall be used. Tagout is the placement of a warning tag on an energy or material isolating device indicating that the equipment controls may not be operated until the personnel who attached the tag remove the tag.

8.14 ELECTRICAL SAFETY

Electricity may pose a particular hazard to Site workers due to the use of portable electrical equipment. If wiring or other electrical work is needed, a qualified electrician must perform it.

General electrical safety requirements include:

- All electrical wiring and equipment must be a type listed by Underwriters Laboratories (UL), Factory Mutual Engineering Corporation (FM), or other recognized testing or listing agency.
- All installations must comply with the National Electrical Safety Code (NESC), the National Electrical Code (NEC), or USCG regulations.
- Portable and semi-portable tools and equipment must be grounded by a multi-conductor cord having an identified grounding conductor and a multi-contact polarized plug-in receptacle.
- Tools protected by an approved system of double insulation, or its equivalent, need not be grounded. Double insulated tools must be distinctly marked and listed by UL or FM.
- Live parts of wiring or equipment must be guarded to prevent persons or objects from touching them.
- Electric wire or flexible cord passing through work areas must be covered or elevated to protect it from damage by foot traffic, vehicles, sharp corners, projections, or pinching.
- All circuits must be protected from overload.
- Temporary power lines, switchboxes, receptacle boxes, metal cabinets, and enclosures around equipment must be marked to indicate the maximum operating voltage.
- Plugs and receptacles must be kept out of water unless of an approved submersible construction.
- All extension cord outlets must be equipped with ground fault circuit interrupters (GFCI).
- Attachment plugs or other connectors must be equipped with a cord grip and be constructed to endure rough treatment.
- Extension cords or cables must be inspected prior to each use and replaced if worn or damaged. Cords and cables must not be fastened with staples, hung from nails, or suspended by bare wire.
- Flexible cords must be used only in continuous lengths without splice, with the exception of molded or vulcanized splices made by a qualified electrician.

8.15 LIFTING SAFETY

Using proper lifting techniques may prevent back strain or injury. The fundamentals of proper lifting include:

- Consider the size, shape, and weight of the object to be lifted. A mechanical lifting device or additional persons must be used to lift an object if it cannot be lifted safely alone.
- The hands and the object should be free of dirt or grease that could prevent a firm grip.
- Gloves must be used, and the object inspected for metal slivers, jagged edges, burrs, or rough or slippery surfaces.
- Fingers must be kept away from points that could crush or pinch them, especially when putting an object down.
- Feet must be placed far enough apart for balance. The footing should be solid and the intended pathway should be clear.
- The load should be kept as low as possible, close to the body with the knees bent.
- To lift the load, grip firmly and lift with the legs, keeping the back as straight as possible.
- A worker should not carry a load that he or she cannot see around or over.
- When putting an object down, the stance and position are identical to that for lifting; the legs are bent at the knees, and the back is straight as the object is lowered.

8.16 LADDER SAFETY

When portable ladders are used for access to an upper landing surface, the ladder side rails shall extend at least three (3) feet (9 m) above the upper landing surface to which the ladder is used to gain access; or, when such an extension is not possible because of the ladder's length, then the ladder shall be secured at its top to a rigid support that will not deflect, and a grasping device, such as a grabrail, shall be provided to assist employees in mounting and dismounting the ladder. In no case shall the extension be such that ladder deflection under a load would, by itself, cause the ladder to slip off its support.

- Ladders shall be maintained free of oil, grease, and other slipping hazards.
- Ladders shall not be loaded beyond the maximum intended load for which they were built, or beyond their manufacturer's rated capacity.
- Ladders shall be used only for the purpose for which they were designed.
- Non-self-supporting ladders shall be used at an angle such that the horizontal distance from the top support to the foot of the ladder is approximately one-quarter of the working length of the ladder (the distance along the ladder between the foot and the top support).
- Wood job-made ladders with spliced side rails shall be used at an angle such that the horizontal distance is one-eighth the working length of the ladder.
- Fixed ladders shall be used at a pitch no greater than 90 degrees from the horizontal, as measured to the back side of the ladder.
- Ladders shall be used only on stable and level surfaces unless secured to prevent accidental displacement.
- Ladders shall not be used on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental displacement. Slip-resistant feet shall not be used as a substitute for care in placing, lashing, or holding a ladder that is used

upon slippery surfaces, including, but not limited to, flat metal or concrete surfaces that are constructed so they cannot be prevented from becoming slippery.

- Ladders placed in any location where they can be displaced by workplace activities or traffic, such as in passageways, doorways, or driveways, shall be secured to prevent accidental displacement, or a barricade shall be used to keep the activities or traffic away from the ladder.
- The area around the top and bottom of ladders shall be kept clear.
- The top of a non-self-supporting ladder shall be placed with the two rails supported equally unless it is equipped with a single support attachment.
- Ladders shall not be moved, shifted, or extended while occupied.
- Ladders shall have non-conductive side rails if they are used where the employee or the ladder could contact exposed energized electrical equipment.
- The top, top step, or the step labeled that it or any step above it should not be used as a step.
- Cross-bracing on the rear section of stepladders shall not be used for climbing unless the ladders are designed and provided with steps for climbing on both front and rear sections.
- Ladders shall be inspected by the HSM for visible defects on a daily basis and after any occurrence that could affect their safe use.
- Portable ladders with structural defects, such as, but not limited to, broken or missing rungs, cleats, or steps; broken or split rails; corroded components; or other faulty or defective components shall either be immediately marked in a manner that readily identifies them as defective or be tagged with “Do Not Use” or similar language and shall be withdrawn from service.
- Fixed ladders with structural defects, such as, but not limited to, broken or missing rungs, cleats, or steps; broken or split rails; or corroded components; shall be withdrawn from service.
- Ladder repairs shall restore the ladder to a condition meeting its original design criteria, before the ladder is returned to use.
- Single-rail ladders shall not be used.
- When ascending or descending a ladder, the user shall face the ladder.
- Each employee shall use at least one hand to grasp the ladder when progressing up and/or down the ladder.
- An employee shall not carry any object or load that could cause the employee to lose balance and fall.

8.17 TRAFFIC SAFETY

The project Site may be located adjacent to a public roadway where exposure to vehicular traffic is likely. Traffic may also be encountered as vehicles enter and exit the area. To minimize the likelihood of project personnel and activities being affected by traffic, the following procedures will be implemented.

Cones must be placed along the shoulder of the roadway starting 100 feet from the work area to alert passing motorists to the presence of personnel and equipment. A “Slow” or

“Men Working” sign must be placed at the first cone. Barricades with flashing lights should be placed between the roadway and the work area.

During activities along a roadway, equipment will be aligned parallel to the roadway to the extent feasible, facing into the oncoming traffic so as to place a barrier between the work crew and the oncoming traffic. All crewmembers must remain behind the equipment and the traffic barrier.

All Site personnel who are potentially exposed to vehicular traffic must wear an outer layer of orange warning garments, such as vests, jackets, or shirts. If work is performed in hours of dusk or darkness, workers will be outfitted with reflective garments either orange, white (including silver-coated reflective coatings or elements that reflect white light), yellow, fluorescent red-orange, or fluorescent yellow-orange.

The flow of traffic into and out of the adjacent business must be assessed, and precautions taken to warn motorists of the presence of workers and equipment. Where possible, vehicles should be aligned to provide physical protection of people and equipment.

9.0 SITE-SPECIFIC HAZARDS AND CONTROL MEASURES

9.1 EVALUATION OF HAZARDS

The evaluation of hazards is provided as a quick reference as to the known conditions for the Site, wherein the level of detail for each of the subsections is identified.

9.1.1 HAZARD CHARACTERISTICS

Existing information for Site:
__X__ Detailed _____ Preliminary _____ None

Hazardous/Contaminated Material Form(s):
__X__ Solid __X__Liquid _____Sludge ___Gas X Vapor

Containment Type(s):
_____ Drum _____ Tank _____ Pit _____ Debris
_____ Pond _____Lagoon Other: None known

Hazardous Material Characteristics:
__X__ Volatile _____ Corrosive _____ Reactive _____ Radioactive
_____ Ignitable __X__ Toxic __X__ Unknown

Routes of Exposure:
__X__ Oral __X__ Dermal __X__ Eye __X__ Respiratory

9.1.2 POTENTIAL HEALTH AND SAFETY HAZARDS

__X__ Heat
__X__ Cold
_____ Confined space entry
_____ Oxygen depletion
_____ Asphyxiation
__X__ Excavation
_____ Cave-ins
__X__ Falls, slippage
__X__ Heavy equipment
_____ Other: Potential Ignition Hazard

__X__Congested areas
__X__ General Construction
__X__ Physical injury
__X__ Electrical hazards
__X__ Handling and product transfer
__X__ Fire
__X__ Explosion
__X__ Biological Hazards
  _X_ Plants – Poison Ivy, Poison Oak
  _X_ Insects – Ticks
  _X_ Insects – Mosquitoes
  _X_ Insects – Bees and Wasps
  _X_ Rats and Mice
_____ Non-ionizing Radiation (i.e. UV, IR, etc.)

9.2 FIELD ACTIVITIES, HAZARDS AND CONTROL PROCEDURES

The following task-specific safety analyses identify potential health, safety, and environmental hazards associated with each type of field activity. Because of the complex and changing nature of field projects, supervisors must continually inspect the Site to identify hazards that may affect on-Site personnel, the community, or the environment. The FS must be aware of these changing conditions and discuss them with the PM whenever these changes impact employee health, safety, the environment, or performance of the project. The FS will keep on-Site personnel informed of the changing conditions, and the PM will write and/or approve addenda or revisions to this HASP as necessary.

9.2.1 MOBILIZATION/CONSTRUCTION STAKEOUT

Description of Tasks

Site mobilization will include establishing excavation locations, determining the location of utilities and other installations, and establishing work areas. Mobilization will also include setting up equipment and establishing a temporary site office. A break area will be set up outside of regulated work areas. Mobilization may involve clearing areas for the SZ and CRZ. During this initial phase, project personnel will walk the Site to confirm the existence of anticipated hazards and identify safety and health issues that may have arisen since the writing of this plan.

Hazard Identification

The hazards of this phase of activity are associated with heavy equipment operation, manual materials handling, installation of temporary on-site facilities, and manual site preparation.

Manual materials handling and manual site preparation may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion, and laceration hazards. Installation of temporary field office and support facilities may expose personnel to electrical hazards, underground and overhead utilities, and physical injury due to the manual lifting and moving of materials. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, rain, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and blood-borne pathogens.

Controls
Control procedures for these hazards are discussed in Section 8.0, General Safety Practices.

9.2.2 DEMOLITION/SITE-CLEARING

Description of Tasks
Site clearance will involve manual or mechanical removal of objects impeding access to the construction footprint. These obstructions are both natural and man-made items and will include, but not be limited to, fabricated metal and concrete structures, trees, vegetation, rubble, and miscellaneous trash/debris.

Hazard Identification
Hazards associated with demolition and site clearance include personnel working in and around potentially unstable structures, or locations of potential contact with hazardous chemicals, utilities, and/or falling objects. This task will involve manual, as well as mechanical demolition/clearance efforts so exertion and equipment hazards exist.

Controls
PPE – Personnel shall be protected from hazards of irritant and toxic plants and suitably instructed in the first aid treatment available.

Preparatory Operations – Prior to permitting employees to start demolition operations, an engineering survey shall be made, by a licensed Professional Engineer, of the structure to determine the stability of the structure. Any adjacent structure shall where personnel may be exposed shall also be similarly checked. The PO shall have in writing evidence that such a survey has been performed. All structural instabilities shall be shored or braced, under the supervision of a licensed Professional Engineer, prior to access by an FP.

Utilities – All electric, gas, water, steam, sewer, and other service lines shall be shut off, caped, or otherwise controlled, outside the building line before demolition work is started. In each case, any utility company that is involved shall be notified in advance. If it is necessary to maintain any power, water or other utilities during demolition, such lines shall be temporarily relocated, as necessary.

Hazardous Substances – It shall also be determined if any type of hazardous chemicals, gases, explosives, flammable materials, or similarly dangerous substances have been used in any pipes, tanks, or other equipment on the property. When the presence of any such substances is apparent or suspected, testing and purging shall be performed and the hazard eliminated before demolition is started.

Falling Debris/Objects – No material shall be dropped to any point lying outside the exterior walls of the structure unless the area is effective protected. Access to the area where falling objects/debris may be encountered must be gated and controlled.

Structural Collapse – Structural or load supporting members on any floor shall not be cut or removed until all stories above such a floor have been demolished and removed. Walls, which are to serve as retaining walls against which debris will be piled, shall not be so used unless capable of safely supporting the imposed load. Mechanical equipment shall not be used on floors or working surfaces unless such floors or surfaces are not of sufficient strength to support the imposed load.

Rollover Guards – All equipment used in site clearing operations shall be equipped with rollover guards meeting the applicable requirements. In addition, rider-operated equipment shall be equipped with an overhead and rear canopy guard meeting the applicable requirements.

Inspections – During demolition, continuing inspections by a licensed Professional Engineer shall be made as the work progresses to detect hazards resulting from weakened or deteriorated floors, walls, or loosened material. No FP shall be permitted to work where such hazards exist until they are corrected by shoring, bracing, or other effective means.

9.2.3 EXCAVATION AND CUT/FILL OPERATIONS

9.2.3.1 EXCAVATION TRENCHING

Description of Tasks

This task includes the excavation of contaminated soils and superficial debris. Excavation depths vary across the Site.

Hazard Identification

The hazards of this activity are associated with heavy equipment operation, subsurface intrusion, manual materials handling, stockpiling, and disposal. Subsurface intrusion presents hazards associated with negotiating buried utilities, cave-ins of the excavated areas, and regress methods for personnel working inside the excavated areas. Disruption of contaminated soil also presents a health hazard.

Controls

Underground Utilities – The estimated locations of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during the excavation work, shall be determined prior to opening an excavation. Utility companies or owners shall be contacted ("Call Before You Dig") within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation.

When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by save and acceptable means. While the excavation is open, underground installations shall be protected, supported, or removed, as necessary, to safeguard site personnel.

Cave-Ins – Project personnel in an excavation shall be protected from cave-ins by an adequate protective system, except when:

- Excavations are made entirely in stable rock or excavations are less than five feet in depth and examination of the ground by the SSO provides no indication of a potential cave-in.
- Protective systems shall have the capacity to resist, without failure, all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

Project personnel shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least two feet from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

Daily inspections of excavations, the adjacent areas, and protective systems shall be made by the SSO for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the SSO prior to the start of work and as needed throughout operations. Inspections shall also be made after every rainstorm or other hazard-increasing occurrence. These inspections are only required when project personnel exposure can be reasonably anticipated.

Where the SSO finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed personnel shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

Excavation Egress – A stairway, ladder, ramp, or other safe means of egress shall be located in trench excavations that are four feet or more in depth so as to require no more than 25 feet or lateral travel for project personnel.

9.2.3.2 HEAVY EQUIPMENT OPERATION

Description of Tasks
Heavy equipment to be used for this task include, but are not limited to, excavators, dozers, dump trucks, and water sprayers (if required).

Hazard Identification
The most common type of accident that occurs in material handling operations is the “caught between” situation when a load is being handled and an object gets caught between two moving parts of the equipment. Operation of the heavy construction equipment may produce harmful noise.

Controls
Equipment Inspection – All vehicles in use shall be checked prior to operation to ensure that all parts, equipment, and accessories that affect safe operations are in proper operating condition and free from defects. All defects shall be corrected before the vehicle is placed in service.

Ground Guides – No personnel shall use any motor vehicle, earthmoving, or compacting equipment having an obstructed view to the rear, unless:

- The vehicle has a reverse signal alarm distinguishable from the surrounding noise level; or
- The vehicle is backed up only when an observer signals that it is safe to do so.

Blocking – Heavy machinery, equipment, or parts thereof that are suspended or held aloft shall be substantially blocked to prevent falling or shifting before employees are permitted to work under or between them.

Noise – Control measures for noise are addressed in Section 8.9.

Traffic – Control measures for traffic are addressed in Section 8.17.

9.2.3.3 DISTURBANCE/HANDLING OF CONTAMINATED MATERIAL

Description of Tasks

After the contaminated soil is excavated from below the Site's surface, the material will be stockpiled, dried, and either transported off Site or relocated and backfilled on Site.

Hazard Identification

The hazards associated with materials handling include contact of the contaminated material with project personnel, or cross contamination with other site soil.

Controls

Cross Contamination – Following excavation, contaminated soil stockpiles will be placed on a structure constructed to separate the material from the site soil and collect any groundwater leachate. The material shall be covered to prevent storm water erosion or migration of contaminants through storm water.

Air Monitoring – Air and particulate monitoring will be conducted during soil excavation activities to assess the potential for exposure to airborne COCs. If the results of air monitoring indicate the presence of organic vapors or particulates in a concentration causing concern, personnel will upgrade to Level C protection. Refer to Section 5.1, Air Monitoring, for a description of air monitoring requirements and action levels. A description of each level of personal protection is included in Section 4.0, Personal Protective Equipment.

Traffic – Control measures for traffic are addressed in Section 8.17.

9.2.4 DRILLING/SUBSURFACE INTRUSION ACTIVITIES

Description of Tasks

Site mobilization will include establishing excavation locations, determining the location of utilities and other installations, and establishing work areas. Mobilization will also include setting up equipment and establishing a temporary Site office. A break area will be set up outside of regulated work areas. Mobilization may involve clearing areas for the SZ and CRZ. During this initial phase, project personnel will walk the Site to confirm the existence of anticipated hazards and identify safety and health issues that may have arisen since the writing of this plan.

Hazard Identification

The primary physical hazards for this activity are associated with the use of soil boring and grouting equipment. The equipment is hydraulically powered and uses static force and dynamic percussion force to advance sampling and penetrating tubes.

Accidents can occur as a result of improperly placing the equipment on uneven or unstable terrain or failing to adequately secure the equipment prior to the start of operations. Overhead utility lines can create hazardous conditions if contacted by the equipment. Underground installations such as electrical lines, conduit, and product lines pose a significant hazard if contacted.

Controls

Geoprobe and Drill Rig Safety Procedures - The operator of the equipment must possess required state or local licenses to perform such work. All members of the crew shall receive Site-specific training prior to beginning work.

The operator is responsible for the safe operation of the rig, as well as the crew's adherence to the requirements of this HASP. The operator must ensure that all safety equipment is in proper condition and is properly used. The members of the crew must follow all instructions of the operator, wear all personal protective equipment, and be aware of all hazards and control procedures. The operator and crew must participate in the Daily Safety Meetings and be aware of all emergency procedures.

Equipment Inspection - Each day, prior to the start of work, the rig and associated equipment must be inspected by the operator. The following items must be inspected:

- Vehicle condition;

- Proper storage of equipment;
- Condition of all hydraulic lines;
- Fire extinguisher; and
- First aid kit.

Equipment Set Up - The drill rig must be properly blocked and leveled prior to raising the derrick. The wheels which remain on the ground must be chocked. The leveling jacks shall not be raised until the derrick is lowered. The rig shall be moved only after the derrick has been lowered.

All well sites will be inspected by the driller prior to the location of the rig to verify a stable surface exists. This is especially important in areas where soft, unstable terrain is common.

The drill rig must be properly blocked and leveled prior to raising the derrick. Blocking provides a more stable drilling structure by evenly distributing the weight of the rig. Proper blocking ensures that differential settling of the rig does not occur.

When the ground surface is soft or otherwise unstable, wooden blocks, at least 24" by 24" and 4" to 8" thick shall be placed between the jack swivels and the ground. The emergency brake shall be engaged, and the wheels that are on the ground shall be chocked.

Rules for Intrusive Activity - Before beginning any intrusive activity, the existence and location of underground pipe, conduit, electrical equipment, and other installations will be determined. This will be done, if possible, by contacting the appropriate client representative to mark the location of the lines. “Call Before You Dig” will verify the potential for encountering subsurface utilities. If the client’s knowledge of the area is incomplete, an appropriate device, such as a magnetometer, will be used to locate the line.

Combustible gas readings of the general work area will be made regularly in areas where and/or during operations when the presence of flammable vapors or gases is suspected, such as during intrusive activities (see Section 5.1). Operations must be suspended and corrective action taken if the airborne flammable concentration reaches 10% of the LEL in the immediate area (a one-foot radius) of the point of drilling, or near any other ignition sources.

Overhead Electrical Clearances - If equipment is operated in the vicinity of overhead power lines, the power to the lines must be shut off or the equipment must be positioned and blocked such that no part, including cables, can come within the minimum clearances as follows:

Nominal System Voltage	**Minimum Required Clearance**
0-50kV	10 feet
51-100kV	12 feet
101-200kV	15 feet
201-300kV	20 feet
301-500kV	25 feet
501-750kV	35 feet
751-1,000kV	45 feet

When the drill rig is in transit, with the boom lowered and no load, the equipment clearance must be at least 4 feet for voltages less than 50kV, 10 feet for voltages of 50 kV to 345 kV, and 16 feet for voltages above 345 kV.

Hoisting Operations - Drillers should never engage the rotary clutch without watching the rotary table, and ensuring it is clear of personnel and equipment.

Unless the drawworks is equipped with an automatic feed control, the brake should not be left unattended without first being tied down.

Drill pipe, auger strings or casing should be picked up slowly. Drill pipe should not be hoisted until the driller is sure that the pipe is latched in the elevator, or the derrickman has signaled that he may safely hoist the pipe.

During instances of unusual loading of the derrick or mast, such as when making an unusually hard pull, only the driller should be on the rig floor; no one else should be on the rig or derrick.

The brakes on the drawworks of the drill rig should be tested by the driller each day. The brakes should be thoroughly inspected by a competent individual each week.

A hoisting line with a load imposed should not be permitted to be in direct contact with any derrick member or stationary equipment, unless it has been specifically designed for line contact.

Workers should never stand near the borehole whenever any wire line device is being run.

Hoisting control stations should be kept clean and controls labeled as to their functions.

Catline Operations - Only experienced workers will be allowed to operate the cathead controls. The kill switch must be clearly labeled and operational prior to operation of the catline. The cathead area must be kept free of obstructions and entanglements.
The operator should not use more wraps than necessary to pick up the load. More than one layer of wrapping is not permitted.

Personnel should not stand near, step over, or go under a cable or catline which is under tension.

Employees rigging loads on catlines shall:

- Keep out from under the load;
- Keep fingers and feet where they will not be crushed;
- Be sure to signal clearly when the load is being picked;
- Use standard visual signals only and not depend on shouting to coworkers; and
- Make sure the load is properly rigged, since a sudden jerk in the catline will shift or drop the load.

Wire Rope - When two wires are broken or rust or corrosion is found adjacent to a socket or end fitting, the wire rope shall be removed from service or re-socketed. Special attention shall be given to the inspection of end fittings on boom support, pendants, and guy ropes.

Wire rope removed from service due to defects shall be cut up or plainly marked as being unfit for further use as rigging.

Wire rope clips attached with U-bolts shall have the U-bolts on the dead or short end of the rope; the clip nuts shall be re-tightened immediately after initial load carrying use and at frequent intervals thereafter.

When a wedge socket fastening is used, the dead or short end of the wire rope shall have a clip attached to it or looped back and secured to itself by a clip; the clip shall not be attached directly to the live end.

Protruding ends of strands in splices on slings and bridles shall be covered or blunted.

Except for eye splices in the ends of wires and for endless wire rope slings, wire rope used in hoisting, lowering, or pulling loads, shall consist of one continuous piece without knot or splice.

An eye splice made in any wire rope shall have not less that five full tucks.

Wire rope shall not be secured by knots. Wire rope clips shall not be used to splice rope.

Eyes in wire rope bridles, slings, or bull wires shall not be formed by wire clips or knots.

Pipe/Auger Handling - Pipe and auger sections shall be transported by cart or carried by two persons. Individuals should not carry auger or pipe sections without assistance.

Workers should not be permitted on top of the load during loading, unloading, or transferring of pipe or rolling stock.

Employees should be instructed never to try to stop rolling pipe or casing; they should be instructed to stand clear of rolling pipe.

Slip handles should be used to lift and move slips. Employees are not permitted to kick slips into position.

When pipe is being hoisted, personnel should not stand where the bottom end of the pipe could whip and strike them.

Pipe and augers stored in racks, catwalks or on flatbed trucks should be secured to prevent rolling.

9.2.5 SUBSURFACE CHEMICAL SAMPLE/COLLECTION ANALYSIS

Description of Tasks

This sub-task consists of the collection of soil samples for subsequent field and laboratory analysis. The physical hazards of soil sampling are primarily associated with the sample collection methods, procedures utilized, and the environment itself.

Hazard Identification

Incidental contact with COCs is the primary hazard associated with sampling the stabilized material. This contact may occur through the manipulation of sample media and equipment, manual transfer of media into sample containers, and proximity of operations to the breathing zone. The primary hazards associated with these sampling procedures are not potentially serious; however, other operations in the area, or the conditions under which samples must be collected, may present chemical and physical hazards. The hazards directly associated with sampling procedures are generally limited to strains/sprains and potential eye hazards. Potential chemical hazards may include contact with media containing Site COCs and potential contact with chemicals used for equipment decontamination.

Controls

PPE – To control dermal exposure during sampling activities, a minimum of Level D protection will be worn. If necessary, based on field observations and site conditions, air monitoring may be conducted during sediment sampling activities. If the results of air monitoring indicate the presence of airborne contaminants in a concentration causing concern, personnel will upgrade to Level C protection. Refer to Section 5.1, Air Monitoring, for a description of air monitoring requirements and action levels. A description of each level of personal protection is included in Section 4.0, Personal Protective Equipment.

9.2.6 UST CLOSURE

9.2.6.1 WORKING IN CONFINED SPACES

Description of Tasks

The project may involve the closure of several USTs.

Hazard Identification

Closure activities may require the entrance into confined spaces to facilitate cleaning and removal of the USTs.

Controls

All personnel required to enter confined or enclosed spaces must be instructed as to the nature of the hazards involved, the necessary precautions to be taken, and in the use of required protective and emergency equipment. The PO shall comply with all specific regulations that apply to work in dangerous or potentially dangerous areas.

9.2.6.2 WORKING WITH COMPRESSED AIR

Description of Tasks

The proposed method of purging the USTs includes the injection of compressed gas into the tank and attached piping network.

Hazard Identification

Uncontrolled release of the highly pressured air can cause injury to FP during this task. Cylinders must also be properly managed to ensure they are not compromised during storage and/or use.

Controls

Pressure Regulation – Compressed air used for cleaning purposes shall be reduced to less than 30 pounds per square inch and then only with effective chip guarding and personal protective equipment.

Cylinder Storage – Valve protection caps shall be in place and secured when compressed gas cylinders are transported, moved, or stored. Cylinder valves shall be closed when work is finished and when cylinders are empty or are moved. Compressed gas cylinders shall be secured in an upright position at all times, except if necessary for short periods of time when cylinders are actually being hoisted or carried. Cylinders shall be placed in a location where they cannot become part of an electrical circuit.

9.2.7 DECONTAMINATION

All equipment will be decontaminated before leaving the Site. Personnel involved in decontamination activities may be inadvertently exposed to skin contact with contaminated materials and chemicals brought from the EZ. Personnel involved in decontamination activities must wear PPE that is, at a minimum, one level below the level worn by personnel working in the EZ.

9.2.8 DEMOBILIZATION

Demobilization involves the removal of all tools, equipment, supplies, and vehicles brought to the site. The hazards of this phase of activity are associated with heavy equipment operation and manual materials handling.

Manual materials handling may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion, and laceration hazards. Heavy equipment operation presents noise and vibration hazards, and hot surfaces, to operators. Personnel in the vicinity of heavy equipment operation may be exposed to physical hazards resulting in fractures, contusions, and lacerations and may be exposed to high noise levels. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, rain, and heat-or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and blood-borne pathogens.

Control procedures for these hazards are discussed in Section 8.0, General Safety Practices.

9.3 CHEMICAL HAZARDS

The chemical hazards associated with site operations are related to inhalation, ingestion, and skin exposure to Site COCs. Concentrations of airborne COCs during Site tasks may be measurable and will require air monitoring during certain operations. Air monitoring requirements for Site tasks are outlined in Section 5.1.

COCs at the Site include heavy metals, some VOC compounds, some SVOC compounds and potentially other industrial chemicals including PCBs and pesticides.

The potential for inhalation of site COCs is low. The potential for dermal contact with soils containing Site COCs during remedial operations is moderate. **Table 9.1** lists the primary contaminants that have been identified at the Site and the media in which they are present.

Table 9.1 – List of Primary Contaminants

Media: Soil		
Metals	**Maximum Concentration (mg/kg)**	**Applicable Monitoring Instrument**
Barium	1250	Not Applicable
Copper	109	Not Applicable
Lead	6160	Not Applicable
Mercury	1.9	Not Applicable
Nickel	109	Not Applicable
Silver	5.1	Not Applicable
Zinc	1010	Not Applicable
SVOCs	**Maximum Concentration (mg/kg)**	**Applicable Monitoring Instrument**
Benzo(a)anthracene	51.9	PID
Benzo(a)pyrene	44.5	PID
Benzo(b)fluoranthene	51.1	PID
Benzo(k)fluoranthene	22.7	PID
Chrysene	46.6	PID
Dibenzo(a,h)anthracene	7.05	PID
Dibenzofuran	13.7	PID
Indeno(1,2,3-cd)pyrene	31.4	PID
PCBs	**Maximum Concentration (mg/kg)**	**Applicable Monitoring Instrument**
Aroclor 1242	37.4	Not Applicable
Pesticides	**Maximum Concentration (mg/kg)**	**Applicable Monitoring Instrument**
4,4'-DDD	0.0662	Not Applicable
4,4'-DDE	0.194	Not Applicable
4,4'-DDT	0.165	Not Applicable
Aldrin	0.0073	Not Applicable
Dieldrin	0.117	Not Applicable

Media: Groundwater		
VOCs	**Maximum Concentration (ug/L)**	**Applicable Monitoring Instrument**
Trichloroethene (TCE)	5.5	PID
SVOCs	**Maximum Concentration (ug/L)**	**Applicable Monitoring Instrument**
benzo(a)anthracene	17.4	PID
benzo(a)pyrene	18.2	PID
benzo(b)fluoranthene	24.5	PID
benzo(k)fluoranthene	8.2	PID
chrysene	19.5	PID
indeno(1,2,3-cd)pyrene	15.5	PID
bis(2-Ethylhexyl)phthalate	7.6	PID

Media: Groundwater		
PFAS	**Maximum Concentration (ng/L)**	**Applicable Monitoring Instrument**
Perfluorooctanoic acid	227	PID
Perfluorooctanesulfonic acid	136	PID
Pesticides	**Maximum Concentration (ug/L)**	**Applicable Monitoring Instrument**
Dieldrin	0.22	Not Applicable
4,4'-DDT	0.55	Not Applicable
4,4-DDD	0.31	Not Applicable
4,4'-DDE	0.27	Not Applicable
Metals	**Maximum Concentration (ug/L)**	**Applicable Monitoring Instrument**
Antimony	6.4	Not Applicable
Arsenic	39.2	Not Applicable
Barium	5920	Not Applicable
Beryllium	20.1	Not Applicable
Cadmium	10.6	Not Applicable
Chromium	306	Not Applicable
Copper	574	Not Applicable
Iron	120000	Not Applicable
Lead	13900	Not Applicable
Magnesium	128000	Not Applicable
Manganese	37500	Not Applicable
Mercury	6.3	Not Applicable
Nickel	1110	Not Applicable
Selenium	12	Not Applicable
Sodium	283000	Not Applicable
Zinc	3790	Not Applicable

Media: Soil Vapor		
VOCs	**Maximum Concentration (ug/L)**	**Applicable Monitoring Instrument**
Acetone (2-Propanone)	287	PID
1,3-Butadiene	2.7	PID
Benzene	7.7	PID
Carbon disulfide	66.6	PID
Chloroform	6.8	PID
Chloromethane	0.87	PID
Cyclohexane	44.4	PID
Dichlorodifluoromethane	9.9	PID
m-Dichlorobenzene	3.4	PID
Ethanol	161	PID
Ethylbenzene	31	PID
Ethyl Acetate	7.9	PID
4-Ethyltoluene	19	PID
Heptane	639	PID

Media: Soil Vapor		
Hexane	2220	PID
Isopropyl Alcohol	55.3	PID
Methylene chloride	1.3	PID
Methyl ethyl ketone	33.6	PID
Methyl Isobutyl Ketone	5.7	PID
Methylmethacrylate	2.0	PID
Propylene	6	PID
Styrene	8.5	PID
1,2,4-Trimethylbenzene	64.9	PID
1,3,5-Trimethylbenzene	17	PID
2,2,4-Trimethylpentane	10	PID
Tertiary Butyl Alcohol	34	PID
Tetrachloroethylene	22	PID
Tetrahydrofuran	5.3	PID
Toluene	88.2	PID
Trichloroethylene	5.2	PID
Trichlorofluoromethane	28	PID
Vinyl Acetate	3.9	PID
m,p-Xylene	132	PID
o-Xylene	47.3	PID
Xylenes (total)	180	PID

10.0 EMERGENCY PROCEDURES

10.1 GENERAL

Prior to the start of operations, the work area will be evaluated for the potential for fire, contaminant release, or other catastrophic event. Unusual conditions or events, activities, chemicals, and conditions will be reported to the FS/SSO immediately.

The FS/SSO will establish evacuation routes and assembly areas for the Site. All personnel entering the Site will be informed of this route and the assembly area.

10.2 EMERGENCY RESPONSE

If an incident occurs, the following steps will be taken:

- The FS/SSO will evaluate the incident and assess the need for assistance and/or evacuation;
- The FS/SSO will call for outside assistance as needed;
- The FS/SSO will ensure the PM is notified promptly of the incident; and
- The FS/SSO will take appropriate measures to stabilize the incident scene.

10.2.1 FIRE

In the case of a fire at the Site, the FS/SSO will assess the situation and direct fire-fighting activities. The FS/SSO will ensure that the PM is immediately notified of any fires. Site personnel will attempt to extinguish the fire with available extinguishers, if safe to do so. In the event of a fire that Site personnel are unable to safely extinguish with one (1) fire extinguisher, the local fire department will be summoned.

10.2.2 CONTAMINANT RELEASE

In the event of a contaminant release, the following steps will be taken:

- Notify FS/SSO immediately;
- Evacuate immediate area of release;
- Conduct air monitoring to determine needed level of PPE; and
- Don required level of PPE and prepare to implement control procedures.

The FS/SSO has the authority to commit resources as needed to contain and control released material and to prevent its spread to off-Site areas.

10.3 MEDICAL EMERGENCY

All employee injuries must be promptly reported to the SSO/FS, who will:

- Ensure that the injured employee receives prompt first aid and medical attention;

- In emergency situations, the worker is to be transported by appropriate means to the nearest urgent care facility (normally a hospital emergency room); and
- If the injured person is a SESI employee, notify SESI at 973-808-9050.

10.3.1 EMERGENCY CARE STEPS

Survey the scene. Determine if it is safe to proceed. Try to determine if the conditions that caused the incident are still a threat. Protect yourself from exposure before attempting to rescue the victim.

- Do a primary survey of the victim. Check for airway obstruction, breathing, and pulse. Assess likely routes of chemical exposure by examining the eyes, mouth, nose, and skin of the victim for symptoms.
- Phone Emergency Medical Services (EMS). Give the location, telephone number used, caller's name, what happened, number of victims, victim's condition, and help being given.
- Maintain airway and perform rescue breathing as necessary.
- Perform CPR as necessary.
- Do a secondary survey of the victim. Check vital signs and do a head-to-toe exam.

Treat other conditions as necessary. If the victim can be moved, take him/her to a location away from the work area where EMS can gain access.

10.4 FIRST AID GENERAL

All persons must report any injury or illness to their immediate supervisor or the FS. Trained personnel will provide first aid. Injuries and illnesses requiring medical treatment must be documented. The FS and SSO must fill out an accident/incident report as soon as emergency conditions no longer exist and first aid and/or medical treatment has been ensured. The report must be completed and submitted to the PM within 24 hours after the incident.

If first-aid treatment is required, first aid kits are kept at the CRZ. If treatment beyond first aid is required, the injured person(s) should be transported to the medical facility. If the injured person is not ambulatory or shows any sign of not being in a comfortable and stable condition for transport, then an ambulance/paramedics should be summoned. If there is any doubt as to the injured worker's condition, it is best to let the local paramedic or ambulance service examine and transport the worker.

10.4.1 FIRST AID--INHALATION

Any employee complaining of symptoms of chemical overexposure as described in Section 4, General Site Safety Procedures, will be removed from the work area and transported to the designated medical facility for examination and treatment.

10.4.2 FIRST AID--INGESTION

Call EMS and consult a poison control center for advice. If available, refer to the MSDS for treatment information. If the victim is unconscious, keep them on their side and clear the airway if vomiting occurs.

10.4.3 FIRST AID—SKIN CONTACT

Project personnel who have had skin contact with contaminants will, unless the contact is severe, proceed through the CRZ, to the wash area. Personnel will remove any contaminated clothing, and then flush the affected area with water for at least 15 minutes. The worker should be transported to the medical facility if he/she shows any sign of skin reddening, irritation, or if he/she requests a medical examination.

10.4.4 FIRST AID—EYE CONTACT

Project personnel who have had contaminants splashed in their eyes or who have experienced eye irritation while in the EZ, must immediately proceed to the eyewash station in the CRZ. Do not decontaminate prior to using the eyewash. Remove whatever protective clothing is necessary to use the eyewash. Flush the eye with clean running water for at least 15 minutes. Arrange prompt transport to the designated medical facility.

10.5 REPORTING INJURIES, ILLNESSES, AND SAFETY INCIDENTS

Injuries and illnesses, however minor, will be reported to the FS immediately. The FS will complete an injury report and submit it to the HSM, and the PM by end of shift.

10.6 EMERGENCY INFORMATION

The means to summon local public response agencies such as police, fire, and ambulance will be reviewed in the daily safety meeting. These agencies are identified in **Table 10.1** below.

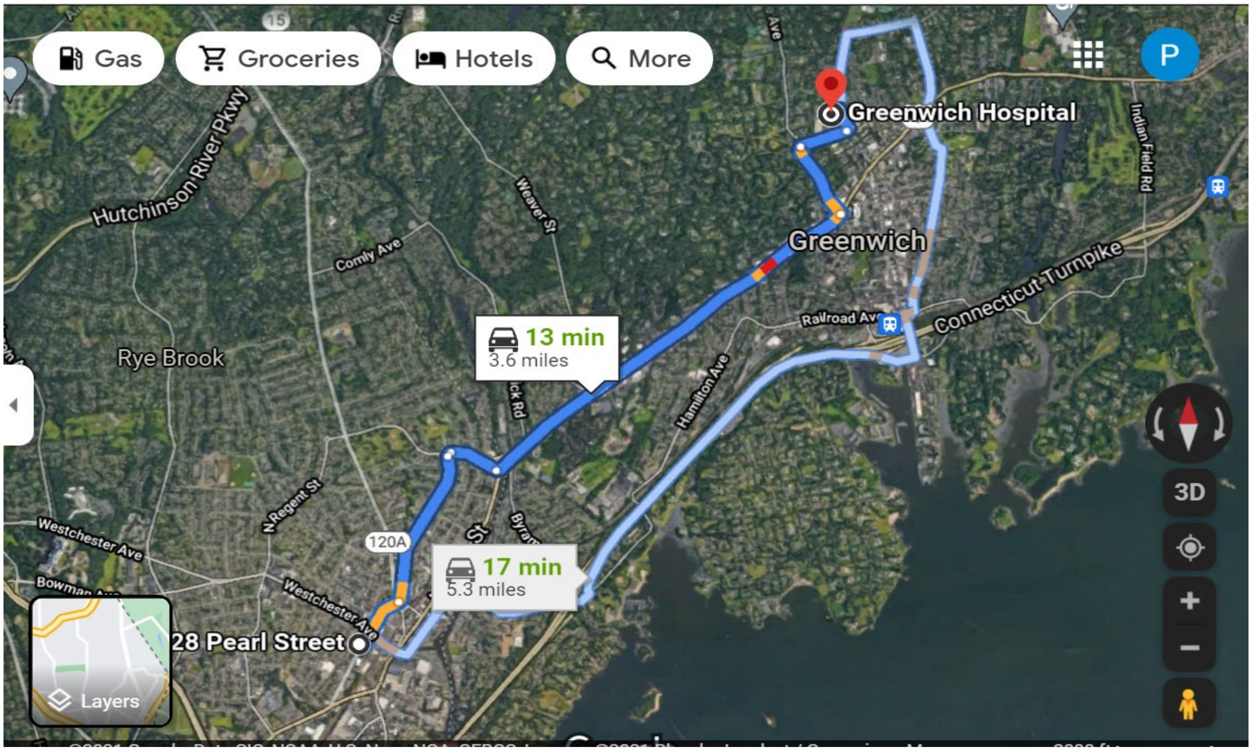
Table 10.1 – Emergency Contacts

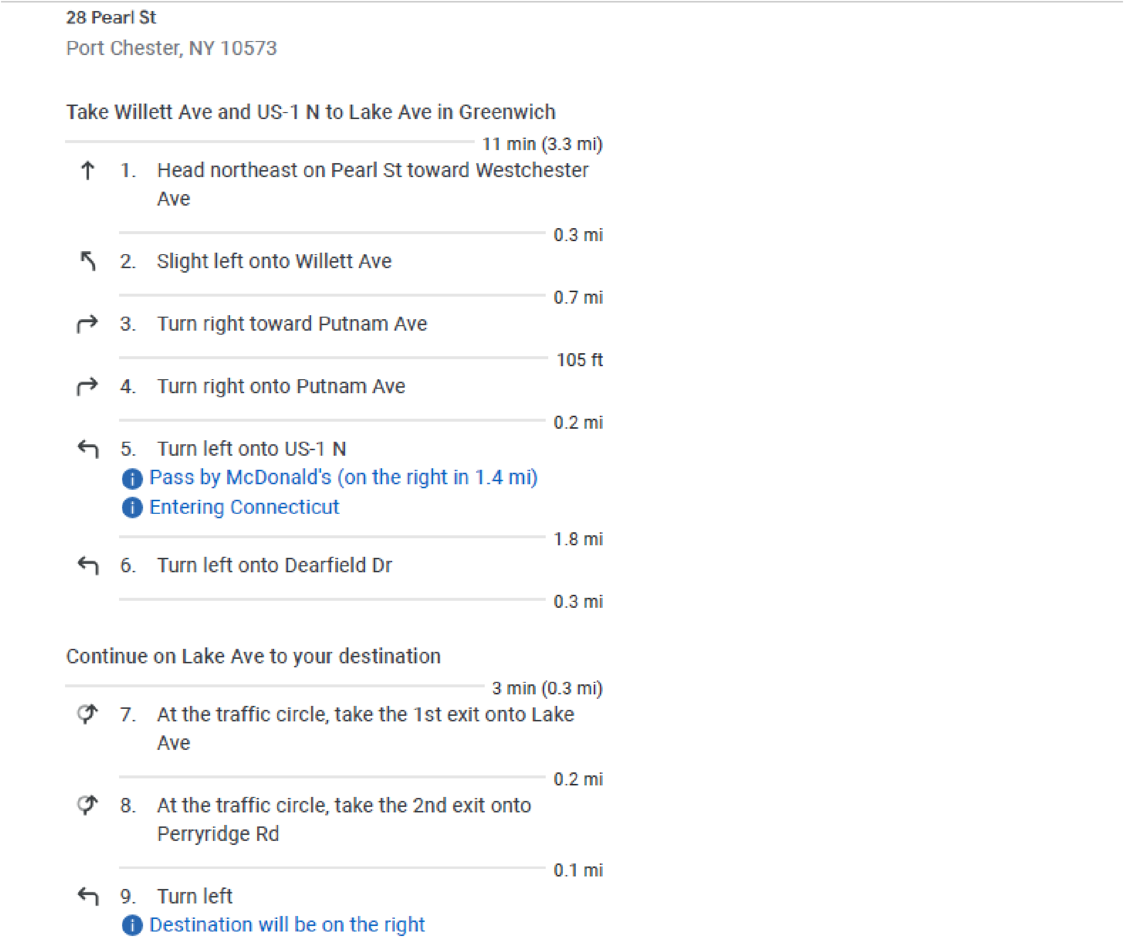
Local Emergency Contacts	**Telephone No.**
EMERGENCY	911
Greenwich Hospital	(203) 863-3000
Police Emergency	911
Fire Emergency	911
Rescue Squad	911
Ambulance	911
Miscellaneous Contacts	**Telephone No.**
N.Y. Poison Control Center	(800) 222-1222
National Response Center and Terrorist Hotline	(800) 424-8802
Center for Disease Control	(800) 311-3435
Utility Mark-Out	(800) 962-7962

10.6.1 DIRECTIONS TO HOSPITAL

Greenwich Hospital
5 Perryridge Road, Greenwich, CT
(203) 863-3000

Directions to Hospital:





28 Pearl St
Port Chester, NY 10573

Take Willett Ave and US-1 N to Lake Ave in Greenwich

11 min (3.3 mi)

↑ 1. Head northeast on Pearl St toward Westchester Ave

0.3 mi

↖ 2. Slight left onto Willett Ave

0.7 mi

↱ 3. Turn right toward Putnam Ave

105 ft

↱ 4. Turn right onto Putnam Ave

0.2 mi

↰ 5. Turn left onto US-1 N
ⓘ Pass by McDonald's (on the right in 1.4 mi)
ⓘ Entering Connecticut

1.8 mi

↰ 6. Turn left onto Dearfield Dr

0.3 mi

Continue on Lake Ave to your destination

3 min (0.3 mi)

7. At the traffic circle, take the 1st exit onto Lake Ave

0.2 mi

8. At the traffic circle, take the 2nd exit onto Perryridge Rd

0.1 mi

↰ 9. Turn left
ⓘ Destination will be on the right

Greenwich Hospital is depicted on **Figure 10.1**

11.0 LOGS, REPORTS, AND RECORD KEEPING

The following is a summary of required health and safety logs, reports, and record keeping for the operations at the subject Site.

11.1 HASP FIELD CHANGE REPORT

To be completed for initiating a change to the HASP. PM approval is required. The original will be kept in the project file (See Attachment 3).

11.2 MEDICAL AND TRAINING RECORDS

The HSM must obtain and keep a log of personnel meeting appropriate training and medical qualifications for the site work. The log will be kept in the project file. Each company's Human Resources Department will maintain medical records, in accordance with 29 CFR 1910.1020.

11.3 EXPOSURE RECORDS

Any personnel monitoring results, laboratory reports, calculations, and air sampling data sheets are part of an employee exposure record. These records will be kept in accordance with 29 CFR 1910.1020. For SESI employees, the originals will be sent to the Human Resources Manager. For subcontractor employees, the original file will be sent to the subcontractor employer with a copy maintained in the SESI project file.

11.4 ACCIDENT/INCIDENT REPORT

Any accident/incident reports must be completed following procedures given in Section 10.5 of this HASP. The originals will be sent to the HSM for maintenance. A copy of the forms will be kept in the project file. (See Attachment 4)

11.5 OSHA FORM 200

An OSHA Form 200 (Log of Occupational Injuries and Illnesses) will be kept at the project Site. All recordable injuries or illnesses will be recorded on this form. At the end of the project, the original will be sent to the Human Resources Manager for maintenance. Subcontractor employees must also meet the requirements of maintaining an OSHA 200 Form. The accident/incident report meets the requirements of OSHA Form 101 (Supplemental Record), which must be maintained with the OSHA Form 200 for all recordable injuries or illnesses.

11.6 ON-SITE HEALTH AND SAFETY FIELD LOGBOOKS

The HSM or designee will maintain an on-Site health and safety log book in which daily Site conditions, activities, personnel, and significant events will be recorded. Calibration records and personnel monitoring results, if available, will also be recorded in the field logbook. The original logbook will be kept in the project file.

Whenever any personnel monitoring is conducted onsite, the monitoring results will be noted in the filed logbook. These will become part of the exposure records file and will be maintained by the HSM.

A signatory page is included (See Attachment 5) and is to be signed by those working on and/or visiting the Site.

11.7 MATERIAL SAFETY DATA SHEETS

Material Safety Data Sheets (MSDS) will be obtained and kept on file at the project site for each hazardous chemical brought to, use, or stored at the Site (See Attachment 6).

12.0 COVID-19 RESPONSE ACTION PLAN

SESI is concerned with the safety and well-being of its employees, vendors, subcontractors, and others with access to its offices and job sites, with particular emphasis on the unique challenges posed by COVID-19.

SESI has established the following protocols in keeping with the recommendations of the CDC and other sources including State Governor Executive Orders for work taking place on construction sites.

We request that all SESI employees, vendors, and subcontractors help with our prevention efforts while at work.

In order to minimize the spread of COVID-19, we must all cooperate in doing the following:

- Wash your hands regularly with soap and water, or clean them with alcohol-based hand rub.
- Cover your mouth and nose with a mask when in public settings or around others.
- Maintain at least six (6) feet distance between you and people coughing or sneezing.
- Avoid touching your face.
- Cover your mouth and nose when coughing or sneezing.
- Stay home if you feel unwell.
- Refrain from smoking and other activities that weaken the lungs.
- Practice physical distancing by avoiding unnecessary travel and staying away from large groups of people.

The following are the specific jobsite protocols and response actions to be taken in the event someone on Site has been in contact with, or has themselves, the COVID-19 virus:

OFFICE/JOBSITE PROTOCOL
What To Do if Not Subject to Quarantine:

- Wear a well-fitting mask around others for 10 days from the date of last close contact with someone with COVID-19 (the date of last close contact is considered day 0)
- Get tested at least 5 days after the date of last close contact with someone with COVID-19. If test is positive or COVID-19 symptoms develop, isolate from other people and follow recommendations in the Isolation section of this guidance document.
- Anyone who had COVID-19 within the last 90 days and has since recovered and remained symptom free, does not need to get tested after close contact with someone with COVID-19.

- If an exposed person who does not have to quarantine cannot separate from one or more individuals with COVID-19 who are in isolation (e.g., because the exposed person lives in the same household with a sick individual who needs care), then the exposed person will have ongoing exposure until the infected person is no longer contagious. See detailed testing and mask recommendations in the “Ongoing COVID-19 Exposure FAQs” section of CDC's quarantine and isolation page.
- If an exposed person who does not have to quarantine travels during the 10 days after last close contact, the person should wear a well-fitting mask when around others for the entire duration of travel during the 10 days. Anyone unable to wear a mask should not travel during the ten (10) days. Travelers should get tested at least five (5) days after the date of the last close contact, receive a negative test result before travel or further travel, and be symptom free

RESPONSE ACTION TRIGGER EVENTS:

- an employee/worker at work has tested positive for COVID-19
- an employee/worker at work has suspected, but unconfirmed, case of COVID-19
- an employee/worker self-reported that they came in contact with someone who had a presumptive positive case of COVID-19
- an employee/worker has been exposed to the virus but only found out after they have interacted with others

RESPONSE ACTIONS:

- Upon occurrence of any of the Trigger Events above, employees/subcontractors shall notify SESI Management about the suspected employee/worker infected with, or exposed to, COVID-19.
- SESI Management will investigate the incident to confirm the report is valid.
- Employees/Subcontractors shall investigate their respective infected employee(s) and report the following to SESI Management and HR:
    - Identify all individuals who worked in proximity (six feet) of the infected employee/worker,
    - Employee(s)/Worker(s) infected with the COVID-19 virus, and employee(s)/worker(s) that came in contact with the infected employee/worker shall be sent home for a period of 14 days,
    - Do not identify the infected employee/worker by name to avoid violation of privacy/confidentiality laws, and,
    - Keep SESI Management informed of progress and updates.

- If an infected person was in the office, SESI will clean and disinfect common areas and surfaces, in accordance with CDC recommendations.
- SESI Management will notify affected employees/workers of the Trigger Event and instruct them to take the response actions above.

- **SESI Management policy requires written documentation from a health care professional, that confirmed infected employees can return to work.**

Except for circumstances in which SESI is legally required to report workplace occurrences of communicable disease, the confidentiality of all medical conditions will be maintained in accordance with applicable law and to the extent practical under the circumstances. When required, the number of persons who will be informed of an employee's/worker's condition will be kept at the minimum needed to appropriately notify other potentially affected employees/workers of Trigger Events and to attempt to minimize the potential for transmission of the virus.

Attachment 1:
Air Monitor Log

Air Monitoring: Sample Collection and Analysis

Date & Time of Monitoring	Task / Operation Being	Substance(s)/ Hazard(s) Being	Monitoring Location	Type/Method of Monitoring	Monitoring Results	Exposure Limits	Required Action

Attachment 2:

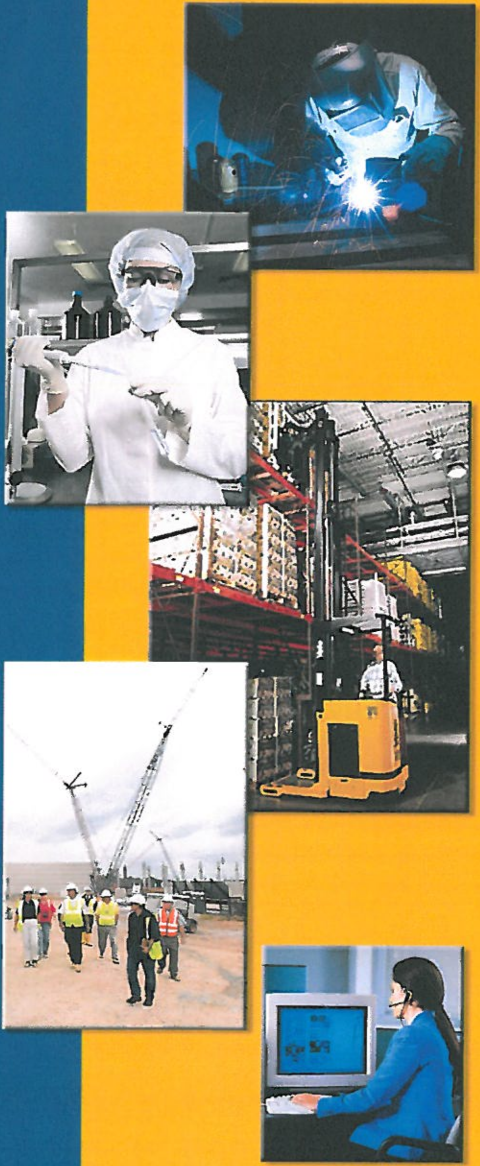
OSHA Poster

Job Safety and Health

It's the law!

OSHA®

Occupational Safety and Health Administration
U.S. Department of Labor



EMPLOYEES:

- 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 that inspection.
- You can file a complaint with OSHA within 30 days of retaliation or discrimination by your employer for making safety and health complaints or for exercising your rights under the *OSH Act*.
- You have the right to see OSHA citations issued to your employer. Your employer must post the citations at or near the place of the alleged violations.
- 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 and records of your exposures to toxic and harmful substances or conditions.
- Your employer must post this notice in your workplace.
- You must comply with all occupational safety and health standards issued under the *OSH Act* that apply to your own actions and conduct on the job.

EMPLOYERS:

- You must furnish your employees a place of employment free from recognized hazards.
- You must comply with the occupational safety and health standards issued under the *OSH Act*.

Free assistance in identifying and correcting hazards or complying with standards is available to employers, without citation or penalty, through OSHA-supported consultation programs in each state.

This free poster available from OSHA –
The Best Resource for Safety and Health

1-800-321-OSHA (6742)
www.osha.gov

OSHA 3165-02 2012R

Attachment 3:
Field Change Request Form

HEALTH & SAFETY PLAN
CHANGE NOTICE

Pages _____ of _____

Project: H&S-CN

1) HASP VERSION: _____ SECTION: _____ PAGE (s): _____

RE:
--- Change to existing HASP Anticipated Revision Date: __________
--- Addition to existing HASP
--- Other: ____
____CONT._______

2) PROPOSED CHANGE: ____
____
____
____

3) REASON FOR PROPOSED CHANGE(s):
--- Required by SPEC or Change Order --- Other: _________________________
--- Disposition of Deficiency _______________CONT.______
--- Change in Regulatory or Other Requirements
--- Operational Experience

4) EXHIBITS ATTACHED ____ NO ____ YES (If YES, describe) _______________________________
________________________CONT._____

5) PMK APPROVALS
PROJECT MANAGER: _______________________________ Date: ________
SITE MANAGER: _________________________________ Date: ________
H&S MANAGER: __________________________________ Date: ________

Client Approval Required: ____ NO ____ YES (If YES, date submitted) _________________________

6) CLIENT APPROVAL _____ APPROVED _____ REMANDED _____ REJECTED

Comments: ____
____
____ CONT._________

Client Representative: ____Date: ________

7) DISTRIBUTION AFTER APPROVAL

X HASP UPDATE LIST --- OTHER: _______________
X CLIENT _______________
X PROJECT FILES _______________

8) PREPARED BY: ____Date: _______
Title: ____

Attachment 4:
Injury Report Form

OSHA's Form 301
Injury and Illness Incident Report

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

This *Injury and Illness Incident Report* is one of the first forms you must fill out when a recordable work-related injury or illness has occurred. Together with the *Log of Work-Related Injuries and Illnesses* and the accompanying *Summary,* these forms help the employer and OSHA develop a picture of the extent and severity of work-related incidents.

Within 7 calendar days after you receive information that a recordable work-related injury or illness has occurred, you must fill out this form or an equivalent. Some state workers' compensation, insurance, or other reports may be acceptable substitutes. To be considered an equivalent form, any substitute must contain all the information asked for on this form.

According to Public Law 91-596 and 29 CFR 1904, OSHA's recordkeeping rule, you must keep this form on file for 5 years following the year to which it pertains.

If you need additional copies of this form, you may photocopy and use as many as you need.

Completed by ______________________

Title ______________________

Phone (______)________-__________ Date ____/ ____/____

Information about the employee

1) Full name ______________________

2) Street ______________________

City ______________ State ________ ZIP ________

3) Date of birth _____/_____/_____

4) Date hired _____/_____/_____

5) ☐ Male
☐ Female

Information about the physician or other health care professional

6) Name of physician or other health care professional ______________________

7) If treatment was given away from the worksite, where was it given?

Facility ______________________

Street ______________________

City ______________ State ________ ZIP ________

8) Was employee treated in an emergency room?
☐ Yes
☐ No

9) Was employee hospitalized overnight as an in-patient?
☐ Yes
☐ No

Information about the case

10) Case number from the *Log* ______________ *(Transfer the case number from the Log after you record the case.)*

11) Date of injury or illness _____/_____/_____

12) Time employee began work ______________ AM / PM

13) Time of event ______________ AM / PM ☐ Check if time cannot be determined

14) ***What was the employee doing just before the incident occurred?*** Describe the activity, as well as the tools, equipment, or material the employee was using. Be specific. *Examples:* "climbing a ladder while carrying roofing materials"; "spraying chlorine from hand sprayer"; "daily computer key-entry."

15) ***What happened?*** Tell us how the injury occurred. *Examples:* "When ladder slipped on wet floor, worker fell 20 feet"; "Worker was sprayed with chlorine when gasket broke during replacement"; "Worker developed soreness in wrist over time."

16) ***What was the injury or illness?*** Tell us the part of the body that was affected and how it was affected; be more specific than "hurt," "pain," or sore." *Examples:* "strained back"; "chemical burn, hand"; "carpal tunnel syndrome."

17) ***What object or substance directly harmed the employee?*** *Examples:* "concrete floor"; "chlorine"; "radial arm saw." *If this question does not apply to the incident, leave it blank.*

18) ***If the employee died, when did death occur?*** Date of death _____/_____/_____

Public reporting burden for this collection of information is estimated to average 22 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Persons are not required to respond to the collection of information unless it displays a current valid OMB control number. If you have any comments about this estimate or any other aspects of this data collection, including suggestions for reducing this burden, contact: US Department of Labor, OSHA Office of Statistical Analysis, Room N-3644, 200 Constitution Avenue, NW, Washington, DC 20210. Do not send the completed forms to this office.

OSHA's Form 300 (Rev. 01/2004)

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 20__ __

U.S. Department of Labor

Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

You must record information about every work-related death and about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR Part 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an Injury and Illness Incident Report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name ____________________

City ____________________ State ____________

Identify the person			**Describe the case**			**Classify the case** CHECK ONLY ONE box for each case based on the most serious outcome for that case:				**Enter the number of days the injured or ill worker was:**		**Check the "Injury" column or choose one type of illness:**					
								Remained at Work				(M)					
(A) Case no.	(B) Employee's name	(C) Job title (*e.g., Welder*)	(D) Date of injury or onset of illness	(E) Where the event occurred (*e.g., Loading dock north end*)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (*e.g., Second degree burns on right forearm from acetylene torch*)	Death (G)	Days away from work (H)	Job transfer or restriction (I)	Other record-able cases (J)	Away from work (K)	On job transfer or restriction (L)	Injury (1)	Skin disorder (2)	Respiratory condition (3)	Poisoning (4)	Hearing loss (5)	All other illnesses (6)
___	___	___	___/___ month/day	___	___	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
___	___	___	___/___ month/day	___	___	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
___	___	___	___/___ month/day	___	___	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
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					Page totals	___	___	___	___	___	___	___	___	___	___	___	___
												Injury (1)	Skin disorder (2)	Respiratory condition (3)	Poisoning (4)	Hearing loss (5)	All other illnesses (6)

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

Public reporting burden for this collection of information is estimated to average 14 minutes per response, including time to review the instructions, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any other aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistical Analysis, Room N-3644, 200 Constitution Avenue, NW, Washington, DC 20210. Do not send the completed forms to this office.

Page ___ **of** ___

OSHA's Form 300A (Rev. 01/2004)

Summary of Work-Related Injuries and Illnesses

Year 20__ __

U.S. Department of Labor

Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

All establishments covered by Part 1904 must complete this Summary page, even if no work-related injuries or illnesses occurred during the year. Remember to review the Log to verify that the entries are complete and accurate before completing this summary.

Using the Log, count the individual entries you made for each category. Then write the totals below, making sure you've added the entries from every page of the Log. If you had no cases, write "0."

Employees, former employees, and their representatives have the right to review the OSHA Form 300 in its entirety. They also have limited access to the OSHA Form 301 or its equivalent. See 29 CFR Part 1904.35, in OSHA's recordkeeping rule, for further details on the access provisions for these forms.

Number of Cases

Total number of deaths	Total number of cases with days away from work	Total number of cases with job transfer or restriction	Total number of other recordable cases
______	______	______	______
(G)	(H)	(I)	(J)

Number of Days

Total number of days away from work	Total number of days of job transfer or restriction
______	______
(K)	(L)

Injury and Illness Types

Total number of . . .
(M)

(1) Injuries	______	(4) Poisonings	______
		(5) Hearing loss	______
(2) Skin disorders	______	(6) All other illnesses	______
(3) Respiratory conditions	______		

Post this Summary page from February 1 to April 30 of the year following the year covered by the form.

Public reporting burden for this collection of information is estimated to average 58 minutes per response, including time to review the instructions, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any other aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistical Analysis, Room N-3644, 200 Constitution Avenue, NW, Washington, DC 20210. Do not send the completed forms to this office.

Establishment information

Your establishment name ______________________

Street ______________________

City ______________ State ____ ZIP ______

Industry description (*e.g., Manufacture of motor truck trailers*)

____

Standard Industrial Classification (SIC), if known (*e.g., 3715*)

__ __ __ __

OR

North American Industrial Classification (NAICS), if known (e.g., 336212)

__ __ __ __ __ __

Employment information *(If you don't have these figures, see the Worksheet on the back of this page to estimate.)*

Annual average number of employees ________

Total hours worked by all employees last year ________

Sign here

Knowingly falsifying this document may result in a fine.

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

____
Company executive Title

(   ) - / /
Phone Date

Attachment 5:
Signatory Page

Attachment 5 – Site-Specific Health and Safety Orientation Signatory Page
HEALTH AND SAFETY PLAN

Title	Name	Signature
Project Manager:	TBD	
Health and Safety Manager:	TBD	

I have read the attached Health and Safety Plan (HASP)and have received site-specific information and orientation regarding the identified physical, chemical, and biological hazards anticipated at this site. My signature certifies that I understand the procedures, equipment, and restrictions applicable to this project site and agree to abide by them.

Signature	Printed Name	Company	Date

Attachment 5– Health and Safety Orientation Signatory Page (continued)

Signature	Printed Name	Company	Date

Attachment 6:
Material Data Safety Sheet

phenova™ Certified Reference Materials | A Phenomenex® Company

4,4'-DDD Standard

Safety Data Sheet

Date of issue: 30/11/2015 Revision date: : Version: 1.0

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

1.1. Product identifier

Product form : Mixture

Product name : 4,4'-DDD Standard

Product code : AL0-101412

Product group : Trade product

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

1.2.1. Relevant identified uses

Main use category : Laboratory Use

Industrial/Professional use spec : Industrial
For professional use only

1.2.2. Uses advised against

No additional information available

1.3. Details of the supplier of the safety data sheet

Phenova
6390 Joyce Dr. Suite 100
80403 Golden, CO - United States
T 1-866-942-2978 - F 1-866-283-0269
info@phenova.com - www.phenova.com

1.4. Emergency telephone number

Emergency number : ChemTel Assistance (US/Canada) 1-800-255-3924
ChemTel Assistance (International) +1 813-248-0585

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Flam. Liq. 2	H225
Acute Tox. 3 (Oral)	H301
Acute Tox. 3 (Dermal)	H311
STOT SE 1	H370
Aquatic Chronic 2	H411

Classification according to Directive 67/548/EEC [DSD] or 1999/45/EC [DPD]

F; R11
T; R23/24/25
T; R39/23/24/25
N; R51/53
Full text of R-phrases: see section 16

Adverse physicochemical, human health and environmental effects

No additional information available

2.2. Label elements

Labeling according to Regulation (EC) No. 1272/2008 [CLP]

Hazard pictograms (CLP) :


GHS02


GHS06


GHS08


GHS09

Signal word (CLP) : Danger

Hazardous ingredients : methanol

Hazard statements (CLP) : H225 - Highly flammable liquid and vapor
H301+H311 - Toxic if swallowed or in contact with skin

H370 - Causes damage to organs
H411 - Toxic to aquatic life with long lasting effects

Precautionary statements (CLP) : P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking
P233 - Keep container tightly closed
P260 - Do not breathe dust/fume/gas/mist/vapors/spray
P270 - Do not eat, drink or smoke when using this product
P273 - Avoid release to the environment
P280 - Wear protective gloves/protective clothing/eye protection/face protection
P308+P313 - IF exposed or concerned: Get medical advice/attention
P361+P364 - Take off immediately all contaminated clothing and wash it before reuse
P391 - Collect spillage
P403+P235 - Store in a well-ventilated place. Keep cool

No labeling applicable

2.3. Other hazards

No additional information available

SECTION 3: Composition/information on ingredients

3.1. Substance

Not applicable

3.2. Mixture

Name	Product identifier	%	Classification according to Regulation (EC) No. 1272/2008 [CLP]
methanol (Component)	(CAS No) 67-56-1 (EC no) 200-659-6 (EC index no) 603-001-00-X	99.9	Flam. Liq. 2, H225 Acute Tox. 3 (Oral), H301 Acute Tox. 3 (Dermal), H311 Acute Tox. 3 (Inhalation), H331 STOT SE 1, H370
4,4'-DDD (Component)	(CAS No) 72-54-8 (EC no) 200-783-0	0.1	Acute Tox. 4 (Dermal), H312 Aquatic Acute 1, H400 (M=100) Aquatic Chronic 1, H410

Name	Product identifier	Specific concentration limits
methanol (Component)	(CAS No) 67-56-1 (EC no) 200-659-6 (EC index no) 603-001-00-X	(3 =<C < 10) STOT SE 2, H371 (C >= 10) STOT SE 1, H370

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general	: Never give anything by mouth to an unconscious person. Call a POISON CENTER or doctor/physician. IF exposed or concerned: Get medical advice/attention.
First-aid measures after inhalation	: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
First-aid measures after skin contact	: Rinse skin with water/shower. Remove/Take off immediately all contaminated clothing. Immediately call a poison center or doctor/physician. Wash with plenty of soap and water. Wash contaminated clothing before reuse.
First-aid measures after eye contact	: Remove contact lenses, if present and easy to do. Continue rinsing. Rinse cautiously with water for several minutes. Obtain medical attention if pain, blinking or redness persist.
First-aid measures after ingestion	: Rinse mouth. Do NOT induce vomiting. Obtain emergency medical attention. Immediately call a poison center or doctor/physician.

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

Symptoms/injuries after skin contact	: Repeated exposure to this material can result in absorption through skin causing significant health hazard. Toxic in contact with skin.
Symptoms/injuries after ingestion	: Toxic if swallowed. Swallowing a small quantity of this material will result in serious health hazard.

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

No additional information available

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media	: Use extinguishing media appropriate for surrounding fire.
Unsuitable extinguishing media	: Do not use a heavy water stream.

5.2. Special hazards arising from the substance or mixture

Fire hazard	: Highly flammable liquid and vapor.
Explosion hazard	: May form flammable/explosive vapor-air mixture.

5.3. Advice for firefighters

Firefighting instructions : Use water spray or fog for cooling exposed containers. Exercise caution when fighting any chemical fire. Prevent fire-fighting water from entering environment.

Protection during firefighting : Do not enter fire area without proper protective equipment, including respiratory protection.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

Emergency procedures : Evacuate unnecessary personnel.

6.1.2. For emergency responders

Protective equipment : Equip cleanup crew with proper protection. Avoid breathing dust/fume/gas/mist/vapors/spray.

Emergency procedures : Ventilate area.

6.2. Environmental precautions

Prevent entry to sewers and public waters. Notify authorities if liquid enters sewers or public waters. Avoid release to the environment.

6.3. Methods and material for containment and cleaning up

Methods for cleaning up : Take up in absorbent material. Collect spillage.

6.4. Reference to other sections

See Heading 8. Exposure controls and personal protection.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Additional hazards when processed : Handle empty containers with care because residual vapors are flammable.

Precautions for safe handling : Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapor. No open flames. No smoking. Use only non-sparking tools.

Hygiene measures : Do not eat, drink or smoke when using this product. Gently wash with plenty of soap and water. Remove/Take off immediately all contaminated clothing. Wash contaminated clothing before reuse.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures : Proper grounding procedures to avoid static electricity should be followed. Ground/bond container and receiving equipment.

Storage conditions : Keep in fireproof place. Keep container tightly closed. Keep container tightly closed and in a well-ventilated place. Keep away from any flames or sparking source.

Incompatible materials : Direct sunlight. Heat sources.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

No additional information available

8.2. Exposure controls

Appropriate engineering controls : Either local exhaust or general room ventilation is usually required.

Personal protective equipment : Avoid all unnecessary exposure. Gloves. Protective clothing. Protective goggles. Safety glasses.

Hand protection : Wear chemically resistant protective gloves. Wear suitable gloves resistant to chemical penetration.

Eye protection : Chemical goggles or safety glasses. Safety glasses.

Skin and body protection : Wear chemically protective gloves, lab coat or apron to prevent prolonged or repeated skin contact.

Respiratory protection : Where exposure through inhalation may occur from use, respiratory protection equipment is recommended.

Other information : Do not eat, drink or smoke during use.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	: Liquid
Color	: Colorless.
Odor	: characteristic.
pH	: No data available
Melting point	: No data available
Freezing point	: No data available
Boiling point	: No data available
Flash point	: No data available
Auto-ignition temperature	: No data available
Decomposition temperature	: No data available
Flammability (solid, gas)	: Highly flammable liquid and vapor
Relative density	: No data available
Solubility	: No data available
Explosive properties	: No data available
Oxidizing properties	: No data available
Explosion limits	: No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

No additional information available

10.2. Chemical stability

Highly flammable liquid and vapor. May form flammable/explosive vapor-air mixture.

10.3. Possibility of hazardous reactions

Not established.

10.4. Conditions to avoid

Direct sunlight. Extremely high or low temperatures. Open flame.

10.5. Incompatible materials

No additional information available

10.6. Hazardous decomposition products

May release flammable gases.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Oral: Toxic if swallowed. Dermal: Toxic in contact with skin.

4,4'-DDD Standard	
ATE CLP (oral)	100.100 mg/kg body weight
ATE CLP (dermal)	300.300 mg/kg body weight

4,4'-DDD (72-54-8)	
LD50 dermal rabbit	1200 mg/kg
ATE CLP (dermal)	1200.000 mg/kg body weight

methanol (67-56-1)	
LD50 oral rat	> 5000 mg/kg (Rat; BASF test; Literature study; 1187-2769 mg/kg bodyweight; Rat; Weight of evidence)
LD50 dermal rabbit	15800 mg/kg (Rabbit; Literature study)
LC50 inhalation rat (mg/l)	85 mg/l/4h (Rat; Literature study)
LC50 inhalation rat (ppm)	64000 ppm/4h (Rat; Literature study)
ATE CLP (oral)	100.000 mg/kg body weight
ATE CLP (dermal)	300.000 mg/kg body weight
ATE CLP (gases)	700.000 ppmV/4h
ATE CLP (vapors)	3.000 mg/l/4h
ATE CLP (dust, mist)	0.500 mg/l/4h

Skin corrosion/irritation : Not classified

Based on available data, the classification criteria are not met

Serious eye damage/irritation	: Not classified Based on available data, the classification criteria are not met
Respiratory or skin sensitization	: Not classified Based on available data, the classification criteria are not met
Germ cell mutagenicity	: Not classified Based on available data, the classification criteria are not met
Carcinogenicity	: Not classified Based on available data, the classification criteria are not met May cause cancer
Reproductive toxicity	: Not classified Based on available data, the classification criteria are not met
Specific target organ toxicity (single exposure)	: Causes damage to organs.
Specific target organ toxicity (repeated exposure)	: Not classified Based on available data, the classification criteria are not met
Aspiration hazard	: Not classified Based on available data, the classification criteria are not met
Potential Adverse human health effects and symptoms	: Toxic if swallowed. Toxic in contact with skin.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - water	: Toxic to aquatic life with long lasting effects.

4,4'-DDD (72-54-8)	
LC50 fish 1	0.04 - 0.05 mg/l Lepomis macrochirus (Bluegill) 96.0 h
LC50 other aquatic organisms 1	0.06 - 0.09 mg/l Oncorhynchus mykiss (rainbow trout) 96.0 h
EC50 Daphnia 1	0.01 mg/l Daphnia pulex (Water flea) 48 H
LC50 fish 2	3.47 - 5.58 mg/l Pimephales promelas (fathead minnow) 96.0 h

methanol (67-56-1)	
LC50 fish 1	15400 mg/l (LC50; EPA 660/3 - 75/009; 96 h; Lepomis macrochirus; Flow-through system; Fresh water; Experimental value)
EC50 Daphnia 1	> 10000 mg/l (EC50; DIN 38412-11; 48 h; Daphnia magna; Static system; Fresh water; Experimental value)
LC50 fish 2	10800 mg/l (LC50; 96 h; Salmo gairdneri)

12.2. Persistence and degradability

4,4'-DDD Standard	
Persistence and degradability	May cause long-term adverse effects in the environment.

methanol (67-56-1)	
Persistence and degradability	Readily biodegradable in water. Biodegradable in the soil. Highly mobile in soil.
Biochemical oxygen demand (BOD)	0.6 - 1.12 g O□ /g substance
Chemical oxygen demand (COD)	1.42 g O□ /g substance
ThOD	1.5 g O□ /g substance
BOD (% of ThOD)	0.8 (Literature study)

12.3. Bioaccumulative potential

4,4'-DDD Standard	
Bioaccumulative potential	Not established.

4,4'-DDD (72-54-8)	
Log Pow	6.02

methanol (67-56-1)	
BCF fish 1	< 10 (BCF; 72 h; Leuciscus idus)
Log Pow	-0.77 (Experimental value; Other)
Bioaccumulative potential	Low potential for bioaccumulation (BCF < 500).

12.4. Mobility in soil

methanol (67-56-1)	
Surface tension	0.023 N/m (20 °C)
Log Koc	Koc,PCKOCWIN v1.66; 1; Calculated value

12.5. Results of PBT and vPvB assessment

No additional information available

12.6. Other adverse effects

Additional information	: Avoid release to the environment

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations	: Dispose in a safe manner in accordance with local/national regulations.
Additional information	: Handle empty containers with care because residual vapors are flammable.
Ecology - waste materials	: Avoid release to the environment. Hazardous waste due to toxicity.

SECTION 14: Transport information

In accordance with ADR / RID / IMDG / IATA / ADN

14.1. UN number

UN-No. (ADR)	: 1992
UN-No.(IATA)	: 1992

14.2. UN proper shipping name

Proper Shipping Name (ADR)	: FLAMMABLE LIQUID, TOXIC, N.O.S.
Proper Shipping Name (IATA)	: FLAMMABLE LIQUID, TOXIC, N.O.S.
Transport document description (ADR)	: UN 1992 FLAMMABLE LIQUID, TOXIC, N.O.S., 3 (6.1), II, (D/E), ENVIRONMENTALLY HAZARDOUS

14.3. Packing group

Class (ADR)	: 3
Classification code (ADR)	: FT1
Class (IATA)	: 3
Subsidiary risks (ADR)	: 6.1
Hazard labels (ADR)	: 3, 6.1

Hazard labels (IATA)	: 3, 6.1

14.4. Packing group

Packing group (ADR)	: II
Packing group (IATA)	: II

14.5. Environmental hazards

Dangerous for the environment	:

Other information	: No supplementary information available.

14.6. Special precautions for user

14.6.1. Overland transport

Hazard identification number (Kemler No.)	: 336
Classification code (ADR)	: FT1
Orange plates	:

Special provision (ADR)	: 274
Transport category (ADR)	: 2
Tunnel restriction code (ADR)	: D/E
Limited quantities (ADR)	: 1l
Excepted quantities (ADR)	: E2

14.6.2. Transport by sea

No additional information available

14.6.3. Air transport

CAO packing instructions (IATA) : 364
CAO max net quantity (IATA) : 60L
PCA packing instructions (IATA) : 352
PCA Limited quantities (IATA) : Y341
PCA limited quantity max net quantity (IATA) : 1L
PCA max net quantity (IATA) : 1L
PCA Excepted quantities (IATA) : E2
ERG code (IATA) : 3HP

14.6.4. Inland waterway transport

Carriage prohibited (ADN) : No

14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable

SECTION 15: Regulatory information

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

15.1.1. EU-Regulations

Contains no substances with Annex XVII restrictions
Contains no REACH candidate substance
Contains no REACH Annex XIV substances.

15.1.2. National regulations

No additional information available

15.2. Chemical safety assessment

No chemical safety assessment has been carried out

SECTION 16: Other information

Data sources : REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2008 on classification, labeling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.

Other information : None.

PHV SDS EU

SAFETY DATA SHEET

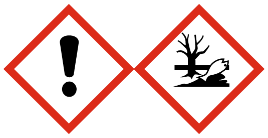
1. Identification

Product identifier	**4,4'-DDE**	
Other means of identification		
Item	N-10875	
CAS number	72-55-9	
Synonyms	1,1'-(Dichloroethenylidene)bis(4-chlorobenzene) * 2,2-Bis(4-chlorophenyl) 1,1-dichloroethene	
Recommended use	For Laboratory Use Only	
Recommended restrictions	None known.	
Manufacturer/Importer/Supplier/Distributor information		
Manufacturer		
Company name	Chem Service, Inc.	
Address	660 Tower Lane West Chester, PA 19380 United States	
Telephone	Toll Free	800-452-9994
	Direct	610-692-3026
Website	www.chemservice.com	
E-mail	info@chemservice.com	
Emergency phone number	Chemtrec US	800-424-9300
	Chemtrec outside US	+1 703-527-3887

2. Hazard(s) identification

Physical hazards	Not classified.	
Health hazards	Acute toxicity, oral	Category 4
Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 1
	Hazardous to the aquatic environment, long-term hazard	Category 1
OSHA defined hazards	Not classified.	

Label elements



Signal word	Warning
Hazard statement	Harmful if swallowed. Very toxic to aquatic life. Very toxic to aquatic life with long lasting effects.
Precautionary statement	
Prevention	Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Avoid release to the environment.
Response	If swallowed: Call a poison center/doctor if you feel unwell. Rinse mouth. Collect spillage.
Storage	Store away from incompatible materials.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC)	None known.
Supplemental information	100% of the mixture consists of component(s) of unknown acute dermal toxicity.

3. Composition/information on ingredients

Substances

Chemical name	Common name and synonyms	CAS number	%
4,4'-DDE	1,1'-(Dichloroethenylidene)bis(4-chlorobenzene) 2,2-Bis(4-chlorophenyl) 1,1-dichloroethene	72-55-9	100

4. First-aid measures

Inhalation	Move to fresh air. Call a physician if symptoms develop or persist.
Skin contact	Wash off with soap and water. Get medical attention if irritation develops and persists.
Eye contact	Rinse with water. Get medical attention if irritation develops and persists.
Ingestion	Rinse mouth. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Get medical advice/attention if you feel unwell.
Most important symptoms/effects, acute and delayed	Direct contact with eyes may cause temporary irritation.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Keep victim warm. Keep victim under observation. Symptoms may be delayed.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO2).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	Use water spray to cool unopened containers.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	The product is immiscible with water and will spread on the water surface. This material is classified as a water pollutant under the Clean Water Act and should be prevented from contaminating soil or from entering sewage and drainage systems which lead to waterways. Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid release to the environment. Inform appropriate managerial or supervisory personnel of all environmental releases. Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Do not taste or swallow. When using, do not eat, drink or smoke. Provide adequate ventilation. Wear appropriate personal protective equipment. Wash hands thoroughly after handling. Avoid release to the environment. Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Store in original tightly closed container. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits	This substance has no PEL, TLV, or other recommended exposure limit.
Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.
Individual protection measures, such as personal protective equipment	
Eye/face protection	Face shield is recommended. Wear safety glasses with side shields (or goggles).
Skin protection	
Hand protection	Wear appropriate chemical resistant gloves.
Other	Wear suitable protective clothing.
Respiratory protection	In case of insufficient ventilation, wear suitable respiratory equipment.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	Keep away from food and drink. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	
Physical state	Solid.
Form	Crystalline.
Color	White
Odor	Not available.
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	192.2 °F (89 °C)
Initial boiling point and boiling range	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	0.0000008 kPa (77 °F (25 °C))
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Insoluble
Partition coefficient (n-octanol/water)	6.51
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Explosive properties	Not explosive.
Molecular formula	C14-H8-Cl4

Molecular weight	318.03 g/mol
Oxidizing properties	Not oxidizing.

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	No adverse effects due to inhalation are expected.
Skin contact	No adverse effects due to skin contact are expected.
Eye contact	Direct contact with eyes may cause temporary irritation.
Ingestion	Harmful if swallowed.
Symptoms related to the physical, chemical and toxicological characteristics	Direct contact with eyes may cause temporary irritation.

Information on toxicological effects

Acute toxicity	Harmful if swallowed.
Skin corrosion/irritation	Prolonged skin contact may cause temporary irritation.
Serious eye damage/eye irritation	Direct contact with eyes may cause temporary irritation.

Respiratory or skin sensitization

Respiratory sensitization	Not a respiratory sensitizer.
Skin sensitization	This product is not expected to cause skin sensitization.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	Not classifiable as to carcinogenicity to humans.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

US. National Toxicology Program (NTP) Report on Carcinogens

Not listed.

Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure	Not classified.
Specific target organ toxicity - repeated exposure	Not classified.
Aspiration hazard	Not an aspiration hazard.

12. Ecological information

Ecotoxicity Very toxic to aquatic life with long lasting effects.

Product		**Species**	**Test Results**
4,4'-DDE (CAS 72-55-9)			
Aquatic			
Crustacea	EC50	Brown shrimp (Penaeus aztecus)	0.028 mg/l, 48 hours

Product		Species	Test Results
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	0.026 - 0.04 mg/l, 96 hours

* Estimates for product may be based on additional component data not shown.

Persistence and degradability

Bioaccumulative potential

Partition coefficient n-octanol / water (log Kow)

6.51

Mobility in soil	No data available.
Other adverse effects	No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose of contents/container in accordance with local/regional/national/international regulations.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

UN number	UN3077
UN proper shipping name	Environmentally hazardous substances, solid, n.o.s. (4,4'-DDE RQ = 1 LBS)
Transport hazard class(es)	
Class	9
Subsidiary risk	-
Label(s)	9
Packing group	III
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	8, 146, 335, A112, B54, IB8, IP3, N20, T1, TP33
Packaging exceptions	155
Packaging non bulk	213
Packaging bulk	240

IATA

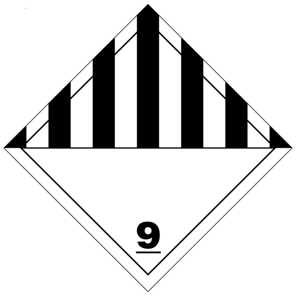
UN number	UN3077
UN proper shipping name	Environmentally hazardous substance, solid, n.o.s. (4,4'-DDE)
Transport hazard class(es)	
Class	9
Subsidiary risk	-
Packing group	III
Environmental hazards	No.
ERG Code	9L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Other information	
Passenger and cargo aircraft	Allowed with restrictions.
Cargo aircraft only	Allowed with restrictions.

IMDG

UN number	UN3077
UN proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (4,4'-DDE)

Transport hazard class(es)	
Class	9
Subsidiary risk	-
Packing group	III
Environmental hazards	
Marine pollutant	No.
EmS	F-A, S-F
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not applicable.

DOT; IATA; IMDG



General information	IMDG Regulated Marine Pollutant. DOT Regulated Marine Pollutant.

15. Regulatory information

US federal regulations	This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

4,4'-DDE (CAS 72-55-9)	Listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - Yes Delayed Hazard - No Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical	Yes

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

4,4'-DDE (CAS 72-55-9)

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Clean Water Act (CWA) Section 112(r) (40 CFR 68.130)	Priority pollutant Bioaccumulative chemical of concern Toxic pollutant
Safe Drinking Water Act (SDWA)	Monitoring

US state regulations WARNING: This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

4,4'-DDE (CAS 72-55-9)	Listed: January 1, 1989

US - California Proposition 65 - CRT: Listed date/Developmental toxin

4,4'-DDE (CAS 72-55-9)	Listed: March 30, 2010

US - California Proposition 65 - CRT: Listed date/Male reproductive toxin

4,4'-DDE (CAS 72-55-9)	Listed: March 30, 2010

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

4,4'-DDE (CAS 72-55-9)

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	No
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	No

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date	09-17-2014
Revision date	12-23-2020
Version #	02
NFPA ratings	Health: 2 Flammability: 0 Instability: 0

Disclaimer	Chem Service, Inc. cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. The above information is believed to be correct on the date it was last revised and must not be considered all inclusive. The information has been obtained only by a search of available literature and is only a guide for handling the chemicals. OSHA regulations require that if other hazards become evident, an upgraded SDS must be made available to the employee within three months. RESPONSIBILITY for updates lies with the employer and not with CHEM SERVICE, Inc. Persons not specifically and properly trained should not handle this chemical or its container. This product is furnished FOR LABORATORY USE ONLY! Our products may NOT BE USED as drugs, cosmetics, agricultural or pesticide products, food additives or as household chemicals. This Safety Data Sheet (SDS) is intended only for use with Chem Service, Inc. products and should not be relied on for use with materials from any other supplier even if the chemical name(s) on the product are identical! Whenever using an SDS for a solution or mixture the user should refer to the SDS for every component of the solution or mixture. Chem Service warrants that this SDS is based upon the most current information available to Chem Service at the time it was last revised. THIS WARRANTY IS EXCLUSIVE, AND CHEM SERVICE, INC. MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. This SDS is provided gratis and CHEM SERVICE, INC. SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR CONTINGENT DAMAGES. Copyright © 2000-2014 Chem Service, Inc. All rights reserved except that this SDS may be printed for the use of a customer or prospective customer of Chem Service, Inc provided the entire SDS is printed. The SDS may not be placed in any database or otherwise stored or distributed in electronic or any other form. This product is furnished FOR LABORATORY USE ONLY.
Revision information	This document has undergone significant changes and should be reviewed in its entirety.

SAFETY DATA SHEET

1. Identification

Product identifier	**4,4'-DDT**	
Other means of identification		
Item	N-10876	
CAS number	50-29-3	
Synonyms	1,1,1-TRICHLORO-2,2-BIS(4-CHLOROPHENYL)ETHANE * 4,4'-Dichlorodiphenyl trichloroethane	
Recommended use	For Laboratory Use Only	
Recommended restrictions	None known.	
Manufacturer/Importer/Supplier/Distributor information		
Manufacturer		
Company name	Chem Service, Inc.	
Address	660 Tower Lane West Chester, PA 19380 United States	
Telephone	Toll Free	800-452-9994
	Direct	610-692-3026
Website	www.chemservice.com	
E-mail	info@chemservice.com	
Emergency phone number	Chemtrec US	800-424-9300
	Chemtrec outside US	+1 703-527-3887

2. Hazard(s) identification

Physical hazards	Not classified.	
Health hazards	Acute toxicity, oral	Category 3
	Acute toxicity, dermal	Category 3
	Carcinogenicity	Category 2
	Specific target organ toxicity, repeated exposure	Category 1
Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 1
	Hazardous to the aquatic environment, long-term hazard	Category 1
OSHA defined hazards	Not classified.	

Label elements

Signal word	Danger
Hazard statement	Toxic if swallowed. Toxic in contact with skin. Suspected of causing cancer. Causes damage to organs through prolonged or repeated exposure. Very toxic to aquatic life. Very toxic to aquatic life with long lasting effects.
Precautionary statement	
Prevention	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not breathe dust/fume/gas/mist/vapors/spray. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Avoid release to the environment. Wear protective gloves/protective clothing/eye protection/face protection.
Response	If swallowed: Immediately call a poison center/doctor. Rinse mouth. If on skin: Wash with plenty of water. If exposed or concerned: Get medical advice/attention. Call a poison center/doctor if you feel unwell. Take off immediately all contaminated clothing and wash it before reuse. Collect spillage.

Storage	Store locked up.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC)	None known.
Supplemental information	None.

3. Composition/information on ingredients

Substances

Chemical name	Common name and synonyms	CAS number	%
4,4'-DDT	1,1,1-TRICHLORO-2,2-BIS(4-CHLOROPHENYL)ETHANE 4,4'-Dichlorodiphenyl trichloroethane	50-29-3	100

4. First-aid measures

Inhalation	Move to fresh air. Call a physician if symptoms develop or persist.
Skin contact	Take off immediately all contaminated clothing. Wash off with soap and water. Get medical advice/attention if you feel unwell. Get medical attention if irritation develops and persists. Wash contaminated clothing before reuse.
Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention if irritation develops and persists.
Ingestion	Call a physician or poison control center immediately. Rinse mouth. Do not induce vomiting without advice from poison control center. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Do not use mouth-to-mouth method if victim ingested the substance. Induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
Most important symptoms/effects, acute and delayed	Convulsions. Headache. Dizziness. Nausea, vomiting. Prolonged exposure may cause chronic effects.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Keep victim warm. Keep victim under observation. Symptoms may be delayed.
General information	Take off immediately all contaminated clothing. IF exposed or concerned: Get medical advice/attention. If you feel unwell, seek medical advice (show the label where possible). Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance.

5. Fire-fighting measures

Suitable extinguishing media	Water spray. Foam. Powder. Carbon dioxide (CO2).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	Use water spray to cool unopened containers.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.

Methods and materials for containment and cleaning up	The product is immiscible with water and will spread on the water surface. Prevent entry into waterways, sewer, basements or confined areas. Large Spills: Stop the flow of material, if this is without risk. Dike the spilled material, where this is possible. Absorb in vermiculite, dry sand or earth and place into containers. Following product recovery, flush area with water. Small Spills: Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use. Put material in suitable, covered, labeled containers. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid release to the environment. Inform appropriate managerial or supervisory personnel of all environmental releases. Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not taste or swallow. Avoid contact with eyes, skin, and clothing. Avoid prolonged exposure. When using, do not eat, drink or smoke. Should be handled in closed systems, if possible. Provide adequate ventilation. Wear appropriate personal protective equipment. Wash hands thoroughly after handling. Avoid release to the environment. Wash contaminated clothing before reuse. Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Store locked up. Store in original tightly closed container. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

The following constituents are the only constituents of the product which have a PEL, TLV or other recommended exposure limit. At this time, the other constituents have no known exposure limits.

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Material	Type	Value
4,4'-DDT (CAS 50-29-3)	PEL	1 mg/m3

US. ACGIH Threshold Limit Values

Material	Type	Value
4,4'-DDT (CAS 50-29-3)	TWA	1 mg/m3

US. NIOSH: Pocket Guide to Chemical Hazards

Material	Type	Value
4,4'-DDT (CAS 50-29-3)	TWA	0.5 mg/m3

Biological limit values No biological exposure limits noted for the ingredient(s).

Exposure guidelines

US - California OELs: Skin designation

4,4'-DDT (CAS 50-29-3)	Can be absorbed through the skin.

US - Tennessee OELs: Skin designation

4,4'-DDT (CAS 50-29-3)	Can be absorbed through the skin.

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

4,4'-DDT (CAS 50-29-3)	Can be absorbed through the skin.

Appropriate engineering controls	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Individual protection measures, such as personal protective equipment

Eye/face protection	Wear safety glasses with side shields (or goggles).
Skin protection	
Hand protection	Wear appropriate chemical resistant gloves.
Other	Wear appropriate chemical resistant clothing. Use of an impervious apron is recommended.
Respiratory protection	In case of insufficient ventilation, wear suitable respiratory equipment.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations	Observe any medical surveillance requirements. Keep away from food and drink. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	
Physical state	Solid.
Form	Crystalline Solid
Color	Colorless
Odor	Not available.
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	227.3 °F (108.5 °C)
Initial boiling point and boiling range	500 °F (260 °C)
	366.8 °F (186 °C) 0.006666 kPa
Flash point	162.0 - 171.0 °F (72.2 - 77.2 °C) Closed Cup
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	< 0.0000001 kPa (68 °F (20 °C))
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Insoluble
Partition coefficient (n-octanol/water)	6.91
Auto-ignition temperature	Not available.
Decomposition temperature	230 °F (110 °C)
Viscosity	Not available.
Other information	
Density	1.56 g/cm3 at 15 °C
Explosive properties	Not explosive.
Molecular formula	C14-H9-Cl5
Molecular weight	354.49 g/mol
Oxidizing properties	Not oxidizing.

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Avoid temperatures exceeding the decomposition temperature. Avoid temperatures exceeding the flash point. Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	Prolonged inhalation may be harmful.
Skin contact	Toxic in contact with skin.
Eye contact	Direct contact with eyes may cause temporary irritation.
Ingestion	Toxic if swallowed.
Symptoms related to the physical, chemical and toxicological characteristics	Convulsions. Headache. Dizziness. Nausea, vomiting.

Information on toxicological effects

Acute toxicity	Toxic in contact with skin. Toxic if swallowed.
Skin corrosion/irritation	Prolonged skin contact may cause temporary irritation.
Serious eye damage/eye irritation	Direct contact with eyes may cause temporary irritation.

Respiratory or skin sensitization

Respiratory sensitization	Not a respiratory sensitizer.
Skin sensitization	This product is not expected to cause skin sensitization.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	Suspected of causing cancer.

IARC Monographs. Overall Evaluation of Carcinogenicity

4,4'-DDT (CAS 50-29-3)	2A Probably carcinogenic to humans.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

US. National Toxicology Program (NTP) Report on Carcinogens

4,4'-DDT (CAS 50-29-3)	Reasonably Anticipated to be a Human Carcinogen.
Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure	Not classified.
Specific target organ toxicity - repeated exposure	Causes damage to organs through prolonged or repeated exposure.
Aspiration hazard	Not an aspiration hazard.
Chronic effects	Causes damage to organs through prolonged or repeated exposure. Prolonged inhalation may be harmful. Prolonged exposure may cause chronic effects.

12. Ecological information

Ecotoxicity	Very toxic to aquatic life with long lasting effects.

Product		**Species**	**Test Results**
4,4'-DDT (CAS 50-29-3)			
Aquatic			
Crustacea	EC50	Water flea (Daphnia magna)	0.0005 - 0.001 mg/l, 48 hours
Fish	LC50	Bluegill (Lepomis macrochirus)	0.0013 - 0.002 mg/l, 96 hours

* Estimates for product may be based on additional component data not shown.

Persistence and degradability

Bioaccumulative potential

Partition coefficient n-octanol / water (log Kow)

6.91

Mobility in soil	No data available.
Other adverse effects	No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose of contents/container in accordance with local/regional/national/international regulations.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

US RCRA Hazardous Waste U List: Reference

4,4'-DDT (CAS 50-29-3)	U061

Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

Not regulated as dangerous goods.

IATA

UN number	UN2811
UN proper shipping name	Toxic solid, organic, n.o.s. (4,4'-DDT)
Transport hazard class(es)	
Class	6.1(PGIII)
Subsidiary risk	-
Packing group	III
Environmental hazards	No.
ERG Code	6L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Other information	
Passenger and cargo aircraft	Allowed with restrictions.
Cargo aircraft only	Allowed with restrictions.

IMDG

UN number	UN2811
UN proper shipping name	TOXIC SOLID, ORGANIC, N.O.S. (4,4'-DDT)
Transport hazard class(es)	
Class	6.1(PGIII)
Subsidiary risk	-
Packing group	III
Environmental hazards	
Marine pollutant	No.
EmS	F-A, S-A
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not applicable.

IATA; IMDG

General information	IMDG Regulated Marine Pollutant.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

4,4'-DDT (CAS 50-29-3)	0.1 % One-Time Export Notification only.

CERCLA Hazardous Substance List (40 CFR 302.4)

4,4'-DDT (CAS 50-29-3)	Listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories
Immediate Hazard - Yes
Delayed Hazard - Yes
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical Yes

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

4,4'-DDT (CAS 50-29-3)

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Clean Water Act (CWA) Section 112(r) (40 CFR 68.130)
Hazardous substance
Priority pollutant
Bioaccumulative chemical of concern
Toxic pollutant

Safe Drinking Water Act (SDWA) Not regulated.

US state regulations WARNING: This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

4,4'-DDT (CAS 50-29-3)	Listed: October 1, 1987

US - California Proposition 65 - CRT: Listed date/Developmental toxin

4,4'-DDT (CAS 50-29-3)	Listed: May 15, 1998

US - California Proposition 65 - CRT: Listed date/Female reproductive toxin

4,4'-DDT (CAS 50-29-3)	Listed: May 15, 1998

US - California Proposition 65 - CRT: Listed date/Male reproductive toxin

4,4'-DDT (CAS 50-29-3)	Listed: May 15, 1998

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

4,4'-DDT (CAS 50-29-3)

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No

Country(s) or region	Inventory name	On inventory (yes/no)*
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 06-09-2014

Revision date 02-25-2020

Version # 02

NFPA ratings Health: 3
Flammability: 0
Instability: 0

Disclaimer Chem Service, Inc. cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. The above information is believed to be correct on the date it was last revised and must not be considered all inclusive. The information has been obtained only by a search of available literature and is only a guide for handling the chemicals. OSHA regulations require that if other hazards become evident, an upgraded SDS must be made available to the employee within three months. RESPONSIBILITY for updates lies with the employer and not with CHEM SERVICE, Inc.

Persons not specifically and properly trained should not handle this chemical or its container. This product is furnished FOR LABORATORY USE ONLY! Our products may NOT BE USED as drugs, cosmetics, agricultural or pesticide products, food additives or as household chemicals.

This Safety Data Sheet (SDS) is intended only for use with Chem Service, Inc. products and should not be relied on for use with materials from any other supplier even if the chemical name(s) on the product are identical! Whenever using an SDS for a solution or mixture the user should refer to the SDS for every component of the solution or mixture. Chem Service warrants that this SDS is based upon the most current information available to Chem Service at the time it was last revised. THIS WARRANTY IS EXCLUSIVE, AND CHEM SERVICE, INC. MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. This SDS is provided gratis and CHEM SERVICE, INC. SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR CONTINGENT DAMAGES.

This product is furnished FOR LABORATORY USE ONLY.

Revision information This document has undergone significant changes and should be reviewed in its entirety.

Date of Issue:
27 May 2015

SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

Product Identifier

SRM Number: 3077
SRM Name: Aroclor 1242 in Transformer Oil
Other Means of Identification: Not Applicable.

Recommended Use of This Material and Restrictions of Use

This Standard Reference Material (SRM) is a solution of Aroclor 1242 in transformer oil. This SRM is intended primarily for calibrating chromatographic instrumentation and methods of analysis used for the determination of Aroclor 1242 and polychlorinated biphenyls (PCBs) in transformer oil. A unit of SRM 3077 consists of five 2 mL ampoules, each containing approximately 1.2 mL of transformer oil.

Company Information

National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Stop 2300
Gaithersburg, Maryland 20899-2300

Telephone: 301-975-2200
FAX: 301-948-3730
E-mail: SRMMSDS@nist.gov
Website: http://www.nist.gov/srm

Emergency Telephone ChemTrec:
1-800-424-9300 (North America)
+1-703-527-3887 (International)

2. HAZARDS IDENTIFICATION

Classification

Physical Hazard:	Not classified.	
Health Hazard:	Carcinogenicity	Category 1B
	Reproductive Toxicity	Category 2
	Aspiration Hazard	Category 1

Label Elements

Symbol

Signal Word

DANGER

Hazard Statement(s)

H304	May be fatal if swallowed and enters airways.
H350	May cause cancer <inhalation, ingestion>.
H361	Suspected of damaging fertility or the unborn child.

Precautionary Statement(s):

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P280	Wear protective gloves, protective clothing, and eye protection.
P308+P313	If exposed or concerned: Get medical attention.
P301+P310	If swallowed: Immediately call a doctor.
P331	Do NOT induce vomiting.
P405	Store locked up.
P501	Dispose of contents and container according to local regulations.

Hazards Not Otherwise Classified: Not applicable.

Ingredients(s) with Unknown Acute Toxicity: Not applicable.

3. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Substance: Aroclor 1242 in transformer oil.

Other Designations:

Transformer oil (hydrotreated light naphthenic distillate (petroleum), hydraulic petroleum oil, distillates, petroleum).

Aroclor 1242 (PCB 1242; chlorodiphenyl (42 % Cl); polychlorinated biphenyl; chlorobiphenyls; PCB; PCBs)

Components are listed in compliance with OSHA 29 CFR 1910.1200.

Hazardous Component(s)	CAS Number	EC Number (EINECS)	Nominal Mass Concentration (%)
Transformer oil	64742-53-6	265-156-6	>99
Aroclor 1242	53469-21-9	215-648-1[a]	0.41

[a] EC Number as PCB, polychlorinated biphenyl

4. FIRST AID MEASURES

Description of First Aid Measures:

Inhalation: If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration or oxygen by qualified personnel. Seek immediate medical attention.

Skin Contact: Wash exposed skin with soap and water for at least 15 minutes. Seek medical attention if needed.

Eye Contact: Immediately flush eyes, including under the eyelids with copious amounts of water for at least 15 minutes. Seek immediate medical attention.

Ingestion: Aspiration hazard. Do not induce vomiting. If vomiting occurs, keep head lower than hips to prevent aspiration. If not breathing, give artificial respiration by qualified personnel. Seek immediate medical attention.

Most Important Symptoms/Effects, Acute and Delayed: Irritation, dizziness, nausea, coughing, and aspiration.

Indication of any immediate medical attention and special treatment needed, if necessary: Not applicable.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Slight fire hazard. See Section 9, "Physical and Chemical Properties" for flammability properties.

Extinguishing Media:
Suitable: Regular dry chemical, carbon dioxide, regular foam.
Unsuitable: Straight streams of water.

Specific Hazards Arising from the Chemical: None listed.

Special Protective Equipment and Precautions for Fire-Fighters: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH approved self-contained breathing apparatus (SCBA).

NFPA Ratings (0 = Minimal; 1 = Slight; 2 = Moderate; 3 = Serious; 4 = Severe)

Health = 2 Fire = 1 Reactivity = 0

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures: Use suitable protective equipment; see Section 8, "Exposure Controls and Personal Protection".

Methods and Materials for Containment and Clean up: Absorb spilled material with sand or non-combustible material and collect in appropriate container for disposal. Keep out of water supplies and sewers.

7. HANDLING AND STORAGE

Safe Handling Precautions: See Section 8, "Exposure Controls and Personal Protection".

Storage: Store and handle in accordance with all current regulations and standards. The storage floor must be impermeable and form a collecting basin so that, in the event of an accident spillage, the liquid cannot spread beyond the storage area.

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits:

Transformer oil: No occupational exposure limits established.

Aroclor 1242: NIOSH (TWA): 0.001 mg/m^3 (related to 1,1'-Biphenyl, chloro derivatives)

Engineering Controls: Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

Personal Protection Measures: In accordance with OSHA 29 CFR 1910.132, subpart I, wear appropriate Personal Protective Equipment (PPE) to minimize exposure to this material.

Respiratory Protection: If workplace conditions warrant a respirator, a respiratory protection program that meets OSHA 29CFR 1910.134 must be followed. Refer to NIOSH 42 CFR 84 for applicable certified respirators.

Eye/Face Protection: Wear splash resistant safety goggles with a face shield. An eye wash station should be readily available near areas of use.

Skin and Body Protection: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Chemical-resistant gloves should be worn at all times when handling chemicals.

9. PHYSICAL AND CHEMICAL PROPERTIES

Descriptive Properties	**Transformer oil (>99 %)**
Appearance (physical state, color, etc.):	clear, yellow liquid
Molecular Formula:	not applicable
Molar Mass (g/mol):	not applicable
Odor:	not available
Odor threshold:	not available
pH:	not available
Evaporation rate:	not available
Melting point/freezing point:	–55 °C (–67 °F)
Pour point:	–40 °C (–40 °F)
Density:	0.8912 g/mL at 22 °C[b]
Vapor Pressure:	0.1 mmHg 20 °C[a]
Vapor Density (air = 1):	>5 at 101 kPa[a]
Kinematic Viscosity:	12 cSt (12 mm^2/s) at 40 °C
Solubility(ies):	insoluble in water
Partition coefficient (n-octanol/water):	>6.5[a]
Thermal Stability Properties	
Autoignition Temperature:	>315 °C (599 °F)[a]
Thermal Decomposition:	not available
Initial boiling point and boiling range:	260 °C to 371 °C (500 °F to 700 °F)
Explosive Limits, LEL:	not available
Explosive Limits, UEL:	not available
Flash Point:	>145 °C (293 °F)[a]
Flammability (solid, gas):	not applicable

[a] Physical property listed in the NIST Certificate of Analysis. Values are not certified.
[b] Vendor supplied health and safety information.

10. STABILITY AND REACTIVITY

Reactivity: Stable at normal temperatures and pressure.

Stability: X Stable ___ Unstable

Possible Hazardous Reactions: None listed.

Conditions to Avoid: Avoid excessive heat; high energy ignition sources.

Incompatible Materials: Oxidizers.

Fire/Explosion Information: See Section 5, "Fire Fighting Measures".

Hazardous Decomposition: Oxides of carbon, sulfur oxides, aldehydes.

Hazardous Polymerization: ___ Will Occur X Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Exposure: X Inhalation X Skin X Ingestion

Symptoms Related to the Physical, Chemical and Toxicological Characteristics: Dizziness, nausea, coughing.

Potential Health Effects (Acute, Chronic and Delayed):

Inhalation: Acute exposure to high levels of vapor from transformer oil may cause central nervous system depression, headache, dizziness, nausea, vomiting, anorexia, incoordination and unconsciousness. Prolonged or repeated exposure may cause irritation. Short term exposure to Aroclor 1242 may cause irritation or liver damage; long term exposure may cause rash, itching, hair loss, digestive issues, headache, dizziness, impotence, coma, and cancer.

Skin Contact: Short term and long term contact with transformer oil may cause skin irritation and dermatitis. Short-term exposure to Aroclor 1242 may cause skin irritation or liver damage; long term exposure to Aroclor 1242 may cause same effects as for inhalation, plus hair loss and reproductive effects.

Eye Contact: Acute exposure of liquid or vapor may cause irritation.

Ingestion: Acute ingestion of transformer oil may cause abdominal pain, nausea, and vomiting. Small amounts of oil aspirated during ingestion or vomiting may cause lung damage; no information available for long-term exposure to transformer oil. Short term exposure to Aroclor 1242 may cause liver damage; long term exposure to Aroclor 1242 may cause same effects as for inhalation, plus hyperactivity, menstrual disorders, reproductive effects.

Numerical Measures of Toxicity:

Acute Toxicity: Not classified.

Component: Transformer oil

Rat, Oral LD50:	>5000 mg/kg
Rat, Inhalation LC50:	2180 mg/m^3 (4 h)
Rabbit, Skin LD50:	>2000 mg/kg

Component: Aroclor 1242

Rat, Oral LD50:	4250 mg/kg

Skin Corrosion/Irritation: Not classified.
Transformer oil, Rabbit, skin: 0.5 mL/24 h, moderate

Serious Eye Damage/ Eye Irritation: Not classified.
Transformer oil, Rabbit, eye: 0.1 mL, mild

Respiratory Sensitization: No data available; not classified.

Skin Sensitization: No data available; not classified.

Germ Cell Mutagenicity: No data available; not classified.

Carcinogenicity: Category 1B

Listed as a Carcinogen/Potential Carcinogen X Yes ______ No

Transformer oil is not listed by NTP, IARC, or OSHA as a carcinogen/potential carcinogen.

Aroclor 1242 is listed by NTP as *reasonably anticipated to be a human carcinogen* (as PCB, polychlorinated biphenyl, CAS number 1336-36-3) and by IARC as Group 1, c*arcinogenic to humans* (related to Polychlorinated biphenyls).

Reproductive Toxicity: Category 2
Aroclor 1242: Overexposure has resulted in decreased birth weight in offspring of exposed mothers. Significant exposure to PCBs that reach the fetus can cause teratogenic effects.

Oral Rat TDLo: 945 mg/kg TDLo (prior to copulation, 36 week)

STOT, Single Exposure: No data available; not classified.

STOT, Repeated Exposure: Not classified; this SRM contains less than 1 % of Archlor 1242, a Category 2 target organ toxicant.

Aspiration Hazard: Category 1
Transformer oil is a human aspiration toxicity hazard.

12. ECOLOGICAL INFORMATION

Ecotoxicity Data:

Transformer oil:	Fish, Rainbow Trout (*Oncorhynchus mykiss*) LC50: >5000 mg/L (96 h) Invertebrate, Water flea (*Daphnia magna*) EC50: >1000 mg/L (48 h)
Aroclor 1242:	Fish, Fathead minnow (*Pimephales promelas*) LC50 (flow-through, newly hatched): 0.015 mg/L (96 h)

Persistence and Degradability: Has the potential to biodegradable.

Bioaccumulative Potential: No data available

Mobility in Soil: Expected to migrate from land to water and vice versa.

Other Adverse effects: Keep out of water supplies.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose of waste in accordance with all applicable federal, state, and local regulations.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: This material is not regulated by IATA or DOT.

15. REGULATORY INFORMATION

U.S. Regulations:

CERCLA Sections 102a/103 (40 CFR 302.4): Aroclor 1242, 1 lb. (0.454 kg) final RQ.

SARA Title III Section 302 (40 CFR 355.30): Not regulated.

SARA Title III Section 304 (40 CFR 355.40): Not regulated.

SARA Title III Section 313 (40 CFR 372.65): Aroclor 1242, 0.1 % supplier notification limit (related or polychlorinated biphenyls).

OSHA Process Safety (29 CFR 1910.119): Not regulated.

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE HEALTH: Yes.
CHRONIC HEALTH: Yes.
FIRE: No.
REACTIVE: No.
PRESSURE: No.

State Regulations:

California Proposition 65:

> WARNING! This product contains a chemical (Aroclor 1242, related to PCBs) known to the state of California to cause cancer, reproductive, and/or developmental effects.

U.S. TSCA Inventory: Transformer oil is listed.

TSCA 12(b), Export Notification: Aroclor 1242 is listed in Section 6, 50 ppm de minimis concentration (see 40 CFR 761, related to polychlorinated biphenyls).

Canadian Regulations:

WHMIS Information: Not provided for this material.

16. OTHER INFORMATION

Issue Date: 27 May 2015

Sources: ChemADVISOR, Inc., SDS, *Aroclor 1242*, 20 March 2015.

ChemADVISOR, Inc., SDS, *Transformer Oil*, 20 March 2015.

Vendor MSDS, Exxon Mobile Corporation, UNIVOLT N 61 B, 30 May 2014.

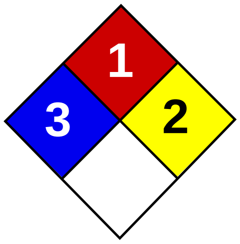
Key of Acronyms:

ACGIH	American Conference of Governmental Industrial Hygienists	NRC	Nuclear Regulatory Commission
ALI	Annual Limit on Intake	NTP	National Toxicology Program
CAS	Chemical Abstracts Service	OSHA	Occupational Safety and Health Administration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	PEL	Permissible Exposure Limit
CFR	Code of Federal Regulations	RCRA	Resource Conservation and Recovery Act
DOT	Department of Transportation	REL	Recommended Exposure Limit
EINECS	European Inventory of Existing Commercial Chemical Substances	RQ	Reportable Quantity
EPCRA	Emergency Planning and Community Right-to-Know Act	RTECS	Registry of Toxic Effects of Chemical Substances
IARC	International Agency for Research on Cancer	SARA	Superfund Amendments and Reauthorization Act
IATA	International Air Transportation Agency	SCBA	Self-Contained Breathing Apparatus
IDLH	Immediately Dangerous to Life and Health	RM	Reference Material
LC50	Lethal Concentration	STEL	Short Term Exposure Limit
LD50	Median Lethal Dose or Lethal Dose, 50 %	STOT	Specific Target Organ Toxicity
LEL	Lower Explosive Limit	TLV	Threshold Limit Value
MSDS	Material Safety Data Sheet	TPQ	Threshold Planning Quantity
NFPA	National Fire Protection Association	TSCA	Toxic Substances Control Act
NIOSH	National Institute for Occupational Safety and Health	TWA	Time Weighted Average
NIST	National Institute of Standards and Technology	UEL	Upper Explosive Limit
		WHMIS	Workplace Hazardous Materials Information System

Disclaimer: Physical and chemical data contained in this SDS are provided only for use in assessing the hazardous nature of the material. The SDS was prepared carefully, using current references; however, NIST does not certify the data in the SDS. The certified values for this material are given in the NIST Certificate of Analysis.

Users of this SRM should ensure that the SDS in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail srmmsds@nist.gov; or via the Internet at http://www.nist.gov/srm.

ScienceLab.com
Chemicals & Laboratory Equipment



Health	3
Fire	1
Reactivity	2
Personal Protection	E

Material Safety Data Sheet

Arsenic MSDS

Section 1: Chemical Product and Company Identification

Product Name: Arsenic

Catalog Codes: SLA1006

CAS#: 7440-38-2

RTECS: CG0525000

TSCA: TSCA 8(b) inventory: Arsenic

CI#: Not applicable.

Synonym:

Chemical Name: Arsenic

Chemical Formula: As

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Arsenic	7440-38-2	100

Toxicological Data on Ingredients: Arsenic: ORAL (LD50): Acute: 763 mg/kg [Rat]. 145 mg/kg [Mouse].

Section 3: Hazards Identification

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

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, lungs, the nervous system, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

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

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

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

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

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Flammable in presence of open flames and sparks, of heat, of oxidizing materials.

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

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

Special Remarks on Fire Hazards:
Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits highly toxic fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

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

Large Spill:
Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable

protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids, moisture.

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

Section 8: Exposure Controls/Personal Protection

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

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.01 from ACGIH (TLV) [United States] [1995] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

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

Odor: Not available.

Taste: Not available.

Molecular Weight: 74.92 g/mole

Color: Silvery.

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

Boiling Point: Not available.

Melting Point: Sublimation temperature: 615°C (1139°F)

Critical Temperature: Not available.

Specific Gravity: 5.72 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

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

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 145 mg/kg [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH. Causes damage to the following organs: kidneys, lungs, the nervous system, mucous membranes.

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

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

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

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

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Arsenic UNNA: UN1558 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Arsenic California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Arsenic Pennsylvania RTK: Arsenic Massachusetts RTK: Arsenic TSCA 8(b) inventory: Arsenic

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

Other Classifications:

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

DSCL (EEC):
R22- Harmful if swallowed. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 2

Personal Protection: E

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

Health: 3

Flammability: 1

Reactivity: 2

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

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

Other Special Considerations: Not available.

Created: 10/09/2005 04:16 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.

BARIUM STANDARD

MATERIAL SAFETY DATA SHEET

INTEGRA Chemical Company
1216 6th Ave N
Kent WA 98032
Phone: 253-479-7000
24 Hour Emergency Response: CHEMTREC 800-424-9300 (Outside USA 703-527-3887)

MSDS Number: B125.7A
Revision Date: 16-Apr-08
Revision No.: 004

Product Identification

Product Name:	BARIUM STANDARD
Synonyms:	
Chemical Formula:	Mixture
Formula Weight:	NA
Chemical Family:	Laboratory standard solution
Integra Product Numbers:	B125.7A

Hazard Overview

HMIS Rating: 1-0-0-B NFPA Rating: NE
Warning Label:

Warning.
May be harmful if swallowed. Avoid contact with skin, eyes or clothing. Wash thoroughly after handling.

Components

Component	CAS #	%
Water	07732-18-5	99.82
Barium chloride	10361-37-2	0.18

Physical Data

Boiling Point:	NA	Specific Gravity:	NA
Melting Point:	NA	Evaporation Rate:	NA
Vapor Pressure:	NA	Vapor Density:	NA Air = 1

Solubility:

Miscible with water.

Appearance and Odor:

Clear, colorless liquid.

Fire and Explosion Data

Flash Point: NA Test Method:
Auto-ignition Temperature: NA
Flammable Limits (% by volume in air): Upper: NA Lower: NA

Fire Extinguishing Media:

Use extinguishing media appropriate for surrounding fire.

Special Firefighting Procedures:

Use water to cool nearby containers and structures. Wear full protective equipment, including suitable respiratory protection.

Unusual Fire and Explosion Hazards:

None identified

Health Hazard Information

Effects of Overexposure

Skin Contact:

Contact may cause skin irritation.

Health Hazard Information

Eye Contact:

Contact may be irritating to the eyes.

Ingestion:

May be harmful if swallowed.

Inhalation:

None Identified

Chronic Effects of Overexposure:

None Identified

Exposure Limits:

	OSHA PEL		
	TWA	*STEL*	*Ceiling*
Water	NE	NE	NE
Barium chloride	(as Ba) 0.5 mg/m3	NE	NE

	ACGIH TLV		
	TWA	*STEL*	*Ceiling*
Water	NE	NE	NE
Barium chloride	(as Ba) 0.5 mg/m3	NE	NE

Toxicity Data:

Water	No information available	
Barium chloride	LD50 (oral, rat)	118 mg/kg

Medical Conditions Generally Aggravated by Exposure:

None Identified

Target Organs:

None Identified

Reproductive Effects:

None Identified

Carcinogenicity:

None Identified

Component	NTP Listing	IARC Listing	OSHA Regulated
Water	No listing	No Listing	☐
Barium chloride	No listing	No listing	☐

Emergency First Aid Procedures

Skin Contact:

Wash with soap and water. Seek medical attention if irritation develops.

Eye Contact:

Flush eyes with water. If irritation persists, seek medical attention.

Inhalation:

Remove to fresh air.

Ingestion:

Give victim large amounts of water and induce vomiting. Never give anything by mouth to an unconscious or convulsing person. Seek immediate medical attention.

Additional First aid and Treatment Notes:

Emergency First Aid Procedures

No information available

Reactivity Data

Stability: Stable

Hazardous Polymerization: Will Not Occur

Incompatibles:

None identified

Decomposition Products:

None identified

Conditions to Avoid:

Contamination.

Spill and Disposal Procedures

Spill and Leak Procedures:

Prevent spread of spill. Absorb with sand or inert material. Sweep or scoop into a disposal container. Flush spill area with water.

Disposal Procedures:

Dispose in accordance with all Local, State and Federal regulations.

Protective Equipment

Ventilation:

Use general or local exhaust ventilation to meet TLV and PEL requirements.

Respiratory Protection:

None required where adequate ventilation conditions exist. If airborne concentration exceeds PEL or TLV a dust/mist respirator is recommended.

Skin and Eye Protective Equipment:

Safety goggles, protective clothing and gloves. Maintain an eyewash station and safety shower nearby.

Storage and Handling Precautions

Storage Area: GENERAL

Store in a cool, dry area. Protect containers from physical damage. Protect material from contamination. Sensitive standard, handle carefully.

Transportation Information

☐ *Regulated Material domestic ground transportation*
(reference: CFR Title 49, Transportation)

Proper Shipping Name:
UN or NA Identification number:
Packing Group:
Hazard Class and Label:
Subsidiary Risk and Label:

☐ *Regulated Material via Air Transportation*
(reference: ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air)

Transportation Information

Proper Shipping Name:
UN Identification Number:
Hazard Class and Label:
Packing Group:
Subsidiary Risk and Label:

	Packing Instruction	Max net qty per package
Passenger Aircraft:		
Cargo Aircraft:		

Regulatory Information

Component	TSCA Inventory	CERCLA RQ	SARA EHS TPQ	SARA 313 Toxic Release *de minimus*
Water	☐	lbs	☐ lbs	☐ lbs
Barium chloride	☑	lbs	☐ lbs	☐ lbs

SARA Hazard Categories:	Acute	Chronic	Flammability	Pressure	Reactivity
Water	☐	☐	☐	☐	☐
Barium chloride	☑	☐	☐	☐	☐

Clean Air Act Categories:	SOCMI	HAP	Volatile HAP	Organic HAP	Ozone Depleting
Water	☐	☐	☐	☐	☐
Barium chloride	☐	☐	☐	☐	☐

MSDS Revision History:
002 - Changed header phone number
003 - Format revisions; updated header phone number
004 - Updated Header Information

NE = Not established, NA = Not applicable or Not available

The information presented above is offered for informational purposes only. This MSDS, and the associated product, is intended for use only by technically qualified persons, and at their own discretion and risk. Since conditions and manner of use are outside the control of Integra Chemical Company, we make no warranties, either expressed or implied, and assume no liability in connection with any use of this information.

***** END OF MSDS *****

NJ Health
New Jersey Department of Health

Right to Know
Hazardous Substance Fact Sheet

Common Name: **BENZ(a)ANTHRACENE**

Synonyms: Naphthanthracene; Tetraphene

Chemical Name: Benz[a]Anthracene

Date: August 2008 Revision: November 2016

Description and Use

Benz(a)Anthracene is an odorless, colorless to yellow brown flake, plate or powder. It is not produced commercially, but is used in research laboratories. It is also found in *Coal Tar*, roasted coffee, smoked foods, and automobile exhaust, and is formed as an intermediate during chemical manufacturing.

Reasons for Citation

- **Benz(a)Anthracene** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, and EPA.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

Skin Contact

- Remove contaminated clothing and wash contaminated skin with soap and water.

Inhalation

- Remove the person from exposure.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

CAS Number:	56-55-3
RTK Substance Number:	0193
DOT Number:	UN 3077

EMERGENCY RESPONDERS >>>> SEE BACK PAGE

Hazard Summary

Hazard Rating	NJDHSS	NFPA
HEALTH	3	-
FLAMMABILITY	1	-
REACTIVITY	0	-
CARCINOGEN POISONOUS GASES ARE PRODUCED IN FIRE		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

- **Benz(a)Anthracene** can affect you when inhaled.
- **Benz(a)Anthracene** should be handled as a CARCINOGEN and MUTAGEN--WITH EXTREME CAUTION.
- *For more information, consult the Right to Know Hazardous Substance Fact Sheet on COAL TAR PITCH.*

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **0.2 mg/m^3** (as *Coal Tar Pitch Volatiles, Benzene-soluble fraction*) averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **0.1 mg/m^3** (as *Coal Tar Pitch Volatiles, Cyclohexane-extractable fraction*) averaged over a 10-hour workshift.

ACGIH: Recommends that exposure by all routes be controlled to levels as low as possible.

- **Benz(a)Anthracene** is a PROBABLE CARCINOGEN in humans. There may be <u>no</u> safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK Program website (http://nj.gov/health/workplacehealthandsafety/right-to-know/) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) requires private employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Benz(a)Anthracene**:

- No acute (short-term) health effects are known at this time.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Benz(a)Anthracene** and can last for months or years:

Cancer Hazard

- **Benz(a)Anthracene** is a PROBABLE CARCINOGEN in humans. There is evidence that it causes cancer in humans and it has been shown to cause liver and lung cancer in animals.
- Many scientists believe there is no safe level of exposure to a carcinogen. Such substance may also have the potential for causing reproductive damage in humans.

Reproductive Hazard

- According to the information presently available to the New Jersey Department of Health, **Benz(a)Anthracene** has not been tested for its ability to affect reproduction.

Other Effects

- No chronic (long-term) health effects are known at this time.

Medical

Medical Testing

There is no special test for this chemical. However, seek medical attention if illness occurs or overexposure is suspected.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Use a Class I, Type B, biological safety hood when mixing, handling, or preparing **Benz(a)Anthracene**.
- Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.
- Use a high efficiency particulate air (HEPA) filter when vacuuming. Do not use a standard shop vacuum.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **Benz(a)Anthracene**. Wear personal protective equipment made from material that can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Nitrile or Natural Rubber for gloves and DuPont Tyvek®, or the equivalent, as a protective material for clothing.

Eye Protection

- Wear eye protection with side shields or goggles.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **0.1 mg/m^3** (as *Coal Tar Pitch Volatiles*), use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to **80 mg/m^3** (as *Coal Tar Pitch Volatiles*) is immediately dangerous to life and health. If the possibility of exposure above **80 mg/m^3** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Benz(a)Anthracene** may burn, but does not readily ignite.
- Use dry chemical, CO_2, water spray or foam as extinguishing agents.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- Use water spray to keep fire-exposed containers cool.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Benz(a)Anthracene** is spilled, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Moisten spilled material first or use a HEPA-filter vacuum for clean-up and deposit in sealed containers.
- Ventilate and wash area after clean-up is complete.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Benz(a)Anthracene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Benz(a)Anthracene** you should be trained on its proper handling and storage.

- A regulated, marked area should be established where **Benz(a)Anthracene** is handled, used, or stored.
- **Benz(a)Anthracene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).
- Store in tightly closed containers in a cool, well-ventilated area.

Occupational Health Information Resources

The New Jersey Department of Health, Occupational Health Service, offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health
Right to Know Program
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.nj.gov
Web address:
http://nj.gov/health/workplacehealthandsafety/right-to-know/

The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values are intended to provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database maintained by federal EPA. The database contains information on human health effects that may result from exposure to various chemicals in the environment.

LEL or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

PIH is a DOT designation for chemicals which are Poison Inhalation Hazards.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **BENZ(a)ANTHRACENE**

Synonyms: Naphthanthracene; Tetraphene
CAS No: 56-55-3
Molecular Formula: $C_{18}H_{12}$
RTK Substance No: 0193
Description: Odorless, colorless to yellow brown flake, plate or powder

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
3 - Health **1 - Fire** **0 - Reactivity** **DOT#:** UN 3077 **ERG Guide #:** 171 **Hazard Class:** 9 (Environmentally hazardous substance)	**Benz(a)Anthracene** may burn, but does not readily ignite. Use dry chemical, CO_2, water spray or foam as extinguishing agents. POISONOUS GASES ARE PRODUCED IN FIRE. Use water spray to keep fire-exposed containers cool.	**Benz(a)Anthracene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).

SPILL/LEAKS

Isolation Distance:

Small Spill: 50 meters (150 feet)

Fire: 800 meters (1/2 mile)

Moisten spilled material first or use a HEPA-filter vacuum for clean-up and deposit in sealed containers.

Bioaccumulation may occur in seafood.

EXPOSURE LIMITS

OSHA:	0.2 mg/m^3, 8-hr TWA (as *Coal Tar Pitch Volatiles, Benzene soluble fraction*)
NIOSH:	0.1 mg/m^3, 10-hr TWA (as *Coal Tar Pitch Volatiles, Cyclohexane-extractable fraction*)
ACGIH:	Lowest level possible
IDLH:	80 mg/m^3 (as *Coal Tar Pitch Volatiles*)
PAC LEVELS:	PAC-1 = 0.6 mg/m^3; PAC-2 = 120 mg/m^3; PAC-3 = 700 mg/m^3

HEALTH EFFECTS

Eyes:	No information available
Skin:	No information available
Inhalation:	No information available
Chronic:	Cancer (liver and lung) in animals

PHYSICAL PROPERTIES

Odor Threshold:	Odorless
Flash Point:	May burn
Vapor Pressure:	2 mm Hg at 68°F (20°C)
Specific Gravity:	1.3 (water = 1)
Water Solubility:	Insoluble
Boiling Point:	820°F (438°C)
Melting Point:	324°F (162°C)
Molecular Weight:	228.3

PROTECTIVE EQUIPMENT

Gloves:	Nitrile and Natural Rubber
Coveralls:	DuPont Tyvek®
Respirator:	>0.1 mg/m^3 - Supplied Air

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.

Remove contaminated clothing and wash contaminated skin with soap and water.

Transfer to a medical facility.

November 2016

Material Safety Data Sheet
Benzo[a]pyrene, 98%

MSDS# 37175

Section 1 - Chemical Product and Company Identification

MSDS Name:	Benzo[a]pyrene, 98%
Catalog Numbers:	AC105600000, AC105600010, AC105601000, AC377200000, AC377200010, AC377201000 AC377201000
Synonyms:	3,4-Benzopyrene; 3,4-Benzpyrene; Benzo[def]chrysene.

Company Identification:	Acros Organics BVBA Janssen Pharmaceuticalaan 3a 2440 Geel, Belgium
Company Identification: (USA)	Acros Organics One Reagent Lane Fair Lawn, NJ 07410
For information in the US, call:	800-ACROS-01
For information in Europe, call:	+32 14 57 52 11
Emergency Number, Europe:	+32 14 57 52 99
Emergency Number US:	201-796-7100
CHEMTREC Phone Number, US:	800-424-9300
CHEMTREC Phone Number, Europe:	703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#:	50-32-8
Chemical Name:	Benzo[a]pyrene
%:	>96
EINECS#:	200-028-5

Hazard Symbols: T N

Risk Phrases: 45 46 60 61 43 50/53

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Danger! May cause allergic skin reaction. Cancer hazard. May cause harm to the unborn child. May impair fertility. May cause eye, skin, and respiratory tract irritation. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. May cause heritable genetic damage. Target Organs: Reproductive system, skin.

Potential Health Effects

Eye:	May cause eye irritation.
Skin:	May cause skin irritation. May be harmful if absorbed through the skin. May cause an allergic reaction in certain individuals.
Ingestion:	May cause irritation of the digestive tract. The toxicological properties of this substance have not been fully investigated. May be harmful if swallowed.
Inhalation:	May cause respiratory tract irritation. The toxicological properties of this substance have not been fully investigated. May be harmful if inhaled.

Chronic: May cause cancer in humans. May cause reproductive and fetal effects. Laboratory experiments have resulted in mutagenic effects.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion: Never give anything by mouth to an unconscious person. Get medical aid. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.

Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or appropriate foam.

Autoignition Temperature: Not available.

Flash Point: Not available

Explosion Limits: Lower: Not available

Explosion Limits: Upper: Not available

NFPA Rating: health: 2; flammability: 0; instability: 0;

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.

Storage: Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Benzo[a]pyrene	0.2 mg/m3 TWA (as benzene soluble aerosol) (listed under Coal tar pitches).	0.1 mg/m3 TWA	0.2 mg/m3 TWA (benzene soluble fraction) (listed under Coal tar pitches).

OSHA Vacated PELs: Benzo[a]pyrene: 0.2 mg/m3 TWA (benzene soluble fraction) (listed under Coal tar pitches)

Engineering Controls:

Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

Exposure Limits

Personal Protective Equipment

Eyes:	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin:	Wear appropriate protective gloves to prevent skin exposure.
Clothing:	Wear appropriate protective clothing to prevent skin exposure.
Respirators:	A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Powder
Color: yellow to brown
Odor: faint aromatic odor
pH: Not available
Vapor Pressure: Not available
Vapor Density: Not available
Evaporation Rate: Not available
Viscosity: Not available
Boiling Point: 495 deg C @ 760 mm Hg (923.00°F)
Freezing/Melting Point: 175 - 179 deg C
Decomposition Temperature: Not available
Solubility in water: 1.60x10-3 mg/l @25°C
Specific Gravity/Density:
Molecular Formula: C20H12
Molecular Weight: 252.31

Section 10 - Stability and Reactivity

Chemical Stability:	Stable under normal temperatures and pressures.
Conditions to Avoid:	Dust generation.
Incompatibilities with Other Materials	Strong oxidizing agents.
Hazardous Decomposition Products	Carbon monoxide, carbon dioxide.
Hazardous Polymerization	Has not been reported.

Section 11 - Toxicological Information

RTECS#:	CAS# 50-32-8: DJ3675000
LD50/LC50:	RTECS: Not available.
Carcinogenicity:	Benzo[a]pyrene - ACGIH: A1 - Confirmed Human Carcinogen (Coal tar pitches). California: carcinogen, initial date 7/1/87 NTP: Suspect carcinogen IARC: Group 1 carcinogen
Other:	The toxicological properties have not been fully investigated.

Section 12 - Ecological Information

Not available

Section 13 - Disposal Considerations

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

Section 14 - Transport Information

US DOT
Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOL (Benzo{a} pyrene)
Hazard Class: 9
UN Number: UN3077
Packing Group: III
Canada TDG
Shipping Name: Not available
Hazard Class:
UN Number:
Packing Group:

USA RQ: CAS# 50-32-8: 1 lb final RQ; 0.454 kg final RQ

Section 15 - Regulatory Information

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: T N

Risk Phrases:

R 45 May cause cancer.

R 46 May cause heritable genetic damage.

R 61 May cause harm to the unborn child.

R 43 May cause sensitization by skin contact.

R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

R 60 May impair fertility.

Safety Phrases:

S 53 Avoid exposure - obtain special instructions before use.

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 60 This material and its container must be disposed of as hazardous waste.

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

WGK (Water Danger/Protection)

CAS# 50-32-8: Not available

Canada

CAS# 50-32-8 is listed on Canada's DSL List

Canadian WHMIS Classifications: D2A, D2B

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

CAS# 50-32-8 is listed on Canada's Ingredient Disclosure List

US Federal

TSCA

CAS# 50-32-8 is listed on the TSCA Inventory.

Section 16 - Other Information

MSDS Creation Date: 9/02/1997

Revision #8 Date 7/20/2009

SAFETY DATA SHEET

1. Identification

Product identifier	**Benzo(b)fluoranthene**	
Other means of identification		
Item	N-11165	
Recommended use	For Laboratory Use Only	
Recommended restrictions	None known.	

Manufacturer/Importer/Supplier/Distributor information

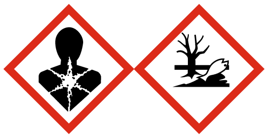
Manufacturer

Company name	Chem Service, Inc.	
Address	660 Tower Lane West Chester, PA 19380 United States	
Telephone	Toll Free	800-452-9994
	Direct	610-692-3026
Website	www.chemservice.com	
E-mail	info@chemservice.com	
Emergency phone number	Chemtrec US	800-424-9300
	Chemtrec outside US	+1 703-527-3887

2. Hazard(s) identification

Physical hazards	Not classified.	
Health hazards	Carcinogenicity	Category 1
Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 1
	Hazardous to the aquatic environment, long-term hazard	Category 1
OSHA defined hazards	Not classified.	

Label elements



Signal word	Danger
Hazard statement	May cause cancer. Very toxic to aquatic life. Very toxic to aquatic life with long lasting effects.
Precautionary statement	
Prevention	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Avoid release to the environment. Wear protective gloves/protective clothing/eye protection/face protection.
Response	If exposed or concerned: Get medical advice/attention. Collect spillage.
Storage	Store locked up.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC)	None known.
Supplemental information	Not applicable.

3. Composition/information on ingredients

Substances

Chemical name	Common name and synonyms	CAS number	%
Benzo(b)fluoranthene		205-99-2	100

*Designates that a specific chemical identity and/or percentage of composition has been withheld as a trade secret.

4. First-aid measures

Inhalation	Move to fresh air. Call a physician if symptoms develop or persist.
Skin contact	Wash off with soap and water. Get medical attention if irritation develops and persists.
Eye contact	Rinse with water. Get medical attention if irritation develops and persists.
Ingestion	Rinse mouth. Get medical attention if symptoms occur.
Most important symptoms/effects, acute and delayed	Direct contact with eyes may cause temporary irritation.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Keep victim under observation. Symptoms may be delayed.
General information	IF exposed or concerned: Get medical advice/attention. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO2).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	Use water spray to cool unopened containers.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Keep out of low areas. Wear appropriate personal protective equipment. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	This material is classified as a water pollutant under the Clean Water Act and should be prevented from contaminating soil or from entering sewage and drainage systems which lead to waterways. Stop the flow of material, if this is without risk. Collect spillage. Following product recovery, flush area with water. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid release to the environment. Contact local authorities in case of spillage to drain/aquatic environment. Prevent further leakage or spillage if safe to do so. Do not contaminate water. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Provide adequate ventilation. Wear appropriate personal protective equipment. Observe good industrial hygiene practices. Avoid release to the environment. Do not empty into drains.
Conditions for safe storage, including any incompatibilities	Store locked up. Store in original tightly closed container. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits	No exposure limits noted for ingredient(s).
Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Individual protection measures, such as personal protective equipment

Eye/face protection	Use personal protective equipment as required.

Skin protection	
Hand protection	Use personal protective equipment as required.
Other	Use personal protective equipment as required.
Respiratory protection	Use personal protective equipment as required.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	
Physical state	Solid.
Form	Solid. Crystalline Solid
Color	Pale yellow
Odor	Not available.
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	334.4 °F (168 °C)
Initial boiling point and boiling range	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	0.0000001 kPa at 25 °C
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Not available.
Partition coefficient (n-octanol/water)	6.6
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Molecular formula	C20-H12
Molecular weight	252.32 g/mol

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	No adverse effects due to inhalation are expected.
Skin contact	No adverse effects due to skin contact are expected.
Eye contact	Direct contact with eyes may cause temporary irritation.
Ingestion	Expected to be a low ingestion hazard.
Symptoms related to the physical, chemical and toxicological characteristics	Direct contact with eyes may cause temporary irritation.

Information on toxicological effects

Acute toxicity	Not available.
Skin corrosion/irritation	Prolonged skin contact may cause temporary irritation.
Serious eye damage/eye irritation	Direct contact with eyes may cause temporary irritation.

Respiratory or skin sensitization

Respiratory sensitization	Not available.
Skin sensitization	This product is not expected to cause skin sensitization.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	May cause cancer.

IARC Monographs. Overall Evaluation of Carcinogenicity

Benzo(b)fluoranthene (CAS 205-99-2)	2B Possibly carcinogenic to humans.

US. National Toxicology Program (NTP) Report on Carcinogens

Benzo(b)fluoranthene (CAS 205-99-2)	Reasonably Anticipated to be a Human Carcinogen.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure	Not classified.
Specific target organ toxicity - repeated exposure	Not classified.
Aspiration hazard	Not available.
Chronic effects	Prolonged exposure may cause chronic effects.

12. Ecological information

Ecotoxicity	Very toxic to aquatic life with long lasting effects. Accumulation in aquatic organisms is expected.
Persistence and degradability	No data is available on the degradability of this product.
Bioaccumulative potential	Not available.

Partition coefficient n-octanol / water (log Kow)

6.6

Mobility in soil	No data available.
Other adverse effects	No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site. This material and its container must be disposed of as hazardous waste. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose of contents/container in accordance with local/regional/national/international regulations.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Empty containers should be taken to an approved waste handling site for recycling or disposal. Since emptied containers may retain product residue, follow label warnings even after container is emptied.

14. Transport information

DOT

UN number	UN3077
UN proper shipping name	Environmentally hazardous substances, solid, n.o.s. (Benzo(b)fluoranthene RQ = 1 LBS)
Transport hazard class(es)	
Class	9
Subsidiary risk	-
Label(s)	9
Packing group	III
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	8, 146, 335, A112, B54, IB8, IP3, N20, T1, TP33
Packaging exceptions	155
Packaging non bulk	213
Packaging bulk	240

IATA

UN number	UN3077
UN proper shipping name	Environmentally hazardous substance, solid, n.o.s. (Benzo(b)fluoranthene)
Transport hazard class(es)	
Class	9
Subsidiary risk	-
Packing group	III
Environmental hazards	No.
ERG Code	9L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Other information	
Passenger and cargo aircraft	Allowed.
Cargo aircraft only	Allowed.

IMDG

UN number	UN3077
UN proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Benzo(b)fluoranthene)
Transport hazard class(es)	
Class	9
Subsidiary risk	-
Packing group	III
Environmental hazards	
Marine pollutant	No.
EmS	F-A, S-F
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not applicable.

DOT; IATA; IMDG

General information	DOT Regulated Marine Pollutant. IMDG Regulated Marine Pollutant.

15. Regulatory information

US federal regulations	This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200. One or more components are not listed on TSCA.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Benzo(b)fluoranthene (CAS 205-99-2)	Listed.

SARA 304 Emergency release notification

Not regulated.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not listed.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - No Delayed Hazard - Yes Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical	Yes

SARA 313 (TRI reporting)

Chemical name	CAS number	% by wt.
Benzo(b)fluoranthene	205-99-2	100

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Benzo(b)fluoranthene (CAS 205-99-2)

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Clean Water Act (CWA) Section 112(r) (40 CFR 68.130)	Priority pollutant Toxic pollutant
Safe Drinking Water Act (SDWA)	Not regulated.

US state regulations

US - New Jersey RTK - Substances: Listed substance

Benzo(b)fluoranthene (CAS 205-99-2)

US - Pennsylvania RTK - Hazardous Substances: Special hazard

Benzo(b)fluoranthene (CAS 205-99-2)

US. California Controlled Substances. CA Department of Justice (California Health and Safety Code Section 11100)

Not listed.

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

Benzo(b)fluoranthene (CAS 205-99-2)

US. Massachusetts RTK - Substance List

Benzo(b)fluoranthene (CAS 205-99-2)

US. New Jersey Worker and Community Right-to-Know Act

Benzo(b)fluoranthene (CAS 205-99-2)

US. Pennsylvania RTK - Hazardous Substances

Benzo(b)fluoranthene (CAS 205-99-2)

US. Pennsylvania Worker and Community Right-to-Know Law

Benzo(b)fluoranthene (CAS 205-99-2)

US. Rhode Island RTK

Benzo(b)fluoranthene (CAS 205-99-2)

US. California Proposition 65

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

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

Benzo(b)fluoranthene (CAS 205-99-2) Listed: July 1, 1987

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	No
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	No
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	No

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date 04-29-2015

Version # 01

NFPA ratings
Health: 0
Flammability: 0
Instability: 0

Disclaimer

The above information is believed to be correct on the date it was last revised and must not be considered all inclusive. The information has been obtained only by a search of available literature and is only a guide for handling the chemicals. OSHA regulations require that if other hazards become evident, an upgraded SDS must be made available to the employee within three months. RESPONSIBILITY for updates lies with the employer and not with CHEM SERVICE, Inc.

Persons not specifically and properly trained should not handle this chemical or its container. This product is furnished FOR LABORATORY USE ONLY! Our products may NOT BE USED as drugs, cosmetics, agricultural or pesticide products, food additives or as household chemicals.

This Safety Data Sheet (SDS) is intended only for use with Chem Service, Inc. products and should not be relied on for use with materials from any other supplier even if the chemical name(s) on the product are identical! Whenever using an SDS for a solution or mixture the user should refer to the SDS for every component of the solution or mixture. Chem Service warrants that this SDS is based upon the most current information available to Chem Service at the time it was last revised. THIS WARRANTY IS EXCLUSIVE, AND CHEM SERVICE, INC. MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. This SDS is provided gratis and CHEM SERVICE, INC. SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR CONTINGENT DAMAGES.

This product is furnished FOR LABORATORY USE ONLY.

SAFETY DATA SHEET

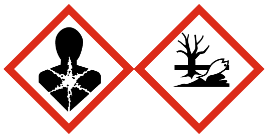
1. Identification

Product identifier	**Benzo(k)fluoranthene**	
Other means of identification		
Item	N-11168	
CAS number	207-08-9	
Recommended use	For Laboratory Use Only	
Recommended restrictions	None known.	
Manufacturer/Importer/Supplier/Distributor information		
Manufacturer		
Company name	Chem Service, Inc.	
Address	660 Tower Lane West Chester, PA 19380 United States	
Telephone	Toll Free	800-452-9994
	Direct	610-692-3026
Website	www.chemservice.com	
E-mail	info@chemservice.com	
Emergency phone number	Chemtrec US	800-424-9300
	Chemtrec outside US	+1 703-527-3887

2. Hazard(s) identification

Physical hazards	Not classified.	
Health hazards	Carcinogenicity	Category 1B
Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 1
	Hazardous to the aquatic environment, long-term hazard	Category 1
OSHA defined hazards	Not classified.	

Label elements



Signal word	Danger
Hazard statement	May cause cancer. Very toxic to aquatic life. Very toxic to aquatic life with long lasting effects.
Precautionary statement	
Prevention	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Avoid release to the environment. Wear protective gloves/protective clothing/eye protection/face protection.
Response	If exposed or concerned: Get medical advice/attention. Collect spillage.
Storage	Store locked up.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC)	None known.
Supplemental information	100% of the mixture consists of component(s) of unknown acute oral toxicity. 100% of the mixture consists of component(s) of unknown acute dermal toxicity.

3. Composition/information on ingredients

Substances

Chemical name	Common name and synonyms	CAS number	%
Benzo(k)fluoranthene		207-08-9	100

4. First-aid measures

Inhalation	Move to fresh air. Call a physician if symptoms develop or persist.
Skin contact	Wash off with soap and water. Get medical attention if irritation develops and persists.
Eye contact	Rinse with water. Get medical attention if irritation develops and persists.
Ingestion	Rinse mouth. Get medical attention if symptoms occur.
Most important symptoms/effects, acute and delayed	Direct contact with eyes may cause temporary irritation.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Keep victim under observation. Symptoms may be delayed.
General information	IF exposed or concerned: Get medical advice/attention. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO2).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	Use water spray to cool unopened containers.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	This material is classified as a water pollutant under the Clean Water Act and should be prevented from contaminating soil or from entering sewage and drainage systems which lead to waterways. Stop the flow of material, if this is without risk. Following product recovery, flush area with water. Put material in suitable, covered, labeled containers. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid release to the environment. Inform appropriate managerial or supervisory personnel of all environmental releases. Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Should be handled in closed systems, if possible. Provide adequate ventilation. Wear appropriate personal protective equipment. Avoid release to the environment. Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Store locked up. Store in original tightly closed container. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits	This substance has no PEL, TLV, or other recommended exposure limit.
Biological limit values	No biological exposure limits noted for the ingredient(s).
Appropriate engineering controls	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level.

Individual protection measures, such as personal protective equipment

Eye/face protection	If contact is likely, safety glasses with side shields are recommended.
Skin protection	
Hand protection	Wear appropriate chemical resistant gloves.
Other	Use of an impervious apron is recommended.
Respiratory protection	In case of insufficient ventilation, wear suitable respiratory equipment.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	Observe any medical surveillance requirements. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	
Physical state	Solid.
Form	Crystalline.
Color	Pale yellow
Odor	Not available.
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	422.6 °F (217 °C)
Initial boiling point and boiling range	896 °F (480 °C)
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	< 0.0000001 kPa (77 °F (25 °C))
Vapor density	Not available.
Relative density	Not available.
Solubility(ies)	
Solubility (water)	Not available.
Partition coefficient (n-octanol/water)	6.84
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Explosive properties	Not explosive.
Molecular formula	C20-H12
Molecular weight	252.32 g/mol
Oxidizing properties	Not oxidizing.

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.

Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	No adverse effects due to inhalation are expected.
Skin contact	No adverse effects due to skin contact are expected.
Eye contact	Direct contact with eyes may cause temporary irritation.
Ingestion	Expected to be a low ingestion hazard.
Symptoms related to the physical, chemical and toxicological characteristics	Direct contact with eyes may cause temporary irritation.

Information on toxicological effects

Acute toxicity	Not known.
Skin corrosion/irritation	Prolonged skin contact may cause temporary irritation.
Serious eye damage/eye irritation	Direct contact with eyes may cause temporary irritation.

Respiratory or skin sensitization

Respiratory sensitization	Not a respiratory sensitizer.
Skin sensitization	This product is not expected to cause skin sensitization.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	May cause cancer.

IARC Monographs. Overall Evaluation of Carcinogenicity

Benzo(k)fluoranthene (CAS 207-08-9)	2B Possibly carcinogenic to humans.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

US. National Toxicology Program (NTP) Report on Carcinogens

Benzo(k)fluoranthene (CAS 207-08-9)	Reasonably Anticipated to be a Human Carcinogen.

Reproductive toxicity	This product is not expected to cause reproductive or developmental effects.
Specific target organ toxicity - single exposure	Not classified.
Specific target organ toxicity - repeated exposure	Not classified.
Aspiration hazard	Not an aspiration hazard.
Chronic effects	Prolonged exposure may cause chronic effects.

12. Ecological information

Ecotoxicity	Very toxic to aquatic life with long lasting effects.
Persistence and degradability	
Bioaccumulative potential	

Partition coefficient n-octanol / water (log Kow)

6.84

Mobility in soil	No data available.
Other adverse effects	No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose of contents/container in accordance with local/regional/national/international regulations.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.
Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

UN number	UN3077
UN proper shipping name	Environmentally hazardous substances, solid, n.o.s. (Benzo(k)fluoranthene RQ = 5000 LBS)
Transport hazard class(es)	
Class	9
Subsidiary risk	-
Label(s)	9
Packing group	III
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	8, 146, 335, A112, B54, IB8, IP3, N20, T1, TP33
Packaging exceptions	155
Packaging non bulk	213
Packaging bulk	240

IATA

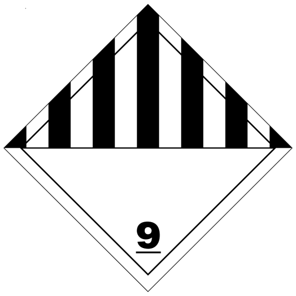
UN number	UN3077
UN proper shipping name	Environmentally hazardous substance, solid, n.o.s. (Benzo(k)fluoranthene)
Transport hazard class(es)	
Class	9
Subsidiary risk	-
Packing group	III
Environmental hazards	No.
ERG Code	9L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Other information	
Passenger and cargo aircraft	Allowed with restrictions.
Cargo aircraft only	Allowed with restrictions.

IMDG

UN number	UN3077
UN proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Benzo(k)fluoranthene)
Transport hazard class(es)	
Class	9
Subsidiary risk	-
Packing group	III
Environmental hazards	
Marine pollutant	No.
EmS	F-A, S-F
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not applicable.

DOT; IATA; IMDG



General information IMDG Regulated Marine Pollutant. DOT Regulated Marine Pollutant.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Benzo(k)fluoranthene (CAS 207-08-9) Listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories
Immediate Hazard - No
Delayed Hazard - Yes
Fire Hazard - No
Pressure Hazard - No
Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical Yes

SARA 313 (TRI reporting)

Chemical name	CAS number	% by wt.
Benzo(k)fluoranthene	207-08-9	100

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Benzo(k)fluoranthene (CAS 207-08-9)

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Clean Water Act (CWA) Section 112(r) (40 CFR 68.130)
Priority pollutant
Toxic pollutant

Safe Drinking Water Act (SDWA) Not regulated.

US state regulations WARNING: This product contains a chemical known to the State of California to cause cancer.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

Benzo(k)fluoranthene (CAS 207-08-9) Listed: July 1, 1987

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

Benzo(k)fluoranthene (CAS 207-08-9)

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	No
Canada	Domestic Substances List (DSL)	No

Country(s) or region	Inventory name	On inventory (yes/no)*
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	No
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	No
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	No
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	No

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date	11-21-2014
Revision date	05-09-2019
Version #	02
NFPA ratings	Health: 0 Flammability: 0 Instability: 0

Disclaimer

Chem Service, Inc. cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. The above information is believed to be correct on the date it was last revised and must not be considered all inclusive. The information has been obtained only by a search of available literature and is only a guide for handling the chemicals. OSHA regulations require that if other hazards become evident, an upgraded SDS must be made available to the employee within three months. RESPONSIBILITY for updates lies with the employer and not with CHEM SERVICE, Inc.

Persons not specifically and properly trained should not handle this chemical or its container. This product is furnished FOR LABORATORY USE ONLY! Our products may NOT BE USED as drugs, cosmetics, agricultural or pesticide products, food additives or as household chemicals.

This Safety Data Sheet (SDS) is intended only for use with Chem Service, Inc. products and should not be relied on for use with materials from any other supplier even if the chemical name(s) on the product are identical! Whenever using an SDS for a solution or mixture the user should refer to the SDS for every component of the solution or mixture. Chem Service warrants that this SDS is based upon the most current information available to Chem Service at the time it was last revised. THIS WARRANTY IS EXCLUSIVE, AND CHEM SERVICE, INC. MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. This SDS is provided gratis and CHEM SERVICE, INC. SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR CONTINGENT DAMAGES.

This product is furnished FOR LABORATORY USE ONLY.

Revision information This document has undergone significant changes and should be reviewed in its entirety.

SIGMA-ALDRICH

sigma-aldrich.com

SAFETY DATA SHEET

Version 5.4
Revision Date 01/30/2014
Print Date 03/03/2014

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Dioctyl phthalate

Product Number : D201154
Brand : Aldrich
Index-No. : 607-317-00-9
REACH No. : 01-2119484611-38-XXXX
CAS-No. : 117-81-7

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

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Reproductive toxicity (Category 1B), H360
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)

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.
P202	Do not handle until all safety precautions have been read and understood.
P273	Avoid release to the environment.
P281	Use personal protective equipment as required.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P391	Collect spillage.
P405	Store locked up.

P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

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3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms	: Bis(2-ethylhexyl) phthalate Phthalic acid bis(2-ethylhexyl ester)
Formula	: $C_{24}H_{38}O_4$
Molecular Weight	: 390.56 g/mol
CAS-No.	: 117-81-7
EC-No.	: 204-211-0
Index-No.	: 607-317-00-9
Registration number	: 01-2119484611-38-XXXX

Hazardous components

Component	Classification	Concentration
bis(2-Ethylhexyl) phthalate Included in the Candidate List of Substances of Very High Concern (SVHC) according to Regulation (EC) No. 1907/2006 (REACH)		
	Repr. 1B; H360	90 - 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

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4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Move out of dangerous area.Consult a physician. Show this safety data sheet to the doctor in attendance.

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
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

no data available

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5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Carbon oxides

5.3 Advice for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further information

no data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
For personal protection see section 8.

6.2 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.

6.3 Methods and materials for containment and cleaning up

Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

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.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
bis(2-Ethylhexyl) phthalate	117-81-7	TWA	5 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Lower Respiratory Tract irritation Confirmed animal carcinogen with unknown relevance to humans		
		TWA	5 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A		
		ST	10 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A		
		TWA	5 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	5 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		STEL	10 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face 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 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: 0.2 mm
Break through time: 480 min
Material tested:Dermatril® P (KCL 743 / Aldrich Z677388, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 120 min
Material tested:Dermatril® (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.

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.

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).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid
b)	Odour	no data available
c)	Odour Threshold	no data available
d)	pH	no data available
e)	Melting point/freezing point	Melting point/range: -50 °C (-58 °F) - lit.
f)	Initial boiling point and boiling range	384 °C (723 °F) - lit.
g)	Flash point	207 °C (405 °F) - closed cup
h)	Evapouration rate	no data available
i)	Flammability (solid, gas)	no data available
j)	Upper/lower flammability or	Lower explosion limit: 0.3 %(V)

	explosive limits	
k)	Vapour pressure	1.6 hPa (1.2 mmHg) at 93.0 °C (199.4 °F)
l)	Vapour density	no data available
m)	Relative density	0.985 g/cm3 at 25 °C (77 °F)
n)	Water solubility	no data available
o)	Partition coefficient: n-octanol/water	no data available
p)	Auto-ignition temperature	390.0 °C (734.0 °F)
q)	Decomposition temperature	no data available
r)	Viscosity	no data available
s)	Explosive properties	no data available
t)	Oxidizing properties	no data available

9.2 Other safety information

no data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

no data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

no data available

10.4 Conditions to avoid

no data available

10.5 Incompatible materials

Strong oxidizing agents

10.6 Hazardous decomposition products

Other decomposition products - no data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - rat - 30,000 mg/kg

Inhalation: no data available

LD50 Dermal - rabbit - 25,000 mg/kg

no data available

Skin corrosion/irritation
Skin - rabbit
Result: Mild skin irritation - 24 h

Serious eye damage/eye irritation
Eyes - rabbit
Result: Mild eye irritation - 24 h

Respiratory or skin sensitisation
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.

IARC:	2B - Group 2B: Possibly carcinogenic to humans (bis(2-Ethylhexyl) phthalate)
NTP:	Reasonably anticipated to be a human carcinogen (bis(2-Ethylhexyl) phthalate)
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
May cause congenital malformation in the fetus.
Presumed human reproductive toxicant

May cause reproductive disorders.

Specific target organ toxicity - single exposure
no data available

Specific target organ toxicity - repeated exposure
no data available

Aspiration hazard
no data available

Additional Information
RTECS: TI0350000

Lung irritation, Gastrointestinal disturbance

Kidney -

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12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - > 0.67 mg/l - 96 h
	LC50 - Oncorhynchus mykiss (rainbow trout) - > 0.32 mg/l - 96 h
	LC50 - Cyprinodon variegatus (sheepshead minnow) - > 0.17 mg/l - 96 h
	LC50 - Lepomis macrochirus (Bluegill) - > 0.20 mg/l - 96 h
	NOEC - other fish - > 0.3 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	Immobilization EC50 - Daphnia magna (Water flea) - > 0.16 mg/l - 48 h

12.2 Persistence and degradability

no data available

Biodegradability	Result: - Readily biodegradable. (OECD Test Guideline 301)

12.3 Bioaccumulative potential

Bioaccumulation	Oncorhynchus mykiss (rainbow trout) - 100 d - 0.014 mg/l Bioconcentration factor (BCF): 113

12.4 Mobility in soil

no data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 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

13.1 Waste treatment methods

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: 3082 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, liquid, n.o.s. (bis(2-Ethylhexyl) phthalate)
Reportable Quantity (RQ): 100 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG

Not dangerous goods

IATA

Not dangerous goods

15. REGULATORY INFORMATION

REACH No. : 01-2119484611-38-XXXX

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
bis(2-Ethylhexyl) phthalate	117-81-7	2007-07-01

SARA 311/312 Hazards

Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
bis(2-Ethylhexyl) phthalate	117-81-7	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
bis(2-Ethylhexyl) phthalate	117-81-7	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
bis(2-Ethylhexyl) phthalate	117-81-7	2007-07-01

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer. bis(2-Ethylhexyl) phthalate	117-81-7	2009-02-01

WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. bis(2-Ethylhexyl) phthalate	CAS-No. 117-81-7	Revision Date 2009-02-01

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

H360	May damage fertility or the unborn child.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.
Repr.	Reproductive toxicity

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	*
Flammability:	1
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	1
Reactivity Hazard:	0

Further information

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.4 Revision Date: 01/30/2014 Print Date: 03/03/2014

CADMIUM METAL
SAFETY DATA SHEET

SECTION 1. IDENTIFICATION

Product Identity: Cadmium Metal

Trade Names and Synonyms: Tadanac Cadmium; Cadmium Balls; Cadmium Sticks; Cd; ASTM B440.

Manufacturer:	Supplier:	Preparer:
Teck Metals Ltd. Trail Operations Trail, British Columbia V1R 4L8 Emergency Telephone: 250-364-4214	Teck Metals Ltd. #1700 – 11 King Street West Toronto, Ontario M5H 4C7	Teck Metals Ltd. Suite 3300 – 550 Burrard Street Vancouver, British Columbia V6C 0B3

Date of Last Review: July 27, 2018.

Date of Last Edit: July 27, 2018.

Product Use: Cadmium metal is used as a constituent in easily fusible alloys, in soft solder and solder for aluminum, in electroplating, as a deoxidizer in nickel plating, in process engraving, in electrodes for cadmium vapour lamps, in photoelectric cells, in nickel-cadmium storage batteries, and in pigment manufacture.

SECTION 2. HAZARDS IDENTIFICATION

CLASSIFICATION:

Health		Physical	Environmental
Acute Toxicity (Oral)	– Does not meet criteria	Does not meet criteria for any Physical Hazard	**Aquatic Toxicity** **Long Term – Category 4**
Acute Toxicity (Inhalation)	**– Category 1**		
Skin Irritation	– Does not meet criteria		
Eye Irritation	– Does not meet criteria		
Sensitization	– Does not meet criteria		
Mutagenicity	– Does not meet criteria		
Carcinogenicity	**– Category 1A**		
Reproductive Toxicity	**– Category 2**		
Specific Target Organ Toxicity			
(Acute Exposure)	**– Category 1**		
(Chronic Exposure)	**– Category 1**		

LABEL:

Symbols:  **Signal Word: DANGER**

<u>Hazard Statements</u>	**<u>Precautionary Statements:</u>**
DANGER! Fatal if inhaled as freshly generated cadmium oxide fume. May cause cancer through inhalation of dust/fume. Suspected of damaging fertility or the unborn child. Causes damage to organs through single exposure or prolonged / repeated inhalation of dust or particularly fume. May cause long lasting harmful effects to aquatic life.	Do not handle until all safety precautions have been read and understood. Obtain special instructions before use. Use only outdoors or in a well-ventilated area. Do not breathe cadmium fumes or dust. Wear respiratory protection where cadmium fumes may be generated. Use other personal protective equipment as required. Do not eat, drink or smoke when using this product. Wash hands thoroughly after handling this product. Avoid release to the environment. IF INHALED: Remove person to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTRE or doctor/physician. Specific treatment for possible pulmonary edema is urgent following cadmium fume exposure. IF SWALLOWED: Rinse mouth. Immediately call a POISON CENTRE or doctor/physician. If concerned about exposure, get medical advice.

Emergency Overview: A bluish-silver lustrous metal that does not burn in bulk. However, clouds of finely-divided dust are a fire and explosion hazard. When heated strongly in air cadmium oxide fumes will be generated. Freshly formed cadmium fume is an intense pulmonary irritant and may result in development of pulmonary edema several hours after exposure. Inhalation or ingestion of dust or fumes may produce both acute and chronic health effects. Probable cancer hazard. A self-contained breathing apparatus (SCBA) and full protective clothing are required for all emergency response personnel when cadmium is involved in a fire situation. Do NOT use water or foam. Apply dry chemical, dry sand, or special powder extinguishing media to any burning metal.

Potential Health Effects: Cadmium dust and fume have both acute and chronic health effects. Cadmium dust is a pulmonary irritant. Freshly formed cadmium fume is an intense pulmonary irritant, resulting in respiratory distress and possible pulmonary edema that may develop as much as 48 hours after exposure. In severe cases death may result. Long term exposures may cause kidney dysfunction and lung injury (emphysema) as well as other symptoms. Cadmium is classified as a carcinogen or probable carcinogen by IARC, ACGIH, NTP, OSHA and the EU (see Toxicological Information, Section 11).

Potential Environmental Effects: While cadmium metal has relatively low bioavailability, compounds which it forms with other elements can be potentially toxic to biota at low concentrations. Bioaccumulation of cadmium occurs readily in aquatic and terrestrial food chains, specifically in plants and aquatic organisms (see Ecological Information, Section 12).

SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENTS	**CAS Registry No.**	**CONCENTRATION (% wt./wt.)**
Cadmium	7440-43-9	90.00 – 99.99%

Note: See Section 8 for Occupational Exposure Guidelines.

SECTION 4. FIRST AID MEASURES

Eye Contact: *Symptoms*: Eye irritation, redness. Gently brush product off face. Do not rub eye(s). Let the eye(s) water naturally for a few minutes. Look right and left, then up and down. If particle/dust does not come out, cautiously rinse eye(s) with lukewarm, gently flowing water for 5 minutes or until particle/dust is removed, while holding eyelid(s) open. If eye irritation persists, get medical advice/attention. DO NOT attempt to manually remove anything stuck to the eye.

Skin Contact: *Symptoms*: Skin soiling, irritation. *Dust:* Gently brush away excess product. Take off contaminated clothing, shoes and leather goods (e.g., watchbands, belts). Wash with plenty of lukewarm, gently flowing water and a non-abrasive soap for 5 minutes. If skin irritation occurs, get medical advice/attention. Wash contaminated clothing before re-use. *Molten Metal:* Flush contact area to solidify and cool, but do not attempt to remove encrusted material or clothing. Cover burns and seek medical attention immediately.

Inhalation: *Symptoms:* Wheezing, coughing, throat/chest irritation. Take proper precautions to ensure your own safety before attempting rescue (e.g., wear appropriate protective equipment). Remove source of exposure or move person from exposure area to fresh air immediately and keep comfortable for breathing. Immediately call a Poison Control Centre/Doctor. If breathing is difficult, trained personnel should administer emergency oxygen if advised to do so by the Poison Control Centre/Doctor. DO NOT allow victim to move around unnecessarily. Treat pulmonary edema as a priority, even if no symptoms (i.e. wheezing, coughing, shortness of breath, etc.) are apparent. Symptoms of pulmonary edema can be delayed up to 48 hours after exposure. Quickly transport victim to an emergency care facility.

Ingestion: *Symptoms:* Stomach pain. Immediately call an emergency care facility/poison control centre. Have patient rinse mouth thoroughly with water. DO NOT INDUCE VOMITING. However, the irritant and emetic action of swallowed cadmium usually leads to spontaneous vomiting. If vomiting occurs naturally, have victim rinse mouth with water again, then lie the affected person on their side in the recovery position. If breathing has stopped, trained personnel should begin rescue breathing or, if the heart has stopped, immediately start cardiopulmonary resuscitation (CPR) or automated external defibrillation (AED).

SECTION 5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Massive metal is not flammable or combustible. Finely-divided metallic dust or powder is a moderate fire hazard and moderate explosion hazard when dispersed in air at high concentrations and exposed to heat, flame or other ignition sources. Freshly formed cadmium powder, in contact with limited amounts of water, may heat spontaneously and may ignite or may ignite combustible materials in contact with the powder. Fires and explosions may also occur upon contact with certain incompatible materials (see Stability and Reactivity, Section 10).

Extinguishing Media: Apply dry chemical, dry sand, or special powder extinguishing media (i.e. a Class D Extinguisher) to any burning pieces of metal and allow to cool. Do NOT use water, carbon dioxide, foam or Halon fire extinguishing agents on any burning or molten metal. Water may be ineffective for extinguishing fire but should be used to keep fire-exposed containers cool.

Fire Fighting: If possible, move material from fire area and cool material exposed to flame. Apply dry chemical, dry sand or special powder extinguishing media to burning cadmium. Highly toxic cadmium oxide fumes will evolve in fires. Fire fighters must be fully trained and wear full protective clothing including an approved, self-contained breathing apparatus which supplies a positive air pressure within a full face-piece mask.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Procedures for Cleanup: Control source of spillage if possible to do so safely. Restrict access to the area until completion of clean-up. Clean up spilled material immediately, observing precautions outlined below. Molten metal should be allowed to solidify prior to clean-up. If solid metal, wear gloves, pick up and return to process. If dust, wear recommended personal protective equipment (see below) and use methods that will minimize dust generation (e.g., vacuum solids). Return uncontaminated spilled material to the process if possible. Place contaminated and non-recyclable material into suitable labelled containers for later disposal. Treat or dispose of waste material in accordance with all local, regional and national requirements, as applicable.

Personal Precautions: Persons responding to an accidental release should wear protective clothing, gloves and a respirator (see also Section 8). Close-fitting safety goggles may be necessary in some circumstances to prevent eye contact with dust and fume. Where molten metal is involved, wear heat-resistant gloves and suitable clothing for protection from radiant heat and hot-metal splash as well as a respirator to protect against inhalation of cadmium fume. Workers should wash and change clothing following cleanup of a cadmium spill to prevent personal contamination with cadmium / cadmium oxide dust.

Environmental Precautions: Cadmium metal has relatively low bioavailability; however, compounds which it forms with other elements can be toxic to aquatic and terrestrial biota. Releases of the product to water and soil should be prevented.

SECTION 7. HANDLING AND STORAGE

Precautions for Safe Handling: Cadmium ingots suspected of containing moisture should be THOROUGHLY DRIED before being added to a molten bath. Otherwise, entrained moisture could expand explosively and spatter molten metal out of the bath. Cadmium metal, in contact with wood or other surfaces, may leave traces of cadmium particulate that can accumulate over time. Cleaning or disposal of these surfaces requires review to ensure that any effluent or solid waste disposal meets the requirements of regulations in the applicable jurisdiction.

Conditions for Safe Storage: Store cadmium in a DRY, covered area, away from incompatible materials and food or feedstuffs.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational Exposure Guidelines: *(Time-Weighted Average (TWA) concentration over 8 hr unless otherwise indicated)*

Component	ACGIH TLV	OSHA PEL	NIOSH REL
Cadmium	0.01 mg Cd/m^3 (total dust) 0.002 mg Cd/m^3 (respirable)	0.005 mg Cd/m^3 *OSHA SECAL** *0.015 or 0.05 mg/m^3*	Lowest feasible level

NOTE: OEGs for individual jurisdictions may differ from those given above. Check with local authorities for the applicable OEGs in your jurisdiction.

ACGIH - American Conference of Governmental Industrial Hygienists; OSHA - Occupational Safety and Health Administration; NIOSH - National Institute for Occupational Safety and Health. TLV – Threshold Limit Value, PEL – Permissible Exposure Limit, REL – Recommended Exposure Limit. SECAL – Separate Engineering Control Airborne Limit, TWA – Time Weighted Average.

*SECAL (Separate Engineering Control Airborne Limits): To be achieved in specified processes and work places where it is not possible to achieve the PEL through engineering and work practices alone. The OSHA SECAL for cadmium is 0.015 or 0.050 mg/m^3, depending on the processes involved. See Table 1 of 29 CFR § 1910.1027.

NOTE: The selection of the necessary level of engineering controls and personal protective equipment will vary depending upon the conditions of use and the potential for exposure. The following are therefore only general guidelines that may not fit all circumstances. Control measures to consider include:

Ventilation: Use adequate local or general ventilation to maintain the concentration of cadmium fumes in the working environment well below recommended occupational exposure limits. Supply sufficient replacement air to make up for air removed by the exhaust system. Local exhaust is strongly recommended for melting, casting, grinding and welding or flame cutting of cadmium.

Protective Clothing: Gloves and coveralls or other work clothing are recommended to prevent prolonged or repeated direct skin contact when cadmium is processed. Appropriate eye protection should be worn where fume or dust is generated. Where hot or molten metal is handled, heat resistant gloves, goggles or face shield, respirator and clothing to protect from radiant heat and hot metal splash should be worn. Safety type boots are recommended.

Respirators: Where cadmium dust or fumes are generated and cannot be controlled to within acceptable levels by engineering means, use appropriate NIOSH-approved respiratory protection equipment (a 42CFR84 Class N, R or P-100 particulate filter cartridge). When exposure levels are obviously high but the actual concentration is unknown, a self-contained breathing apparatus which supplies a positive air pressure within a full face-piece mask should be worn.

General Hygiene Considerations: Do not eat, drink or smoke in work areas. Thoroughly wash hands before eating, drinking, or smoking in appropriate, designated areas only. Work clothing should be removed immediately and laundered before reuse if it becomes heavily contaminated. Work clothing should be removed before leaving the plant site and should be changed daily if there is a reasonable probability that the clothing may be contaminated. If using a commercial or industrial laundry service, inform laundry personnel of contaminants' hazards. Workers should shower at the end of each work shift. A double locker-shower system with separate clean and dirty sides is required for cadmium handling operations to avoid cross-contamination of street clothes. Workers should not take dirty work clothes home and launder them with other personal clothing.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Bluish-silver lustrous metal	**Odour:** None	**Odour Threshold:** Not Applicable	**pH:** Not Applicable
Vapour Pressure: 1 mm of Hg @ 394°C negligible @ 20°C	**Vapour Density:** Not Applicable	**Boiling Point/Range:** 765°C	**Melting Point/Range:** 321°C
Relative Density (Water = 1): 8.65	**Evaporation Rate:** Not Applicable	**Coefficient of Water/Oil Distribution:** Not Applicable	**Solubility:** Insoluble in water
Flash Point: Not Applicable	**Flammable Limits** (LEL/UEL): Not Applicable	**Auto-ignition Temperature:** Not Applicable	**Decomposition Temperature:** Not Applicable

SECTION 10. STABILITY AND REACTIVITY

Stability & Reactivity: Massive metal is stable and not considered reactive under normal temperatures and pressures. Hazardous polymerization or runaway reactions will not occur. Metal surfaces tarnish on exposure to moist air. Finely powdered metal or dust can be ignited from a dust cloud in air. Freshly formed cadmium powder, in contact with limited amounts of water, may heat spontaneously and may ignite or may ignite combustible materials in contact with the powder.

Incompatibilities: Cadmium reacts vigorously with oxidizing agents such as peroxides, chlorates, nitrates, and halogens or interhalogen compounds such as chlorine trifluoride as well as with elemental sulphur, zinc, selenium, or tellurium. Mixtures with nitric acid liberate toxic fumes of nitrogen oxides. Violent explosions can occur when the metal is in contact with fused ammonium nitrate or immersed in hydrazoic acid. Burning metal reacts violently with fire extinguishing agents such as water, foam, carbon dioxide or Halons. Cadmium metal reacts with strong acids giving off flammable hydrogen gas.

Hazardous Decomposition Products: High temperature operations such as oxy-acetylene cutting or burning, electric arc welding or overheating a molten bath will generate highly toxic cadmium oxide fumes. These brownish fumes are highly soluble in body fluids and the particle size of the metal fumes is largely within the respirable size range, which increases the likelihood of inhalation and deposition of the fume within the body.

SECTION 11. TOXICOLOGICAL INFORMATION

General: Cadmium dust and fume are both pulmonary irritants, but freshly generated cadmium fume is an intense irritant and its small particle size allows it to reach into the lung more readily. The onset of symptoms is frequently delayed by 4 to 10 hours after exposure and is aggravated by physical effort. Pulmonary edema may then develop rapidly. The mortality rate from acute pulmonary disease is about 20% according to the ACGIH. Those surviving an episode of acute poisoning generally recover slowly but without apparent residual effects.

Chronic exposure to cadmium has been associated with a wide variety of gastrointestinal symptoms, pulmonary edema, and kidney malfunction with increased excretion of a specific low molecular weight protein (beta-2-microglobulin). The body to a large extent retains absorbed cadmium, and excretion is very slow. Cadmium has been linked to both prostate cancer and lung cancer, though several researchers have recently questioned the association with prostate cancer.

Individuals with pre-existing lung, liver, kidney, and blood ailments should be precluded from exposure until approved by a physician. Initial and periodic medical examinations are recommended for persons exposed to levels consistently above about one half of the exposure limits for cadmium.

Acute:
Skin/Eye: Contact with dust or fume may cause local irritation but would not cause tissue damage.

Inhalation: Fumes of cadmium (i.e. cadmium oxide) are highly toxic by inhalation. They may cause serious systemic poisoning and possible permanent damage to the lungs. Early symptoms of excessive exposure include dryness of the throat; irritation of the nose, throat, and respiratory tract; headache; coughing, and a metallic taste. After a delay of several hours (up to 10), a person may develop constriction of the chest, persistent cough, and progressive shortness of breath. There may be headache, chills, diarrhea, muscle aches, nausea, vomiting, irritability, and restlessness. Pulmonary congestion may progress rapidly causing wheezing and symptoms of oxygen deficiency. Death may follow. Recovery from an acute exposure episode is slow but generally without ongoing or lingering effects. Milder cases of acute exposure have produced symptoms resembling metal fume fever with some symptoms and signs of acute gastroenteritis as well.

Ingestion: Ingestion of excessive quantities of cadmium dust may cause salivation, choking, nausea, vomiting, diarrhea, abdominal pain, tenseness, blurred vision, dizziness, vertigo, and headache. Convulsions, exhaustion, collapse, shock, and unconsciousness may occur. Death has followed within 24 hours from shock or after 7 to 14 days from acute kidney failure or cardiopulmonary depression.

Chronic: Prolonged exposure to cadmium dust and/or fume may cause loss of sense of smell, occasional ulcerations of the nasal passages, rhino laryngitis, cough, shortness of breath, mild anemia, sleeplessness, irritability, loss of appetite, and cadmium-yellow fringe on teeth. The primary target organ for chronic cadmium effects is the kidney with increased excretion of a specific low molecular weight protein (beta-2-microglobulin). Damage to the lungs (of the emphysematous type) has been reported in some studies of cadmium-exposed workers but not found in other studies. Cigarette tobacco contains cadmium and smoking adds to the daily intake of cadmium which may increase the risk of cumulative toxic effects. Clinical evidence of the cumulative effects of cadmium may appear after exposure has ceased. Disease may then be progressive.

The International Agency for Research on Cancer (IARC) has classified cadmium and certain cadmium compounds as Group 1 Carcinogens (carcinogenic to humans). The American Conference of Governmental Industrial Hygienists (ACGIH) classifies cadmium as a Suspected Human Carcinogen (A2). The National Toxicology Program (NTP) classifies cadmium as a Known Human Carcinogen and OSHA lists cadmium as a Carcinogen. The European Union (EU) classifies cadmium as a Category 2 (Probable) Carcinogen.

Animal Toxicity:

Hazardous Ingredient:	**Acute Oral Toxicity:**	**Acute Dermal Toxicity:**	**Acute Inhalation Toxicity:**

Cadmium	LD_{50} † = 2,330 mg/kg	No Data	LC_{50} ‡ = 0.011 mg/L (CdO fume)

† LD_{50}, Rat, Oral,

‡ LC_{50}, Rat, Inhalation, 4 hour

SECTION 12. ECOLOGICAL INFORMATION

While cadmium metal is relatively insoluble, its processing or extended exposure in aquatic and terrestrial environments may lead to the release of cadmium in bioavailable forms. Compared to most other metals, cadmium is relatively mobile and toxic in the aquatic environment. Water hardness, pH and dissolved organic carbon are three major factors which regulate the degree of cadmium toxicity. In soils, higher acidity (lower pH) results in the release of cadmium ions, which may, in turn, yield higher toxicity to soil organisms and uptake of cadmium by plants.

Cadmium is strongly accumulated by all organisms through the food chain. Bioaccumulation in aquatic organisms is greatest in invertebrates, followed by fish and aquatic plants. Bioaccumulation of cadmium into terrestrial plants can result in higher cadmium concentrations in terrestrial animals that feed on the plants.

SECTION 13. DISPOSAL CONSIDERATIONS

If material cannot be returned to process, dispose of in accordance with applicable regulations.

SECTION 14. TRANSPORT INFORMATION

PROPER SHIPPING NAME .... Not a regulated product in ingot form
TRANSPORT CANADA AND U.S. DOT HAZARD CLASSIFICATION.... Not Applicable
TRANSPORT CANADA AND U.S. DOT PIN .... Not Applicable
MARINE POLLUTANT.. No
IMO CLASSIFICATION .... Not Regulated

SECTION 15. REGULATORY INFORMATION

U.S.
INGREDIENTS LISTED ON TSCA INVENTORY.................................. Yes

HAZARDOUS UNDER HAZARD COMMUNICATION STANDARD .... Yes

CERCLA SECTION 103 HAZARDOUS SUBSTANCES........................ Cadmium ....Yes....... RQ: 10lbs. (4.54 kg.)*
*reporting not required when diameter of the pieces of solid metal released is equal to or exceeds 100 micrometers (0.004 inches).

EPCRA SECTION 302 EXTREMELY HAZARDOUS SUBSTANCE........ No

EPCRA SECTION 311/312 HAZARD CATEGORIES............................ Immediate (Acute) Health Hazard – Toxic
Delayed (Chronic) Health Hazard – Target Organ Effects (Kidney)
Delayed (Chronic) Health Hazard – Carcinogen
Delayed (Chronic) Health Hazard – Reproductive Toxin

EPCRA SECTION 313 TOXIC RELEASE INVENTORY:........................ Cadmium
CAS NO. 7440-43-9 Percent by Weight: 90.00 – 99.99%

CANADA
INGREDIENT LISTED ON THE DOMESTIC SUBSTANCES LIST .... Yes

SECTION 16. OTHER INFORMATION

Date of Original Issue: July 23, 1997 **Version:** 01 *(First edition)*

Date of Latest Revision: July 27, 2018 **Version:** 12

The information in this Safety Data Sheet is based on the following references:

- American Conference of Governmental Industrial Hygienists, 2004, Documentation of the Threshold Limit Values and Biological Exposure Indices, Seventh Edition plus updates.
- American Conference of Governmental Industrial Hygienists, 22018, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.
- American Conference of Governmental Industrial Hygienists, 2018, Guide to Occupational Exposure Values.

- Australian National Industrial Chemicals Notification & Assessment Scheme (NICNAS) - Human Health Tier II Assessment for Cadmium.
- Bretherick's Handbook of Reactive Chemical Hazards, 20th Anniversary Edition (P. G. Urben Ed.) 1995.
- Canadian Centre for Occupational Health and Safety, Hamilton, ON, CHEMINFO Record No. 3454 Cadmium.
- Chemical Hazards of the Workplace, Nick H. Proctor and James P. Hughes, J. B. Lippincott Company, Philadelphia, 1978.
- European Chemical Agency (ECHA) - Registered Substances Database - Cadmium (last accessed 13 July 2018).
-- European Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures, amending and repealing directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (REACH).
- Health Council of the Netherlands, Cadmium and its compounds - evaluation of the effects on reproduction Report No. 2000-04OSH (3 mei 2000).
- Industry Canada, SOR/2015-17, Hazardous Products Regulations.
- International Agency for Research on Cancer (IARC), Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, 1972 – present, (multi-volume work), World Health Organization, Geneva.
- International Chemical Safety Cards (WHO/IPCS/ILO), ICSC:0020 – Cadmium (April 2005).
- International Labour Office (WHO/ILO) Encyclopedia of Occupational Health & Safety 4th Ed. CD-ROM Version (1998).
- Merck & Co., Inc., 2001, The Merck Index, An Encyclopedia of Chemicals, Drugs, and Biologicals, Thirteenth Edition.
- National Library of Medicine, National Toxicology Information Program, Hazardous Substance Data Bank. (On line version).
- Oak Ridge National Laboratory, Health Sciences Research Division, Toxicity Summary for Cadmium. - November 1991.
- Patty's Toxicology, 5th Edition, (E Bingham, B Cohrssen & C H Powell, Ed.) 2001.
- Scientific Basis for Swedish Occupational Standards XXIV - Cadmium (February 5, 2003).
- U.S. Dept. of Health and Human Services, National Institute for Occupational Safety and Health, Registry of Toxic Effects of Chemical Substances (RTECS) (On line version – accessed 13 July 2018).
- U. S. Dept. of Health and Human Services, National Institute of Environmental Health Sciences, National Toxicology Program (NTP), 14th Report on Carcinogens, November 2016.
- U.S. Dept. of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Toxicological Profile for Cadmium (September 2012).
- U.S. Occupational Safety and Health Administration, 1989, Code of Federal Regulations, Title 29, Part 1910.127, Part 1910.1000 and Part 1910.1200.

Acronyms not spelled out elsewhere in the SDS:

CAS: Chemical Abstracts Service
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
DOT: Department of Transport
EPCRA: Emergency Planning and Community Right-to-Know Act
IMO: International Maritime Organization
LD_{50} LC_{50}: Lethal Dose 50%, Lethal Concentration 50%
TSCA: Toxic Substances Control Act
Wt.: Weight

Notice to Reader

Although reasonable precautions have been taken in the preparation of the data contained herein, it is offered solely for your information, consideration and investigation. Teck Metals Ltd. extends no warranty and assumes no responsibility for the accuracy of the content and expressly disclaims all liability for reliance thereon. This safety data sheet provides guidelines for the safe handling and processing of this product; it does not and cannot advise on all possible situations. Therefore, your specific use of this product should be evaluated to determine if additional precautions are required. Individuals exposed to this product should read and understand this information and be provided pertinent training prior to working with this product.

MATERIAL SAFETY DATA SHEET

CHROMIUM, POWDER

1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MSDS Name:	Chromium, Powder
Synonyms:	Chrome * Chromium, metal (ACGIH)
Company Identification:	**Sisco Research Laboratories Pvt. Ltd**. Andheri (East), Mumbai – 400 099.
Tel :	+91 22 2687 2601
Fax :	+91 22 2687 8241
Website :	www.srlchem.com

2 - COMPOSITION, INFORMATION ON INGREDIENTS

CAS#	Chemical Name:	%	EINECS#
7440-47-3	Chromium, Powder	99%	231-157-5

3 - HAZARDS IDENTIFICATION

Special Indication Of Hazards To Humans And The Environment

Not hazardous according to Directive 67/548/EEC.

4 - FIRST AID MEASURES

Eyes:	In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.
Skin:	In case of contact, immediately wash skin with soap and copious amounts of water.
Ingestion:	If swallowed, wash out mouth with water provided person is conscious. Call a physician.
Inhalation:	If inhaled, remove to fresh air. If breathing becomes difficult, call a physician.
Notes to Physician:	

5 - FIRE FIGHTING MEASURES

Extinguishing Media

Suitable:	Water spray. Carbon dioxide, dry chemical powder, or appropriate foam.
Specific Hazard(s):	Emits toxic fumes under fire conditions.
Special Protective Equipment For Firefighters:	Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.

6 - ACCIDENTAL RELEASE MEASURES

Procedure(S) Of Personal

Precaution(S): Exercise appropriate precautions to minimize direct contact with skin or eyes and prevent inhalation of dust.

Methods For Cleaning Up: Sweep up, place in a bag and hold for waste disposal. Avoid raising dust. Ventilate area and wash spill site after material pickup is complete.

7 – HANDLING AND STORAGE

Handling: Avoid inhalation. Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated exposure.

Storage: Keep tightly closed.

8 – EXPOSURE CONTROLS, PERSONAL PROTECTION

Engineering Controls: Safety shower and eye bath. Mechanical exhaust required.

General Hygiene Measures: Wash thoroughly after handling.

Exposure Limits:	Country	Source	Type	Value
	Poland		NDS	0.5 mg/m3
	Poland		NDSCh -	
	Poland		NDSP -	
Exposure Limits	Denmark	OEL	TWA	0.5 mg/m3
Exposure Limits	Norway		OEL	0.5 mg/m3
Exposure Limits	Sweden		LLV	(Level0.5 mg/m3
Exposure Limits	Switzerland	OEL	OEL	0.5 mg/m3
Exposure Limits	U K	OEL	OEL	0.5 mg/m3

Personal Protective Equipment

Hand Protection: Protective gloves.

Eye Protection: Chemical safety goggles.

Respirators: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks.

9 - PHYSICAL AND CHEMICAL PROPERTIES

Physical State: Solid

Molecular Formula: Cr

Molecular Weight: 52 AMU

10 - STABILITY AND REACTIVITY

Stability: Stable.

Conditions of Instability: May decompose on exposure to air.

Materials to Avoid: Strong acids, Strong oxidizing agents.

Hazardous Decomposition Products: Nature of decomposition products not known.

Hazardous Polymerization: Will not occur

11 - TOXICOLOGICAL INFORMATION

RTECS#:	GB4200000
Sensitization:	Prolonged or repeated exposure may cause allergic reactions in certain sensitive individuals.
Signs And Symptoms Of Exposure:	To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.
ROUTE OF EXPOSURE	
Skin Contact:	May cause skin irritation.
Skin Absorption:	May be harmful if absorbed through the skin.
Eye Contact:	May cause eye irritation.
Inhalation:	May be harmful if inhaled. Material may be irritating to mucous membranes and upper respiratory tract.
Ingestion:	May be harmful if swallowed.
Target Organ Information:	Kidneys. Liver.
Chronic Exposure	Carcinogen
Result:	This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.
	Rat
Route of Application:	Intravenous
Exposure Time:	6W
Result:	Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Gastrointestinal:Tumors. Blood:Lymphomas including Hodgkin's disease.
	Rat
Route of Application:	Implant
Exposure Time:	6W
Result: Blood:	Lymphomas including Hodgkin's disease.
Tumorigenic:	Equivocal tumorigenic agent by RTECS criteria.
Tumorigenic:	Tumors at site or application.
	Rabbit
Route of Application:	Implant
Result: Tumorigenic:	Equivocal tumorigenic agent by RTECS criteria.
Musculoskeletal:	Tumors.
IARC Carcinogen List:	Rating: Group 3

12 - ECOLOGICAL INFORMATION

No data available.

13 - DISPOSAL CONSIDERATIONS

Substance Disposal:	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 and af terburner and scrubber. Observe all federal, state, and local environmental regulations.

14 - TRANSPORT INFORMATION

	IATA	IMO	RID/ADR
Shipping Name:	Non-hazardous	Non-hazardous	Non-hazardous
Hazard Class:			
UN Number:			
Packing Group:			

15 - REGULATORY INFORMATION

Not hazardous according to Directive 67/548/EEC.

16 - ADDITIONAL INFORMATION

SISCO RESEARCH LABORATORIES provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose.

Material Safety Data Sheet

Chrysene, 98%

MSDS# 95251

Section 1 - Chemical Product and Company Identification

MSDS Name:	Chrysene, 98%
Catalog Numbers:	AC224140000, AC224140010, AC224140050, AC224145000
Synonyms:	1,2-Benzophenanthrene; Benzo(a)phenanthrene; 1,2,5,6-Dibenzonaphthalene.
Company Identification:	Acros Organics BVBA Janssen Pharmaceuticalaan 3a 2440 Geel, Belgium
Company Identification: (USA)	Acros Organics One Reagent Lane Fair Lawn, NJ 07410
For information in the US, call:	800-ACROS-01
For information in Europe, call:	+32 14 57 52 11
Emergency Number, Europe:	+32 14 57 52 99
Emergency Number US:	201-796-7100
CHEMTREC Phone Number, US:	800-424-9300
CHEMTREC Phone Number, Europe:	703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#:	218-01-9
Chemical Name:	Chrysene
%:	98
EINECS#:	205-923-4

Hazard Symbols: T

Risk Phrases: 45 50/53

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Caution! May cause respiratory tract irritation. May cause eye and skin irritation. May cause cancer in humans. Target Organs: Liver, skin.

Potential Health Effects

Eye:	May cause eye irritation.
Skin:	May cause skin irritation.
Ingestion:	May cause gastrointestinal irritation with nausea, vomiting and diarrhea.
Inhalation:	May cause respiratory tract irritation.
Chronic:	May cause cancer according to animal studies.

Section 4 - First Aid Measures

Eyes:	Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Skin: Get medical aid. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion: Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

Inhalation: Get medical aid immediately. Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Notes to Physician:

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. This material in sufficient quantity and reduced particle size is capable of creating a dust explosion.

Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or chemical foam.

Autoignition Temperature: Not available.

Flash Point: Not applicable.

Explosion Limits: Lower: Not available

Explosion Limits: Upper: Not available

NFPA Rating: health: ; flammability: 1; instability: ;

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Vacuum or sweep up material and place into a suitable disposal container. Clean up spills immediately, observing precautions in the Protective Equipment section. Wear a self contained breathing apparatus and appropriate personal protection. (See Exposure Controls, Personal Protection section). Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Wash thoroughly after handling. Avoid contact with eyes, skin, and clothing. Use only with adequate ventilation. Avoid breathing dust.

Storage: Store in a tightly closed container. Store in a cool, dry area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Chrysene	0.2 mg/m3 TWA (as benzene soluble aerosol) (listed under Coal tar pitches).	0.1 mg/m3 TWA	0.2 mg/m3 TWA (benzene soluble fraction) (listed under Coal tar pitches).

OSHA Vacated PELs: Chrysene: 0.2 mg/m3 TWA (benzene soluble fraction) (listed under Coal tar pitches)

Engineering Controls:

Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels.

Exposure Limits

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: 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: Solid
Color: very light beige
Odor: Not available
pH: Not available
Vapor Pressure: Not available
Vapor Density: Not available
Evaporation Rate: Not available
Viscosity: Not available
Boiling Point: 448 deg C @ 760 mm Hg (838.40°F)
Freezing/Melting Point: 250-255 deg C
Decomposition Temperature: Not available
Solubility in water: insoluble
Specific Gravity/Density:
Molecular Formula: C18H12
Molecular Weight: 228.29

Section 10 - Stability and Reactivity

Chemical Stability:	Stable under normal temperatures and pressures.
Conditions to Avoid:	Dust generation.
Incompatibilities with Other Materials	Not available
Hazardous Decomposition Products	Carbon monoxide, carbon dioxide.
Hazardous Polymerization	Has not been reported.

Section 11 - Toxicological Information

RTECS#: CAS# 218-01-9: GC0700000

LD50/LC50: RTECS: Not available.

Carcinogenicity: Chrysene - ACGIH: A1 - Confirmed Human Carcinogen (Coal tar pitches). California: carcinogen, initial date 1/1/90 NTP: Known carcinogen (Coal tar pitches). IARC: Group 1 carcinogen (Coal tar pitches).

Other: See actual entry in RTECS for complete information.

Section 12 - Ecological Information

Ecotoxicity: Water flea LC50 = 1.9 mg/L; 2 Hr.; Unspecified

Section 13 - Disposal Considerations

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

Section 14 - Transport Information

US DOT
Shipping Name: Please contact Fisher Scientific for shipping information
Hazard Class:
UN Number:
Packing Group:
Canada TDG
Shipping Name: Not available
Hazard Class:
UN Number:
Packing Group:

USA RQ: CAS# 218-01-9: 100 lb final RQ; 45.4 kg final RQ

Section 15 - Regulatory Information

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: T

Risk Phrases:

R 45 May cause cancer.

R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 53 Avoid exposure - obtain special instructions before use.

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 60 This material and its container must be disposed of as hazardous waste.

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

WGK (Water Danger/Protection)

CAS# 218-01-9: Not available

Canada

CAS# 218-01-9 is listed on Canada's DSL List

Canadian WHMIS Classifications: D2A

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

CAS# 218-01-9 is listed on Canada's Ingredient Disclosure List

US Federal

TSCA

CAS# 218-01-9 is listed on the TSCA Inventory.

Section 16 - Other Information

MSDS Creation Date: 6/30/1999

Revision #6 Date 7/20/2009

COPPER METAL
SAFETY DATA SHEET

SECTION 1. IDENTIFICATION

Product Identity: Copper Metal.

Trade Names and Synonyms: Cu-CATH-1; Copper Cathode (Higher Purity Grade).

Manufacturer:	**Supplier:**	**Preparer:**
Teck Advanced Materials Inc. 13670 Danielson Street Suite H & I Poway, CA 92064 Emergency Telephone: 858-391-2935	Teck Advanced Materials Inc. 13670 Danielson Street Suite H & I Poway, CA 92064	Teck Metals Ltd. Suite 3300 – 550 Burrard Street Vancouver, British Columbia V6C 0B3

Date of Last Review: June 19, 2015.

Date of Last Edit: June 19, 2015.

Product Use: Copper is used in the manufacture of bronzes, brass, other copper alloys, and electrical conductors.

SECTION 2. HAZARDS IDENTIFICATION

CLASSIFICATION:

NOTE: In the form in which it is sold, this product is not regulated as a Hazardous Product in the U.S. or Canada. This Safety Data Sheet is provided for information purposes only.

Health		Physical	Environmental
Acute Toxicity (Oral, Inhalation)	– Does not meet criteria	Does not meet criteria for any Physical Hazard	Aquatic Toxicity – (Short Term/Long Term) Does not meet any criteria
Skin Corrosion/Irritation	– Does not meet criteria		
Eye Damage/Eye Irritation	– Does not meet criteria		
Respiratory or Skin Sensitization	– Does not meet criteria		
Mutagenicity	– Does not meet criteria		
Carcinogenicity	– Does not meet criteria		
Reproductive Toxicity	– Does not meet criteria		
Specific Target Organ Toxicity:			
Acute Exposure	– Does not meet criteria		
Chronic Exposure	– Does not meet criteria		

LABEL:

Symbols: None required	**Signal Word:** None required
Hazard Statements	**Precautionary Statements:**
None required	None required

Emergency Overview: Reddish metal that does not burn in bulk. Copper dust clouds will not explode readily, if at all, in air. Due to its high melting point, molten copper metal is unlikely to occur in most fire situations. This metal is relatively non-toxic and poses little immediate hazard to personnel or the environment in an emergency situation.

Potential Health Effects: Inhalation of dust may result in irritation of the nasal mucous membranes. Inhalation of copper oxide fumes may cause irritation of the upper respiratory tract and may result in a form of metal fume fever, characterized by flu-like symptoms such as chills, fever, nausea, and vomiting. Ingestion of copper metal may cause metallic taste and gastrointestinal irritation. Copper particles embedded in the eye may cause redness, pain and discoloration of ocular tissue. Direct skin contact may result in irritation in some workers. Discoloration of the skin has been observed from handling copper, but does not indicate an actual injury. Copper is not listed as a carcinogen by OSHA, the NTP, the ACGIH, IARC, or the EU (see Toxicological Information, Section 11).

Potential Environmental Effects: Copper is relatively insoluble in water and, therefore, likely has low bioavailability. However, long-term exposure in aquatic and terrestrial environments or processing of the product can lead to the release of the constituent copper in more bioavailable forms. These bioavailable forms have the potential to yield toxic effects on aquatic organisms (see Ecological Information, Section 12).

SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS

COMPONENT	CAS Registry No.	CONCENTRATION (% wgt/wgt)
Copper	7440-50-8	>99.9%

Note: See Section 8 for Occupational Exposure Guidelines.

SECTION 4. FIRST AID MEASURES

Eye Contact: *Symptoms: Mild eye irritation, redness.* Do not allow victim to rub eye(s). Let the eye(s) water naturally for a few minutes. If particle/dust does not dislodge, flush with lukewarm, gently flowing water for five minutes or until particle/dust is removed, while holding eyelid(s) open. If irritation persists, immediately obtain medical attention. DO NOT attempt to manually remove anything stuck to the eye, but rather seek immediate medical attention in this case.

Skin Contact: *Symptoms: Soiling of skin.* Dust: No health effects expected. If irritation does occur, flush with lukewarm, gently flowing water and mild soap for five minutes or until the product is removed. If skin irritation persists or if you feel unwell, obtain medical advice. Molten Metal: Flush contact area to solidify and cool but do not attempt to remove encrusted material or clothing. Cover burns and seek medical attention immediately.

Inhalation: *Symptoms: Coughing and irritation in heavy dust/fume clouds.* If symptoms are experienced, remove source of contamination or move victim from exposure area to fresh air. Get medical advice/attention if you feel unwell or are concerned. NOTE: Metal fume fever may develop 3-10 hours after exposure to copper fume. If symptoms of metal fume fever (flu-like symptoms) develop, obtain medical attention.

Ingestion: *Symptoms: Metallic taste, stomach upset.* Rinse mouth. If irritation or discomfort occurs, obtain medical advice.

SECTION 5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Massive metal is not considered a fire or explosion hazard. Finely-divided copper metal dust or powder has also been demonstrated to be non-flammable in laboratory testing. Explosions may occur however upon contact with certain incompatible materials (see Stability and Reactivity, Section 10).

Extinguishing Media: Use any means of extinction appropriate for the surrounding fire conditions such as water spray, carbon dioxide, dry chemical, or foam.

Fire Fighting: If possible, move solid materials from fire area. Cool any materials that are exposed to heat or flames by the application of water streams until well after the fire has been extinguished. Copper metal has a high melting point, and is unlikely to melt except in the most extreme fire conditions. If molten metal is present, do not use direct water streams on fires, due to the risk of a steam explosion that could potentially eject molten metal uncontrollably. Use a fine water mist on the front-running edge of the spill and on the top of the molten metal to cool and solidify it. Fire fighters must be fully trained and wear full protective clothing including an approved, self-contained breathing apparatus which supplies a positive air pressure within a full face piece mask.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Procedures for Cleanup: Control source of spillage if possible to do so safely. Clean up spilled material immediately, observing precautions in Section 8, Personal Protection. Molten metal should be allowed to cool and harden before cleanup. Once solidified wear gloves, pick up and return to process. Powder or dust should be cleaned up using methods which will minimize dust generation (e.g., vacuum solids, dampen material and shovel or wet sweep). Return uncontaminated spilled material to the process if possible. Place contaminated material in suitable labelled containers for later recovery in view of the commercial value of copper. Treat or dispose of waste material in accordance with all local, state/provincial, and national requirements.

Personal Precautions: Persons responding to an accidental release should wear protective clothing, gloves and a respirator in the event of a molten metal spill (see also Section 8). Close-fitting safety goggles may be necessary in some circumstances to prevent eye contact with dust and fume. Where molten metal is involved, wear heat-resistant gloves and suitable clothing for protection from hot-metal splash and radiant heat.

Environmental Precautions: Copper compounds, while not readily bioavailable in the environment, have the potential to pose ecological effects to aquatic life forms under certain chemical conditions. Releases of the product to water and soil should, therefore, be prevented.

SECTION 7. HANDLING AND STORAGE

Store copper in a dry, covered area. Copper cathodes suspected of containing moisture should be THOROUGHLY DRIED before being added to a molten bath. Cathodes may contain cavities that collect moisture. Entrained moisture will expand explosively when immersed in a molten bath and potentially spatter molten metal out of the bath.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational Exposure Guidelines:

Component	**ACGIH TLV**	**OSHA PEL**	**NIOSH REL**
Copper (Dust)	1 mg Cu/m^3	1 mg Cu/m^3	1 mg Cu/m^3
Copper (Fume)	0.2 mg Cu/m^3	0.1 mg Cu/m^3	0.1 mg Cu/m^3

NOTE: OEGs for individual jurisdictions may differ from those given above. Check with local authorities for the applicable OEGs in your jurisdiction.
ACGIH - American Conference of Governmental Industrial Hygienists; OSHA - Occupational Safety and Health Administration; NIOSH - National Institute for Occupational Safety and Health. TLV – Threshold Limit Value, PEL – Permissible Exposure Limit, REL – Recommended Exposure Limit.

NOTE: The selection of the necessary level of engineering controls and personal protective equipment will vary depending upon the conditions of use and the potential for exposure. The following are therefore only general guidelines that may not fit all circumstances. Control measures to consider include:

Ventilation: Use adequate local or general ventilation to maintain the concentration of copper (as either dust or fumes) in the working environment well below recommended occupational exposure limits. Supply sufficient replacement air to make up for air removed by the exhaust system.

Protective Clothing: Gloves and coveralls or other work clothing are recommended to prevent prolonged or repeated direct skin contact when copper is processed. Appropriate eye protection should be worn where fume or dust is generated. Where hot or molten metal is handled, heat resistant gloves, goggles or face shield, and clothing to protect from hot metal splash and radiant heat should be worn. Safety type boots are recommended.

Respirators: Where copper dust or fumes are generated and cannot be controlled to within acceptable levels by engineering means, use appropriate NIOSH-approved respiratory protection equipment (a 42CFR84 Class N, R or P-95 particulate filter cartridge as a minimum).

General Hygiene Considerations: Always practice good personal hygiene. Refrain from eating, drinking, or smoking in work areas. Thoroughly wash hands before eating, drinking, or smoking in appropriate, designated areas.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Reddish metal	**Odour:** None	**Odour Threshold:** Not Applicable	**pH:** Not Applicable
Vapour Pressure: 1 mm Hg at 1083°C Negligible @ 20°C	**Vapour Density:** Not Applicable	**Melting Point/Range:** 1083°C	**Boiling Point/Range:** 2595°C
Relative Density (Water = 1)**:** 8.94	**Evaporation Rate:** Not Applicable	**Coefficient of Water/Oil Distribution:** Not Applicable	**Solubility:** Insoluble in water
Flash Point: None	**Flammable Limits (LEL/UEL):** Not Flammable	**Auto-ignition Temperature:** None	**Decomposition Temperature:** None

SECTION 10. STABILITY AND REACTIVITY

Stability & Reactivity: Copper is stable and not considered reactive under normal temperatures and pressures. Hazardous polymerization or runaway reactions will not occur.

Incompatibilities: Copper is incompatible with nitric acid, acetylene, chlorine, fluorine, chlorine trifluoride, and peroxides. Shock-sensitive compounds are formed with acetylenic compounds, ethylene oxide or azide compounds. Copper in finely-divided powder or granular form reacts with strong oxidants like chlorates, bromates, iodates and ammonium nitrate causing a potential explosion hazard.

Hazardous Decomposition Products: High temperature operations such as oxy-acetylene cutting, electric arc welding, arc-air gouging or overheating a molten metal bath may generate copper fumes. These fumes will contain copper oxides, which, on inhalation in sufficient quantity, can produce metal fume fever.

SECTION 11. TOXICOLOGICAL INFORMATION

General: Copper is an essential element, but can become toxic when inhaled or ingested in large doses. Most reports of acute toxicity are from suicidal attempts involving ingestion of copper sulphate. Individuals with a rare disorder called “Wilson’s Disease” (estimated prevalence 0.003% of the population) are predisposed to accumulate copper and should not be occupationally exposed. However, in the form in which this product is sold it is relatively non-toxic. The major route of exposure would be through the generation and inhalation of copper oxide fume.

Acute:
Skin: Copper metal is not irritating to skin other than by direct abrasive action of metal particles on skin tissue.

Eye: Contact with dust or fume may cause local irritation. Embedded copper particles in the eye result in a brownish or green-brown discoloration of the cornea, lens and iris (chalcosis) which may progress to serious ocular complications.

Inhalation: Copper dust may be irritating to the nasal passages and the throat with a sweetish, metallic taste and excessive salivation. An intense, short-term exposure to copper fumes from cutting or welding, etc. could result in the condition called metal fume fever. The symptoms of metal fume fever generally occur within 3 to 10 hours. They may include immediate dryness and irritation of the throat, metallic taste, tightness of the chest, and coughing that may later be followed by flu-like symptoms of fever, malaise, perspiration, frontal headache, muscle cramps, low back pain, occasionally blurred vision, nausea, and vomiting. Those experiencing a single acute episode of metal fume fever generally recover slowly but without apparent residual effects.

Ingestion: Ingestion of copper metal may cause metallic taste and gastrointestinal irritation. Individuals reported to have ingested large quantities of copper salts have reported gastrointestinal effects including vomiting, diarrhea, nausea, malaise, anorexia, abdominal pain and a metallic taste in the mouth. Effects on the kidneys and liver, and even death have also been reported in severe cases of copper poisoning from ingesting soluble copper salts. However, copper is a strong emetic and spontaneous vomiting following ingestion usually limits uptake of copper.

Chronic: Prolonged exposure to copper dust or fume can cause irritation to the eye and skin. A green discoloration of the skin has been reported similar to that sometimes experienced from copper jewelry. This green discoloration may occasionally also be seen in hair (particularly notable in blonde hair), nails and teeth. A few instances of allergic contact dermatitis have been reported. Copper is not listed as a human carcinogen by the Occupational Safety and Health Administration (OSHA), the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), the American Conference of Governmental Industrial Hygienists (ACGIH) or the European Union (EU).

Animal Toxicity:

Hazardous Ingredient:	Acute Oral Toxicity:	Acute Dermal Toxicity:	Acute Inhalation Toxicity:
Copper	>5,000 mg/kg[†]	>2,000 mg/kg[*]	>5.11 mg/L[‡]

[†] LD_{50}, Mouse, Oral, [‡] LC_{50}, Rat, Inhalation, 4 hour [*] LD_{50}, Mouse, Dermal

SECTION 12. ECOLOGICAL INFORMATION

Copper metal is relatively insoluble in water and, therefore, generally has low bioavailability. However, long-term exposure in aquatic and terrestrial environments or processing of the product can lead to the release of the constituent copper in more bioavailable forms. These more bioavailable forms have the potential to yield toxic effects under specific chemical conditions (e.g., low pH). The mobility of the copper compounds in soluble forms is also media-dependent. They can bind with inorganic and organic ligands, reducing their mobility and bioavailability in both soil and water. Bioavailability is also regulated by other factors in the aquatic environment, such as hardness and dissolved organic carbon content.

SECTION 13. DISPOSAL CONSIDERATIONS

If material cannot be returned to process or salvage, dispose of in accordance with applicable regulations.

SECTION 14. TRANSPORT INFORMATION

No special shipping or transportation requirements in ingot form.

SECTION 15. REGULATORY INFORMATION

U.S.
INGREDIENTS LISTED ON TSCA INVENTORY..................................... Yes

HAZARDOUS UNDER HAZARD COMMUNICATION STANDARD......... No (CFR 1910.1200, revised March 26, 2012)

CERCLA SECTION 103 HAZARDOUS SUBSTANCES .... Yes ....RQ: 5,000 lbs. (2270 kg.)*
*reporting not required when diameter of the pieces of solid metal released is equal to or exceeds 100 micrometers (0.004 inches).

EPCRA SECTION 302 EXTREMELY HAZARDOUS SUBSTANCE .... No

EPCRA SECTION 311/312 HAZARD CATEGORIES .... No Hazard Categories Apply

EPCRA SECTION 313 TOXIC RELEASE INVENTORY:......................... Copper ....CAS No. 7440-50-8
Percent by Weight - At least 99%

SECTION 16. OTHER INFORMATION

Date of Original Issue:	January 12, 2007	**Version:**	01 *(First edition)*
Date of Latest Revision:	June 19, 2015	**Version:**	05

The information in this Safety Data Sheet is based on the following references:

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- American Conference of Governmental Industrial Hygienists, 2015, Guide to Occupational Exposure Values.
- BIA Report 13/97 – Combustion and Explosion Characteristics of Dusts – Table 2 Product Group: Metals and Alloys.
- Bretherick's Handbook of Reactive Chemical Hazards, 20th Anniversary Edition. (P. G. Urben, Ed.) 1995.
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- Commission de la santé et la sécurité du travail, Service du répertoire toxicologique, Cuivre , 2010-07.
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- International Labour Office (WHO/ILO) Encyclopedia of Occupational Health & Safety 4th Ed. CD-ROM Version (1998).
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- Toxicology of the Eye, 2nd Ed. W. Morton Grant, MD, Charles C. Thomas , Publishers; Springfield. IL (1974).
- University of Pittsburgh Safety Manual, EHS Policy # 02-005 – Combustible Metals – 01 Jan 2007.
- U.S. Dept of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Toxicological Profile for Copper (Sept 2004).
- U.S. Dept of Health and Human Services, National Institute for Occupational Safety and Health, NIOSH Pocket Guide to Chemical Hazards. CD-ROM Edition September 2005.
- U.S. Dept of Health and Human Services, National Institute for Occupational Safety and Health, Registry of Toxic Effects of Chemical Substances (RTECS) CCOHS Web Access subscription.
- U.S. Occupational Safety and Health Administration, 1989, Code of Federal Regulations, Title 29, Part 1910.

Notice to Reader
Although reasonable precautions have been taken in the preparation of the data contained herein, it is offered solely for your information, consideration and investigation. Teck Advanced Materials Inc. extends no warranty and assumes no responsibility for the accuracy of the content and expressly disclaims all liability for reliance thereon. This safety data sheet provides guidelines for the safe handling and processing of this product; it does not and cannot advise on all possible situations. Therefore, your specific use of this product should be evaluated to determine if additional precautions are required. Individuals exposed to this product should read and understand this information and be provided pertinent training prior to working with this product.

Material Safety Data Sheet

Dibenz[a,h]anthracene, 99% (UV-Vis)

MSDS# 66416

Section 1 - Chemical Product and Company Identification

MSDS Name:	Dibenz[a,h]anthracene, 99% (UV-Vis)
Catalog Numbers:	AC406430000, AC406430010, AC406432500
Synonyms:	1,2:5,6-Dibenz(a)anthracene.
Company Identification:	Acros Organics BVBA Janssen Pharmaceuticalaan 3a 2440 Geel, Belgium
Company Identification: (USA)	Acros Organics One Reagent Lane Fair Lawn, NJ 07410
For information in the US, call:	800-ACROS-01
For information in Europe, call:	+32 14 57 52 11
Emergency Number, Europe:	+32 14 57 52 99
Emergency Number US:	201-796-7100
CHEMTREC Phone Number, US:	800-424-9300
CHEMTREC Phone Number, Europe:	703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#:	53-70-3
Chemical Name:	Dibenz[a,h]anthracene
%:	99
EINECS#:	200-181-8

Hazard Symbols: T N

Risk Phrases: 45 50/53

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Caution! May cause respiratory tract irritation. Cancer suspect agent. May cause eye and skin irritation. Target Organs: None known.

Potential Health Effects

Eye:	May cause eye irritation.
Skin:	May cause skin irritation.
Ingestion:	May cause irritation of the digestive tract.
Inhalation:	May cause respiratory tract irritation.
Chronic:	May cause cancer in humans.

Section 4 - First Aid Measures

Eyes:	Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Remove contaminated clothing and shoes.

Ingestion: Get medical aid. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.

Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media: Use agent most appropriate to extinguish fire. Use water spray, dry chemical, carbon dioxide, or appropriate foam.

Autoignition Temperature: Not applicable.

Flash Point: Not applicable.

Explosion Limits: Lower: Not available

Explosion Limits: Upper: Not available

NFPA Rating: health: 1; flammability: 1; instability: 0;

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Vacuum or sweep up material and place into a suitable disposal container. Clean up spills immediately, observing precautions in the Protective Equipment section. Avoid generating dusty conditions. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.

Storage: Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Dibenz[a,h]anthracene	none listed	none listed	none listed

OSHA Vacated PELs: Dibenz[a,h]anthracene: None listed

Engineering Controls:

Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

Exposure Limits

Personal Protective Equipment

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Solid
Color: off-white
Odor: Not available
pH: Not available
Vapor Pressure: Not available
Vapor Density: Not available
Evaporation Rate: Not available
Viscosity: Not available
Boiling Point: Not available
Freezing/Melting Point: 265 deg C (509.00°F)
Decomposition Temperature: Not available
Solubility in water: Not available
Specific Gravity/Density:
Molecular Formula: C22H14
Molecular Weight: 278.34

Section 10 - Stability and Reactivity

Chemical Stability:	Stable under normal temperatures and pressures.
Conditions to Avoid:	Incompatible materials, dust generation, excess heat, strong oxidants.
Incompatibilities with Other Materials	Not available
Hazardous Decomposition Products	Carbon monoxide, carbon monoxide, carbon dioxide.
Hazardous Polymerization	Has not been reported.

Section 11 - Toxicological Information

RTECS#:	CAS# 53-70-3: HN2625000
LD50/LC50:	RTECS: Not available.
Carcinogenicity:	Dibenz[a,h]anthracene - California: carcinogen, initial date 1/1/88 NTP: Suspect carcinogen IARC: Group 2A carcinogen
Other:	See actual entry in RTECS for complete information.

Section 12 - Ecological Information

Ecotoxicity:	Not available

Other: For more information, see "HANDBOOK OF ENVIRONMENTAL FATE AND EXPOSURE DATA."

Section 13 - Disposal Considerations

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

Section 14 - Transport Information

US DOT
Shipping Name: Please contact Fisher Scientific for shipping information
Hazard Class:
UN Number:
Packing Group:
Canada TDG
Shipping Name: Not available
Hazard Class:
UN Number:
Packing Group:

USA RQ: CAS# 53-70-3: 1 lb final RQ; 0.454 kg final RQ

Section 15 - Regulatory Information

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: T N

Risk Phrases:

R 45 May cause cancer.

R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 53 Avoid exposure - obtain special instructions before use.

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 60 This material and its container must be disposed of as hazardous waste.

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

WGK (Water Danger/Protection)

CAS# 53-70-3: Not available

Canada

CAS# 53-70-3 is listed on Canada's NDSL List

Canadian WHMIS Classifications: D2A

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

CAS# 53-70-3 is listed on Canada's Ingredient Disclosure List

US Federal

TSCA

CAS# 53-70-3 is listed on the TSCA Inventory.

Section 16 - Other Information

MSDS Creation Date: 6/24/1999

Revision #6 Date 7/20/2009

SAFETY DATA SHEET

1. Identification

Product identifier	**Dieldrin**	
Other means of identification		
Item	N-11688	
CAS number	60-57-1	
Synonyms	(1a.alpha.,2.beta.,2a.alpha.,3.beta.,6.beta.,6a.alpha .,7.beta.,7a.alpha.)-3,4,5,6,9,9-Hexachloro-1a,2,2a,3 ,6,6a,7,7a-octahydro-2,7 : 3,6-dimethanonaphth[2,3-b]oxirene	
Recommended use	For Laboratory Use Only	
Recommended restrictions	None known.	
Manufacturer/Importer/Supplier/Distributor information		
Manufacturer		
Company name	Chem Service, Inc.	
Address	660 Tower Lane West Chester, PA 19380 United States	
Telephone	Toll Free	800-452-9994
	Direct	610-692-3026
Website	www.chemservice.com	
E-mail	info@chemservice.com	
Emergency phone number	Chemtrec US	800-424-9300
	Chemtrec outside US	+1 703-527-3887

2. Hazard(s) identification

Physical hazards	Not classified.	
Health hazards	Acute toxicity, oral	Category 2
	Acute toxicity, dermal	Category 1
	Acute toxicity, inhalation	Category 1
	Skin corrosion/irritation	Category 1B
	Serious eye damage/eye irritation	Category 1
	Carcinogenicity	Category 1B
	Reproductive toxicity	Category 1
	Specific target organ toxicity, repeated exposure	Category 1
Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 1
	Hazardous to the aquatic environment, long-term hazard	Category 1
OSHA defined hazards	Not classified.	

Label elements

Signal word	Danger
Hazard statement	Fatal if swallowed. Fatal in contact with skin. Causes severe skin burns and eye damage. Causes serious eye damage. Fatal if inhaled. May cause cancer. May damage fertility or the unborn child. Causes damage to organs through prolonged or repeated exposure. Very toxic to aquatic life. Very toxic to aquatic life with long lasting effects.

Precautionary statement

Prevention	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not breathe dust. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Use only outdoors or in a well-ventilated area. Avoid release to the environment. Wear protective gloves/protective clothing/eye protection/face protection. Wear respiratory protection.
Response	If swallowed: Immediately call a poison center/doctor. If swallowed: Rinse mouth. Do NOT induce vomiting. If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. If inhaled: Remove person to fresh air and keep comfortable for breathing. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a poison center/doctor. Take off immediately all contaminated clothing and wash it before reuse. Collect spillage.
Storage	Store in a well-ventilated place. Keep container tightly closed. Store locked up.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC)	None known.
Supplemental information	None.

3. Composition/information on ingredients

Substances

Chemical name	Common name and synonyms	CAS number	%
Dieldrin	(1a.alpha.,2.beta.,2a.alpha.,3.beta.,6.beta.,6a.alpha.,7.beta.,7a.alpha.)-3,4,5,6,9,9-Hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-2,7 : 3,6-dimethanonaphth[2,3-b]oxirene	60-57-1	100

4. First-aid measures

Inhalation	Remove victim to fresh air and keep at rest in a position comfortable for breathing. Oxygen or artificial respiration if needed. Do not use mouth-to-mouth method if victim inhaled the substance. Induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Call a physician or poison control center immediately.
Skin contact	Take off immediately all contaminated clothing. Rinse skin with water/shower. Call a physician or poison control center immediately. Chemical burns must be treated by a physician. Wash contaminated clothing before reuse.
Eye contact	Do not rub eyes. Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a physician or poison control center immediately.
Ingestion	Call a physician or poison control center immediately. Rinse mouth. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs. Do not use mouth-to-mouth method if victim ingested the substance. Induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
Most important symptoms/effects, acute and delayed	Convulsions. Headache. Dizziness. Nausea, vomiting. Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result. Prolonged exposure may cause chronic effects.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Chemical burns: Flush with water immediately. While flushing, remove clothes which do not adhere to affected area. Call an ambulance. Continue flushing during transport to hospital. Keep victim warm. Keep victim under observation. Symptoms may be delayed.
General information	Take off immediately all contaminated clothing. IF exposed or concerned: Get medical advice/attention. If you feel unwell, seek medical advice (show the label where possible). Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance. Discard any shoes or clothing items that cannot be decontaminated.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Foam. Dry chemical powder. Carbon dioxide (CO_2).
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	During fire, gases hazardous to health may be formed.

Special protective equipment and precautions for firefighters	Self-contained breathing apparatus and full protective clothing must be worn in case of fire.
Fire fighting equipment/instructions	Use water spray to cool unopened containers.
Specific methods	Use standard firefighting procedures and consider the hazards of other involved materials.
General fire hazards	No unusual fire or explosion hazards noted.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Wear appropriate protective equipment and clothing during clean-up. Do not breathe dust. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ensure adequate ventilation. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Avoid dispersal of dust in the air (i.e., clearing dust surfaces with compressed air). Prevent entry into waterways, sewer, basements or confined areas. Stop the flow of material, if this is without risk . Large Spills: Wet down with water and dike for later disposal. Absorb in vermiculite, dry sand or earth and place into containers. Shovel the material into waste container. Following product recovery, flush area with water. Small Spills: Sweep up or vacuum up spillage and collect in suitable container for disposal. Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. Never return spills to original containers for re-use. Put material in suitable, covered, labeled containers. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid release to the environment. Inform appropriate managerial or supervisory personnel of all environmental releases. Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground.

7. Handling and storage

Precautions for safe handling	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Minimize dust generation and accumulation. Do not breathe dust. Do not get in eyes, on skin, or on clothing. Do not taste or swallow. Avoid prolonged exposure. When using, do not eat, drink or smoke. Pregnant or breastfeeding women must not handle this product. Should be handled in closed systems, if possible. Use only outdoors or in a well-ventilated area. Wear appropriate personal protective equipment. Wash hands thoroughly after handling. Avoid release to the environment. Wash contaminated clothing before reuse. Observe good industrial hygiene practices.
Conditions for safe storage, including any incompatibilities	Store locked up. Store in original tightly closed container. Store in a well-ventilated place. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

The following constituents are the only constituents of the product which have a PEL, TLV or other recommended exposure limit. At this time, the other constituents have no known exposure limits.

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Material	Type	Value
Dieldrin (CAS 60-57-1)	PEL	0.25 mg/m3

US. ACGIH Threshold Limit Values

Material	Type	Value	Form
Dieldrin (CAS 60-57-1)	TWA	0.1 mg/m3	Inhalable fraction and vapor.

US. NIOSH: Pocket Guide to Chemical Hazards

Material	Type	Value
Dieldrin (CAS 60-57-1)	TWA	0.25 mg/m3

Biological limit values No biological exposure limits noted for the ingredient(s).

Exposure guidelines

US - California OELs: Skin designation

Dieldrin (CAS 60-57-1)	Can be absorbed through the skin.

US - Minnesota Haz Subs: Skin designation applies

Dieldrin (CAS 60-57-1)	Skin designation applies.

US - Tennessee OELs: Skin designation

Dieldrin (CAS 60-57-1)	Can be absorbed through the skin.

US ACGIH Threshold Limit Values: Skin designation

Dieldrin (CAS 60-57-1)	Can be absorbed through the skin.

US NIOSH Pocket Guide to Chemical Hazards: Skin designation

Dieldrin (CAS 60-57-1)	Can be absorbed through the skin.

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Dieldrin (CAS 60-57-1)	Can be absorbed through the skin.

Appropriate engineering controls	Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Eye wash facilities and emergency shower must be available when handling this product.

Individual protection measures, such as personal protective equipment

Eye/face protection	Wear safety glasses with side shields (or goggles) and a face shield.
Skin protection	
Hand protection	Wear appropriate chemical resistant gloves.
Other	Wear appropriate chemical resistant clothing. Use of an impervious apron is recommended.
Respiratory protection	Wear positive pressure self-contained breathing apparatus (SCBA).
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	Observe any medical surveillance requirements. Keep away from food and drink. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance	
Physical state	Solid.
Form	Crystalline.
Color	Colorless to light tan
Odor	Not available.
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	347.9 °F (175.5 °C)
Initial boiling point and boiling range	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	Not available.
Flammability limit - upper (%)	Not available.
Explosive limit - lower (%)	Not available.
Explosive limit - upper (%)	Not available.
Vapor pressure	0.000001 kPa (77 °F (25 °C))
Vapor density	13.2
Relative density	Not available.
Solubility(ies)	
Solubility (water)	0.2 mg/l

Partition coefficient (n-octanol/water)	5.4
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
Viscosity	Not available.
Other information	
Density	1.75 g/cm3
Explosive properties	Not explosive.
Molecular formula	C12-H8-Cl6-O
Molecular weight	380.91 g/mol
Oxidizing properties	Not oxidizing.
Specific gravity	1.75

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Contact with incompatible materials.
Incompatible materials	Strong acids. Strong oxidizing agents. Phenols.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	Fatal if inhaled.
Skin contact	Fatal in contact with skin. Causes severe skin burns.
Eye contact	Causes serious eye damage.
Ingestion	Fatal if swallowed. Causes digestive tract burns.
Symptoms related to the physical, chemical and toxicological characteristics	Convulsions. Headache. Dizziness. Nausea, vomiting. Burning pain and severe corrosive skin damage. Causes serious eye damage. Symptoms may include stinging, tearing, redness, swelling, and blurred vision. Permanent eye damage including blindness could result.

Information on toxicological effects

Acute toxicity	Fatal if inhaled. Fatal in contact with skin. Fatal if swallowed.
Skin corrosion/irritation	Causes severe skin burns and eye damage.
Serious eye damage/eye irritation	Causes serious eye damage.
Respiratory or skin sensitization	
Respiratory sensitization	Not a respiratory sensitizer.
Skin sensitization	This product is not expected to cause skin sensitization.
Germ cell mutagenicity	No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.
Carcinogenicity	May cause cancer.

IARC Monographs. Overall Evaluation of Carcinogenicity

Dieldrin (CAS 60-57-1)	3 Not classifiable as to carcinogenicity to humans.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

US. National Toxicology Program (NTP) Report on Carcinogens

Not listed.

Reproductive toxicity	May damage fertility or the unborn child.
Specific target organ toxicity - single exposure	Not classified.
Specific target organ toxicity - repeated exposure	Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard	Not an aspiration hazard.
Chronic effects	Causes damage to organs through prolonged or repeated exposure. Prolonged inhalation may be harmful.

12. Ecological information

Ecotoxicity	Very toxic to aquatic life with long lasting effects.

Product		**Species**	**Test Results**
Dieldrin (CAS 60-57-1)			
Aquatic			
Crustacea	EC50	Water flea (Daphnia magna)	0.074 - 0.0854 mg/l, 48 hours
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	0.001 - 0.0013 mg/l, 96 hours

* Estimates for product may be based on additional component data not shown.

Persistence and degradability

Bioaccumulative potential

Partition coefficient n-octanol / water (log Kow)

5.4

Mobility in soil	No data available.
Other adverse effects	No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal instructions	Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose of contents/container in accordance with local/regional/national/international regulations.
Local disposal regulations	Dispose in accordance with all applicable regulations.
Hazardous waste code	The waste code should be assigned in discussion between the user, the producer and the waste disposal company.

US RCRA Hazardous Waste P List: Reference

Dieldrin (CAS 60-57-1)	P037

Waste from residues / unused products	Dispose of in accordance with local regulations. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe manner (see: Disposal instructions).
Contaminated packaging	Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

UN number	UN2811
UN proper shipping name	Toxic solids, organic, n.o.s. (Dieldrin RQ = 1 LBS)
Transport hazard class(es)	
Class	6.1(PGI, II)
Subsidiary risk	-
Label(s)	6.1
Packing group	II
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	IB8, IP2, IP4, T3, TP33
Packaging exceptions	153
Packaging non bulk	212
Packaging bulk	242

IATA

UN number	UN2811
UN proper shipping name	Toxic solid, organic, n.o.s. (Dieldrin)
Transport hazard class(es)	
Class	6.1(PGI, II)
Subsidiary risk	-

Packing group	II
Environmental hazards	No.
ERG Code	6L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Other information	
Passenger and cargo aircraft	Allowed with restrictions.
Cargo aircraft only	Allowed with restrictions.
IMDG	
UN number	UN2811
UN proper shipping name	TOXIC SOLID, ORGANIC, N.O.S. (Dieldrin)
Transport hazard class(es)	
Class	6.1(PGI, II)
Subsidiary risk	-
Packing group	II
Environmental hazards	
Marine pollutant	No.
EmS	F-A, S-A
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not applicable.

DOT

IATA; IMDG

General information	IMDG Regulated Marine Pollutant.

15. Regulatory information

US federal regulations	This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Dieldrin (CAS 60-57-1)	Listed.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - Yes Delayed Hazard - Yes Fire Hazard - No Pressure Hazard - No Reactivity Hazard - No

SARA 302 Extremely hazardous substance

Not listed.

SARA 311/312 Hazardous chemical	Yes

SARA 313 (TRI reporting)

Not regulated.

Other federal regulations

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Not regulated.

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Clean Water Act (CWA) Section 112(r) (40 CFR 68.130)	Hazardous substance Priority pollutant Bioaccumulative chemical of concern Toxic pollutant
Safe Drinking Water Act (SDWA)	Not regulated.
US state regulations	WARNING: This product contains a chemical known to the State of California to cause cancer.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

Dieldrin (CAS 60-57-1)	Listed: July 1, 1988

International Inventories

Country(s) or region	**Inventory name**	**On inventory (yes/no)***
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	No
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	Yes
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	No
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	No

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date	09-27-2014
Revision date	08-30-2019
Version #	02
NFPA ratings	Health: 4 Flammability: 0 Instability: 0

Disclaimer	Chem Service, Inc. cannot anticipate all conditions under which this information and its product, or the products of other manufacturers in combination with its product, may be used. It is the user's responsibility to ensure safe conditions for handling, storage and disposal of the product, and to assume liability for loss, injury, damage or expense due to improper use. The above information is believed to be correct on the date it was last revised and must not be considered all inclusive. The information has been obtained only by a search of available literature and is only a guide for handling the chemicals. OSHA regulations require that if other hazards become evident, an upgraded SDS must be made available to the employee within three months. RESPONSIBILITY for updates lies with the employer and not with CHEM SERVICE, Inc. Persons not specifically and properly trained should not handle this chemical or its container. This product is furnished FOR LABORATORY USE ONLY! Our products may NOT BE USED as drugs, cosmetics, agricultural or pesticide products, food additives or as household chemicals. This Safety Data Sheet (SDS) is intended only for use with Chem Service, Inc. products and should not be relied on for use with materials from any other supplier even if the chemical name(s) on the product are identical! Whenever using an SDS for a solution or mixture the user should refer to the SDS for every component of the solution or mixture. Chem Service warrants that this SDS is based upon the most current information available to Chem Service at the time it was last revised. THIS WARRANTY IS EXCLUSIVE, AND CHEM SERVICE, INC. MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. This SDS is provided gratis and CHEM SERVICE, INC. SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR CONTINGENT DAMAGES. Copyright © 2000-2014 Chem Service, Inc. All rights reserved except that this SDS may be printed for the use of a customer or prospective customer of Chem Service, Inc provided the entire SDS is printed. The SDS may not be placed in any database or otherwise stored or distributed in electronic or any other form. This product is furnished FOR LABORATORY USE ONLY.
Revision information	This document has undergone significant changes and should be reviewed in its entirety.

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SAFETY DATA SHEET

Version 5.6
Revision Date 12/11/2017
Print Date 10/19/2018

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Indeno[1,2,3-*cd*]pyrene

Product Number : 48499
Brand : Supelco

CAS-No. : 193-39-5

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

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887 (CHEMTREC)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Carcinogenicity (Category 2), H351

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Warning

Hazard statement(s)

H351	Suspected of causing cancer.

Precautionary statement(s)

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P281	Use personal protective equipment as required.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula : $C_{22}H_{12}$
Molecular weight : 276.33 g/mol
CAS-No. : 193-39-5
EC-No. : 205-893-2

Hazardous components

Component	Classification	Concentration
Indeno[1,2,3-cd]pyrene		
	Carc. 2; H351	90 - 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of 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.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

No data available

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 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.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

Store at room temperature.
Storage class (TRGS 510): 13: Non Combustible Solids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters
Contains no substances with occupational exposure limit values.
Hazardous components without workplace control parameters

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Indeno[1,2,3-cd]pyrene	193-39-5	1-Hydroxypyrene (1-HP)		Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift at end of workweek			

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face 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 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.

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.

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).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	163.6 °C (326.5 °F)
f)	Initial boiling point and boiling range	536.0 °C (996.8 °F)
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides
Other decomposition products - No data available
In the event of fire: see section 5

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11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Inhalation: No data available

Dermal: No data available

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
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 (Indeno[1,2,3-cd]pyrene)
NTP:	RAHC - Reasonably anticipated to be a human carcinogen (Indeno[1,2,3-cd]pyrene)
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

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

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12. ECOLOGICAL INFORMATION

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

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
Not dangerous goods

IATA
Not dangerous goods

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
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
Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Indeno[1,2,3-cd]pyrene	193-39-5	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Indeno[1,2,3-cd]pyrene	193-39-5	1993-04-24

	CAS-No.	Revision Date
Indeno[1,2,3-cd]pyrene	193-39-5	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
Indeno[1,2,3-cd]pyrene	193-39-5	1993-04-24

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.	CAS-No.	Revision Date
Indeno[1,2,3-cd]pyrene	193-39-5	2007-09-28

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Carc.	Carcinogenicity
H351	Suspected of causing cancer.

HMIS Rating

Health hazard: 0
Chronic Health Hazard: *
Flammability: 0
Physical Hazard 0

NFPA Rating

Health hazard: 1
Fire Hazard: 0
Reactivity Hazard: 0

Further information

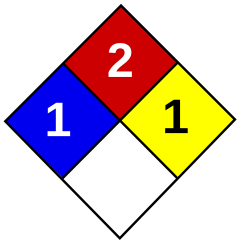
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent 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.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.6 Revision Date: 12/11/2017 Print Date: 10/19/2018

ScienceLab.com
Chemicals & Laboratory Equipment



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.

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 decompositon 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, chloroformamidinum, chloric acid, ammonium nitrate, dinitorgen 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, coagulaopathy, 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 postingestion, 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 develop 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, similiar effects were also seen in iron defficiency. 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 hypersensivity.

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

Lead Metal
Safety Data Sheet

Section 1: Identification

Product Name: Lead Metal
CAS No.: 7439-92-1
Chemical Formula: Pb
Other Names: Lead, Lead Block, Lead Wire, Lead Ingot, Pb, Plumbum, Pure Lead, Refined Lead, Sheet Lead, Soft Lead, Lead rod
Intended Use / Restrictions on Use:
For professional/industrial use only.

Contact Information:
Chemical Store Inc.
1059 Main Avenue,
Clifton, NJ 07011
Phone: 973-405-6248

Emergency Contact:
Chemical Store: 973-420-4972

Section 2: Hazard Identification

Classification:

Carcinogen 1B - H350

Label Elements:

Hazard Pictograms:

Signal Word: Danger

Hazard Statements: H350 – May cause cancer. H302 – Harmful if swallowed.

Precautionary Statements: P201 – Obtain special instructions before use. P202 Do not handle until all safety precautions have been read and understood. P260 – Do not breathe dust/fume/gas/mist/vapors/spray. P264 – Wash skin thoroughly after handling. P273 – Avoid release to the environment. P280 - Wear eye protection, protective clothing, protective gloves. P308 +P313 – If exposed or concerned: Get medical advice/attention. P405 – Store locked up. P501 – Dispose of contents/container in accordance with local, regional, national and international regulations.

Other Hazards: Prevent particles from becoming airborne. Can cause thermal burns when molten.

Unknown Acute Toxicity Statement:

Not Applicable

Section 3: Composition / Information on Ingredients

Name: Lead Metal

Synonyms: Lead, Lead Block, Lead wire, Lead Ingot, Pb, Plumbum, Pure Lead, Refined Lead, Sheet Lead, Soft Lead

Chemical Name	CAS Number	% by Weight
Lead (Pb)	7439-92-1	>99

Mixture:

Not applicable

Section 4: First-Aid Measures

Required Treatment:

After inhalation, move to fresh air and rest in a position comfortable for breathing.
After skin contact, wash skin thoroughly. If contact with molten metal, cool skin rapidly and seek medical assistance.
After eye contact, remove contact lenses if applicable and flush eyes with water for at least 15 minutes.
After ingestion, do not induce vomiting. Call poison control center or doctor.

Important Symptoms & Effects, Acute & Delayed:

Lead poisoning can occur through acute or chronic doses. Symptoms include headaches, abdominal pain, memory loss, kidney failure, anemia, change in skin tone, reproductive problems, weakness, pain, or tingling.

Indication of Medical Attention:

If any acute or chronic symptoms arise or if feeling unwell after exposure, seek medical advice.

Section 5: Fire Fighting Measures

Extinguishing Techniques/Equipment:

Use extinguishing media appropriate for surrounding media. Do not use water if metal is hot as it may increase fire intensity.

Chemical Hazards from Fire:

Lead Metal is not flammable or explosive. May react violently with water in molten state.

Special Equipment and Precautions for Firefighters:

Exercise caution. Under fire conditions, fumes will be present. If entering fire area, wear proper protective equipment including respiratory protection.

Section 6: Accidental Release Measures

Emergency Procedures/Personal Protection:

Avoid all contact with skin, eyes, or clothing. Avoid breathing fumes and dust.
Evacuate all unnecessary personnel.

Protective Equipment:

Use appropriate personal protection equipment (PPE), as listed in section 8.

Methods of Containment & Cleanup:

Allow metal to cool and solidify if molten. Collect solid metal and clean up spill site, disposing of waste properly.

Section 7: Handling and Storage

Precautions for Safe Handling:
When molten, use safe furnace practices. When solid, practice good industrial hygiene and safety procedures. Wash exposed areas with soap and water.

Precautions for Safe Storage:
Store in cool, dry and well ventilated location. Seal containers. Keep away from incompatible materials such as strong acids, strong bases, and strong oxidizers. If molten, keep away from water.

Section 8: Exposure Controls / Personal Protection

Control Parameters:

USA ACGIH	ACGIH TWA (mg/m^3)	0.05 mg/m^3
USA NIOSH	NIOSH REL (TWA) (mg/m^3)	0.050 mg/m^3
USA IDLH	US IDLH (mg/m^3)	100 mg/m^3
USA OSHA	OSHA PEL (TWA) (mg/m^3)	50 µg/m^3

Engineering Controls:
Ensure adequate ventilation. Emergency eye wash stations and safety showers should be nearby any potential exposure. Ensure national/local regulations are observed.

Personal Protective Equipment:
Protective goggles, gloves and clothing. If insufficient ventilation, wear respiratory protection.
Materials for Protective Clothing: Wear chemically resistant materials and fabrics.
Hand Protection: Wear chemically resistant gloves. If working with molten or hot material, wear thermally resistant gloves.
Eye Protection: Chemical googles or safety glasses should be worn at all times. For furnace work, wear a face shield or safety glasses.
Respiratory Protection: If exposure limits are exceeded or irritation is experienced, NIOSH approved respiratory protection should be worn.
Thermal Hazard Protection: For furnace work, fire retardant clothing, gloves, and safety shoes should be worn.
Consumer Exposure Controls: Do not eat, drink, or smoke during use.

Section 9: Physical and Chemical Properties

Physical State: Solid (Metal)	**Evaporation Rate:** N/A
Color: Blueish-grey. Silvery	**Flammability:** N/A
Taste: N/A	**Upper/Lower Flammability Limits:** N/A
Molecular Weight: 207.21 g/mol	**Vapor Pressure:** 1 mm Hg @ 973°C (1783°F)
Odor: N/A	**Vapor Density:** N/A
Odor Threshold: N/A	**Specific Gravity (Relative Density):** 11.3
pH: N/A	**Solubility:** Insoluble in water
Melting Point: 327.43°C (621.4°F)	**Partition Coefficient:** N/A
Boiling Point: 1740 °C (3164°F)	**Auto-ignition Temperature:** N/A
Boiling Range: N/A	**Decomposition Temperature:** N/A
Flash Point: N/A	**Viscosity:** N/A

Section 10: Stability and Reactivity

Reactivity: May react violently with water in molten form.

Stability: Stable under proper handling and storage conditions.

Hazardous Reactions: Thermal reactions generate lead fumes.

Conditions to Avoid: Avoid incompatible materials. Avoid Moisture in molten form.

Incompatible Materials: Strong acids, strong bases, and strong oxidizers. If molten, water. **Hazardous Decomposition Products:** Melting produces lead fumes.

Section 11: Toxicological Information

Routes of Exposure
Inhalation of dust, fumes. Skin contact through physical contact. Eye contact through physical contact or dust and fumes. Ingestion through contamination of skin/surfaces.

Chronic and Acute Related Symptoms/Effects:
Inhalation of fumes or dust can cause respiratory irritation. Skin contact with molten metal can cause burns. Dust or fumes can cause eye irritation. Ingestion can cause harmful effects. Acute symptoms can include headaches, abdominal pain, memory loss, kidney failure, anemia, change in skin tone, reproductive problems, weakness, pain, or tingling. Chronic exposure may cause cancer or lead poisoning.

Measures of Toxicology:
Acute Toxicity: Not Classified
Skin Corrosion/Irritation: Not Classified
Serious Eye Damage/ Irritation: Not Classified
Respiratory or Skin Sensitization: Not Classified **Germ Cell Mutagenicity:** Not Classified **Reproductive Toxicity:** Not Classified **Carcinogenic Information:**
May cause cancer.
IARC Group: 2A
National Toxicology Program (NTP) Status: Reasonably anticipated to be a human carcinogen.

Section 12: Ecological Information

Ecotoxicity: Toxic to aquatic life and terrestrial environments
Persistence and Degradability: N/A
Bioaccumulative Potential: Bioaccumulates in animals and plants
Mobility in Soil: Accumulates in Soil but not particularly mobile
Other Adverse Effects:
Prevent entry to sewers and public waterways. Avoid release to the environment. Ensure accordance with national and local regulations.

Section 13: Disposal Considerations

Dispose of waste in accordance with all local, regional, national, and international regulations.

Section 14: Transportation Information

UN Number: 3077
UN Proper Shipping Name: Environmentally hazardous substance, solid, n.o.s. (Lead)
Class: 9
Packing Group: III
Environmental Hazards: Do not release to waterways.
Transportation in Bulk: N/A
Special Precautions: Wash skin after contact

Section 15: Regulatory Information

US Federal Regulations:
SARA Section 311/312 Hazard Classes – Delayed (chronic) Health Hazard
SARA Section 313 Emissions Reporting – 0.1%

US State Regulations:
California – Prop. 65 – Carcinogens List California –
Prop. 65 – Developmental Toxicity
California – Prop. 65 – Reproductive Toxicity Male/Female
Massachusetts – Right To Know List
Pennsylvania – Right To Know List (Environmental Hazard)
Pennsylvania – Right To Know List
New Jersey – Right To Know List (Hazardous Substance)

Section 16: Other Information

Date of Preparation: 05/20/15
Date of Revision: 05/07/18
Prepared in accordance with OSHA HCS 29 CFR 1910.1200.
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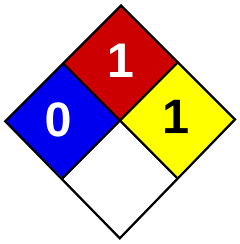


Health	1
Fire	3
Reactivity	2
Personal Protection	E

Material Safety Data Sheet

Magnesium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Magnesium

Catalog Codes: SLM4408, SLM2263, SLM3637

CAS#: 7439-95-4

RTECS: OM2100000

TSCA: TSCA 8(b) inventory: Magnesium

CI#: Not applicable.

Synonym: Magnesium ribbons, turnings or sticks

Chemical Name: Magnesium

Chemical Formula: Mg

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Magnesium	7439-95-4	100

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

Section 3: Hazards Identification

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

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

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

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

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat. Flammable in presence of acids, of moisture. Non-flammable in presence of shocks.

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

Fire Fighting Media and Instructions:
Flammable solid. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:
Magnesium turnings, chips or granules, ribbons, are flammable. They can be easily ignited. They may reignite after fire is extinguished. Produces flammable gases on contact with water and acid. May ignite on contact with water or moist air. Magnesium fires do not flare up violently unless moisture is present.

Special Remarks on Explosion Hazards: Reacts with acids and water to form hydrogen gas with is highly flammable and eplosive

Section 6: Accidental Release Measures

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

Large Spill:
Flammable solid. Stop leak if without risk. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe dust. Keep away from incompatibles such as oxidizing agents, acids, moisture.

Storage:
Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Moisture sensitive. Dangerous when wet.

Section 8: Exposure Controls/Personal Protection

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

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 24.31 g/mole

Color: Silver-white

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

Boiling Point: 1100°C (2012°F)

Melting Point: 651°C (1203.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.74 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:
Very slightly soluble in hot water. Insoluble in cold water. Insoluble in chromium trioxides, and mineral acids, alkalies. Slightly soluble with decomposition in hot water. Soluble in concentrated hydrogen fluoride, and ammonium salts.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, incompatible materials, water or moisture, moist air.

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

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Violent chemical reaction with oxidizing agents. Reacts with water to create hydrogen gas and heat. Must be kept dry. Reacts with acids to form hydrogen gas which is highly flammable and explosive. Magnesium forms hazardous or explosive mixtures with aluminum and potassium perchlorate; ammonium nitrate; barium nitrate, barium dioxide and zinc; beryllium oxide; boron phosphodiiodide; bromobenzyl trifluoride; cadmium cyanide; cadmium oxide; calcium carbide; carbonates; carbon tetrachloride; chlorine; chlorine trifluoride; chloroform; cobalt cyanide; copper cyanide; copper sulfate(anhydrous), ammonium nitrate, potassium chlorate and water; cupric oxide; cupric sulfate; fluorine; gold cyanide; hydrogen and calcium carbonate; hydrogen iodide; hydrogen peroxide; iodine; lead cyanide; mercuric oxide; mercury cyanide; methyl chloride; molybdenum trioxide; nickel cyanide; nitric acid; nitrogen dioxide; oxygen (liquid); performic acid; phosphates; potassium chlorate; potassium perchlorate; silver nitrate; silver oxide; sodium perchlorate; sodium peroxide; sodium peroxide and carbon dioxide; stannic oxide; sulfates; trichloroethylene; zinc cyanide; zinc oxide.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

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

Chronic Effects on Humans: Not available.

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: May cause skin irritation by mechanical action. May get mechanical injury or embedding of chips/particles in skin. The particles that are embedded in the wounds may retard healing. Eyes: May cause eye irritation by mechanical action. Mechanical injury may occur. Particles or chips may embed in eye and retard healing. Inhalation: Low hazard for ususal industrial handling. It may cause respiratory tract irritation. However, it is unlikely due to physical form. When Magnesium metal is heated during welding or smelting process, Metal Fume Fever may result from inhalation of magnesium fumes. Metal Fume Fever is a flu-like condition consisting of fever, chills, sweating, aches, pains, cough, weakness, headache, nausea, vomiting, and breathing difficulty. Other symptoms may include metallic taste, increased white blood cell count. There is no permanent ill-effect. Ingestion: Low hazard for usual industrial handling. There are no known reports of serious industrial poisonings with Magnesium. Ingeston of large amounts of chips, turnings or ribbons may cause gastrointestinal tract irritation with nausea, vomiting, and diarrhea. Acute ingestion may also result in Hypermagnesia. Hypermagnesia may cause hypotension, bradycardia, CNS depression, respiratory depression, and impairment of neuromuscular transmission (hyporeflexia, paralysis).

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

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

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

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

Section 14: Transport Information

DOT Classification: CLASS 4.1: Flammable solid.

Identification: : Magnesium UNNA: 1869 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Magnesium Rhode Island RTK hazardous substances: Magnesium Pennsylvania RTK: Magnesium Massachusetts RTK: Magnesium Massachusetts spill list: Magnesium New Jersey: Magnesium TSCA 8(b) inventory: Magnesium

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

Other Classifications:

WHMIS (Canada):
CLASS B-4: Flammable solid. CLASS B-6: Reactive and very flammable material.

DSCL (EEC):
R11- Highly flammable. R15- Contact with water liberates extremely flammable gases. S7/8- Keep container tightly closed and dry. S43- In case of fire, use dry chemical. Never use water.

HMIS (U.S.A.):

- **Health Hazard:** 1
- **Fire Hazard:** 3
- **Reactivity:** 2
- **Personal Protection:** E

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

- **Health:** 0
- **Flammability:** 1
- **Reactivity:** 1
- **Specific hazard:**

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 06:00 PM

Last Updated: 11/01/2010 12:00 PM

Date of Issue:
21 December 2018

SAFETY DATA SHEET

1. SUBSTANCE AND SOURCE IDENTIFICATION

Product Identifier

SRM Number: 3132
SRM Name: Manganese (Mn) Standard Solution
Other Means of Identification: Not applicable.

Recommended Use of This Material and Restrictions of Use

This Standard Reference Material (SRM) is intended for use as a primary calibration standard for the quantitative determination of manganese. A unit of SRM 3132 consists of five 10 mL sealed borosilicate glass ampoules of an acidified aqueous solution prepared gravimetrically to contain a known mass fraction of manganese. The solution contains nitric acid at a volume fraction of approximately 10 %.

Company Information

National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Stop 2300
Gaithersburg, Maryland 20899-2300

Telephone: 301-975-2200
FAX: 301-948-3730
E-mail: SRMMSDS@nist.gov
Website: https://www.nist.gov/srm

Emergency Telephone ChemTrec:
1-800-424-9300 (North America)
+1-703-527-3887 (International)

2. HAZARDS IDENTIFICATION

Classification

Physical Hazard:	Not classified.	
Health Hazard:	Skin Corrosion/Irritation	Category 1B
	Serious Eye Damage/Eye Irritation	Category 1
	STOT, Repeated Exposure	Category 2

Label Elements
Symbol

Signal Word
DANGER

Hazard Statement(s)

H314	Causes severe skin burns and eye damage.
H373	May causes damage to organs (respiratory system, central nervous system, blood, kidneys) through prolonged or repeated exposure < inhalation, ingestion>.

Precautionary Statement(s)

P260	Do not breathe fumes, mists, vapors, or spray.
P264	Wash hands thoroughly after handling.
P280	Wear protective gloves, protective clothing, and eye protection.
P301+P330+P331	If swallowed: Rinse mouth. Do NOT induce vomiting.
P303+P361+P353	If on skin (or hair): Remove immediately all contaminated clothing. Rinse skin with water.
P304+P340	If inhaled: Remove person to fresh air and keep comfortable for breathing.
P305+P351+P338	If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310	Immediately call a doctor.

P314	Get medical attention if you feel unwell.
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of container and contents according to local regulations.

Hazards Not Otherwise Classified: Not applicable.

Ingredients(s) with Unknown Acute Toxicity: Not applicable.

3. COMPOSITION AND INFORMATION ON HAZARDOUS INGREDIENTS

Substance: Manganese in nitric acid solution

Other Designations:

Nitric acid (aqua fortis; hydrogen nitrate; azotic acid; engraver's acid)

Manganese nitrate [manganese dinitrate; manganese (II) nitrate; nitric acid, manganese (II) salt]

NOTE: Manganese in nitric acid solution forms a solvated manganese nitrate salt. The health and physical hazard information provided in this SDS are for nitric acid and manganese nitrate. No physical or chemical data are listed for this solution. The actual effects of the solution may differ from the individual components.

Components are listed in compliance with OSHA's 29 CFR 1910.1200; for the actual values see the NIST Certificate of Analysis.

Hazardous Component(s)	CAS Number	EC Number (EINECS)	Nominal Mass Concentration (%)
Nitric acid	7697-37-2	231-714-2	10
Manganese nitrate	10377-66-9	233-828-8	3.26
Non-Hazardous Component(s)			
Water	7732-18-5	231-791-2	>86

4. FIRST AID MEASURES

Description of First Aid Measures:

Inhalation: If adverse effects occur, remove to uncontaminated area. If not breathing, give artificial respiration or oxygen by qualified personnel. Seek immediate medical attention.

Skin Contact: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get immediate medical attention. Thoroughly clean and dry contaminated clothing before reuse. Destroy contaminated shoes.

Eye Contact: Immediately flush eyes, including under the eyelids with copious amounts of water for at least 15 minutes. Seek immediate medical attention.

Ingestion: Contact a poison control center immediately for instructions. Do not induce vomiting. Give water to rinse out mouth. Never give liquids to a person with reduced awareness or becoming unconscious. If vomiting occurs, keep head lower than hips to prevent aspiration. If not breathing, give artificial respiration by qualified personnel. Seek immediate medical attention.

Most Important Symptoms/Effects, Acute and Delayed: Acid burns to skin, eyes, and lungs.

Indication of any immediate medical attention and special treatment needed, if necessary: If any of the above symptoms are present, seek immediate medical attention.

5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Negligible fire hazard. See Section 9, "Physical and Chemical Properties" for flammability properties.

Extinguishing Media:

Suitable: Use extinguishing media appropriate to the surrounding fire.

Unsuitable: None listed.

Specific Hazards Arising from the Chemical: Miscellaneous decomposition products.

Special Protective Equipment and Precautions for Fire-Fighters: Avoid inhalation of material or combustion byproducts. Wear full protective clothing and NIOSH approved self-contained breathing apparatus (SCBA).

NFPA Ratings (0 = Minimal; 1 = Slight; 2 = Moderate; 3 = Serious; 4 = Severe)

Health = 3 Fire = 0 Reactivity = 0

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures: Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment; see Section 8, "Exposure Controls and Personal Protection".

Methods and Materials for Containment and Clean up: Do not touch spilled material. Notify safety personnel of spills. Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Isolate hazard area and deny entry.

7. HANDLING AND STORAGE

Safe Handling Precautions: See Section 8, "Exposure Controls and Personal Protection".

Storage: Store and handling in accordance with all current regulations and standards. Keep separated from incompatible substances (see Section 10, "Stability and Reactivity").

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits

Nitric acid:

NIOSH (REL): 5 mg/m^3 (2 ppm) TWA, 10 mg/m^3 (4 ppm) STEL, 65 mg/m^3 (25 ppm) IDLH
ACGIH (TLV): 5 mg/m^3 (2 ppm) TWA, 10 mg/m^3 (4 ppm) STEL
OSHA (PEL): 5 mg/m^3 (2 ppm) TWA

Manganese nitrate:

NIOSH (REL) (related to Manganese compounds): 1 mg/m^3 TWA, 3 mg/m^3 STEL, 500 mg/m^3 IDLH
ACGIH (TLV): 0.02 mg/m^3 TWA (as Mn)
0.1 mg/m^3 TWA (as Mn, related to Manganese inorganic compounds)
OSHA (PEL): 5 mg/m^3 Ceiling (as Mn, related to Manganese compounds)

Engineering Controls: Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

Personal Protection: In accordance with OSHA 29 CFR 1910.132, subpart I, wear appropriate Personal Protective Equipment (PPE) to minimize exposure to this material.

Respiratory Protection: If workplace conditions warrant a respirator, a respiratory protection program that meets OSHA 29CFR 1910.134 must be followed. Refer to NIOSH 42 CFR 84 for applicable certified respirators.

Eye/Face Protection: Wear splash resistant safety goggles with a face shield. An eyewash station should be readily available near areas of use.

Skin and Body Protection: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Chemical-resistant gloves should be worn at all times when handling chemicals.

9. PHYSICAL AND CHEMICAL PROPERTIES

NOTE: The physical and chemical data provided are for the pure components.

Descriptive Properties:	**Nitric acid (10 % of this SRM)**	**Manganese nitrate (3.26 % of this SRM)**
Appearance (physical state, color, etc.):	colorless to yellow liquid	colorless; hygroscopic crystalline, solid
Molecular Formula	HNO_3	$Mn(NO_3)_2$
Molar Mass (g/mol)	63.01	178.96
Odor	irritating odor	not available
Odor threshold	not available	not available
pH	1 (1 M)	not available
Evaporation rate	not available	not applicable
Melting point/freezing point	–42 ºC (–43 ºF)	not available
Relative Density as specific gravity (water = 1)	1.5027 at 25 ºC	not available
Vapor Pressure	47.9 at 20 ºC	not available

Descriptive Properties:	**Nitric acid (10 % of this SRM)**	**Manganese nitrate (3.26 % of this SRM)**
Vapor Density (air = 1)	3.2	not applicable
Viscosity (cP)	not available	not available
Solubility(ies)	miscible with water and ether	soluble in water, dioxane, tetrahydrofuran, and acetonitrile.
Partition coefficient (n-octanol/water)	not available	not available
Thermal Stability Properties		
Autoignition Temperature	not applicable	not applicable
Thermal Decomposition	not applicable	not available
Initial boiling point and boiling range	83 ºC (181 ºF)	not available
Explosive Limits, LEL (Volume %)	not applicable	not applicable
Explosive Limits, UEL (Volume %)	not applicable	not applicable
Flash Point	not applicable	not applicable
Flammability (solid, gas)	not applicable	not applicable

10. STABILITY AND REACTIVITY

Reactivity: Stable at normal temperatures and pressure.

Stability: __X__ Stable ______ Unstable

Possible Hazardous Reactions: None listed.

Conditions to Avoid: Contact with combustible or incompatible materials.

Incompatible Materials: Acids, combustible materials, halo carbons, amines, bases, oxidizing materials, metals, halogens, metal salts, metal oxides, reducing agents, peroxides, metal carbide, cyanides.

Fire/Explosion Information: See Section 5, “Fire Fighting Measures”.

Hazardous Decomposition: Thermal decomposition will produce oxides of nitrogen.

Hazardous Polymerization: ______ Will Occur __X__ Will Not Occur

11. TOXICOLOGICAL INFORMATION

Route of Exposure: __X__ Inhalation __X__ Skin __X__ Ingestion

Symptoms Related to the Physical, Chemical and Toxicological Characteristics: Burning pain; severe skin corrosion and eye damage.

Potential Health Effects (Acute, Chronic and Delayed):

Inhalation: Inhalation of nitric acid can damage the mucous membranes and upper respiratory tract. Short term exposure may cause irritation and inflammation of the upper respiratory tract, coughing, choking, sore throat, shortness of breath, headache, dizziness, and nausea. Long term exposure to acid fumes may cause damage to teeth, bronchial irritation, chronic cough, bronchial pneumonia, and gastrointestinal disturbances. Repeated or prolonged exposure to manganese compounds may result in systemic poisoning known as "manganism", a Parkinsonian-like syndrome. It is characterized initially by anorexia, asthenia, headache, insomnia or somnolence, irritability, restlessness, and spasm or pain in the muscles.

Skin Contact: Nitric acid can cause severe skin burns. Severity of the damage depends on the concentration and duration of exposure. Effects of acid burns may be delayed. Manganese nitrate may cause irritation.

Eye Contact: Nitric acid can cause severe eye irritation, corneal burns, permanent eye damage, or blindness. Severity of the damage depends on the concentration and duration of exposure. Contact with manganese nitrate may cause irritation.

Ingestion: If ingested, nitric acid can cause severe burns and damage to the gastrointestinal tract. Manganese nitrate can cause nausea, vomiting, diarrhea, bluish skin and similar effects reported in long term inhalation.

Numerical Measures of Toxicity:

Acute Toxicity: Not classified.
Nitric acid: Rat, Inhalation LC50: 130 mg/m^3 (4 h)
Manganese nitrate: No data available.

Skin Corrosion/Irritation: This SRM contains >1 % of nitric acid and it is classified as Category 1B.

Serious Eye damage/Eye irritation: This SRM contains >1 % nitric acid and it is classified as Category 1.

Respiratory Sensitization: No data available.

Skin Sensitization: No data available.

Germ Cell Mutagenicity: No data available.

Carcinogenicity: Not classified.
Listed as a Carcinogen/Potential Carcinogen ______ Yes __X__ No
Nitric acid and manganese nitrate are not listed by NTP, IARC or OSHA as carcinogens/potential carcinogens.
Mutagenic: Manganese nitrate, (*Bacillus subtilis*): 50 mmol/L

Reproductive Toxicity: Not classified.
Nitric acid: Rat, Oral TDLo: 21 150 mg/kg (pregnant 1 d to 21 d)
Nitric acid: Rat, Oral TDLo: 2345 mg/kg (pregnant 18 d)

Specific Target Organ Toxicity, Single Exposure: No data available.

Specific Target Organ Toxicity, Repeated Exposure: Category 2, This SRM contains >1 % manganese nitrate which may result in systemic poisoning and accumulation in critical organs (respiratory system, central nervous system, blood, kidneys) through repeated inhalation or ingestion.

Aspiration Hazard: No data available.

12. ECOLOGICAL INFORMATION

Ecotoxicity Data

Nitric acid: Fish, mosquitofish (*Gambusia affinis*) LC50: 72 mg/L (96 h)
Manganese nitrate: No data available.

Persistence and Degradability: No data available.

Bioaccumulative Potential: No data available.

Mobility in Soil: No data available.

Other Adverse effects: No data available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal: Dispose of waste in accordance with all applicable federal, state, and local regulations. Nitric acid subject to disposal regulations: U.S. EPA 40 CFR 262, Hazardous Waste Numbers: D001, D002.

14. TRANSPORTATION INFORMATION

U.S. DOT and IATA: UN1760, Corrosive liquid, n.o.s. (contains nitric acid), Hazard Class 8, Packing Group II.

15. REGULATORY INFORMATION

U.S. Regulations:

CERCLA Sections 102a/103 (40 CFR 302.4):	Nitric acid, 1000 lbs. (454 kg) final RQ
SARA Title III Section 302 (40 CFR 355.30):	Nitric acid, 1000 lbs. (454 kg) TPQ
SARA Title III Section 304 (40 CFR 355.40):	Nitric acid, 1000 lbs. (454 kg) EPCRA RQ
SARA Title III Section 313 (40 CFR 372.65):	1 % de minimis concentration for nitric acid and manganese related compounds
OSHA Process Safety (29 CFR 1910.119):	Regulated for nitric acid at higher concentrations 500 lbs. TQ (≥94.5 % by weight).

SARA Title III Sections 311/312 Hazardous Categories (40 CFR 370.21):

ACUTE HEALTH:	Yes
CHRONIC HEALTH:	Yes
FIRE:	No
REACTIVE:	No
PRESSURE:	No

State Regulations: Not listed under California Proposition 65.

U.S. TSCA Inventory: Nitric acid and manganese nitrate are listed.

TSCA 12(b), Export Notification: Not listed.

Canadian Regulations: WHMIS Information is not provided for this material.

16. OTHER INFORMATION

Issue Date: 21 December 2018

Sources: ChemAdvisor, Inc., MSDS *Nitric Acid*, 09 December 2015.

ChemAdvisor, Inc., MSDS *Manganese Nitrate*, 09 December 2015.

Hazardous Substances Data Bank (HSDB), National Library of Medicine's TOXNET system, *Nitric Acid CAS No. 7697-37-2*; available at https://toxnet.nlm.nih.gov (accessed Dec 2018).

Hazardous Substances Data Bank (HSDB), National Library of Medicine's TOXNET system, *Manganese Nitrate CAS No. 10377-66-9*; available at https://toxnet.nlm.nih.gov (accessed Dec 2018).

Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health (NIOSH), NIOSH Pocket Guide to Chemical Hazards, *Manganese compounds and fume (as Mn)*, 18 November 2010; available at https://www.cdc.gov/niosh/npg/npgd0379.html (accessed Dec 2018).

Key of Acronyms:

ACGIH	American Conference of Governmental Industrial Hygienists	NRC	Nuclear Regulatory Commission
ALI	Annual Limit on Intake	NTP	National Toxicology Program
CAS	Chemical Abstracts Service	OSHA	Occupational Safety and Health Administration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	PEL	Permissible Exposure Limit
CFR	Code of Federal Regulations	RCRA	Resource Conservation and Recovery Act
DOT	Department of Transportation	REL	Recommended Exposure Limit
EC50	Effective Concentration, 50 %	RM	Reference Material
EINECS	European Inventory of Existing Commercial Chemical Substances	RQ	Reportable Quantity
EPCRA	Emergency Planning and Community Right-to-Know Act	RTECS	Registry of Toxic Effects of Chemical Substances
IARC	International Agency for Research on Cancer	SARA	Superfund Amendments and Reauthorization Act
IATA	International Air Transport Association	SCBA	Self-Contained Breathing Apparatus
IDLH	Immediately Dangerous to Life and Health	SRM	Standard Reference Material
LC50	Lethal Concentration, 50 %	STEL	Short Term Exposure Limit
LD50	Lethal Dose, 50 %	STOT	Specific Target Organ Toxicity
LEL	Lower Explosive Limit	TLm	Threshold Limit, median
MSDS	Material Safety Data Sheet	TLV	Threshold Limit Value
NFPA	National Fire Protection Association	TPQ	Threshold Planning Quantity
NIOSH	National Institute for Occupational Safety and Health	TSCA	Toxic Substances Control Act
NIST	National Institute of Standards and Technology	TWA	Time Weighted Average
n.o.s.	Not Otherwise Specified	UEL	Upper Explosive Limit
		WHMIS	Workplace Hazardous Materials Information System

Disclaimer: Physical and chemical data contained in this SDS are provided only for use in assessing the hazardous nature of the material. The SDS was prepared carefully, using current references; however, NIST does not certify the data in the SDS. The certified values for this material are given in the NIST Certificate of Analysis.

Users of this SRM should ensure that the SDS in their possession is current. This can be accomplished by contacting the SRM Program: telephone (301) 975-2200; fax (301) 948-3730; e-mail srmmsds@nist.gov; or via the Internet at https://www.nist.gov/srm.

BETHLEHEM RESOURCE RECOVERY DIVISION™
BETHLEHEM APPARATUS COMPANY

MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

PART I *What is the material and what do I need to know in an emergency?*

1. PRODUCT IDENTIFICATION

TRADE NAME (AS LABELED):	**MERCURY**
CHEMICAL NAME/CLASS:	Mercury; Element
SYNONYMS:	Colloidal Mercury, Quick Silver; Liquid Silver; NCI-C60399; Hydrargyrum
PRODUCT USE:	Variety of industrial, analytical, and research applications.
SUPPLIER/MANUFACTURER'S NAME:	**BETHLEHEM APPARATUS COMPANY**
ADDRESS:	890 Front Street Hellertown, PA 18055
EMERGENCY PHONE:	610-838-7034
BUSINESS PHONE:	610-838-7034
DATE OF PREPARATION:	May 20, 1997
DATE OF REVISION:	May 2, 2005

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	%w/w	EXPOSURE LIMITS IN AIR					
			ACGIH-TLV		OSHA-PEL		IDLH	OTHER
			TWA mg/m^3	STEL mg/m^3	TWA mg/m^3	STEL mg/m^3	mg/m^3	mg/m^3
Mercury Exposure limits are for Mercury, Inorganic Compounds	7439-97-6	100	0.025, (skin) A4 (Not Classifiable as a Human Carcinogen)	NE	Mercury Vapor: 0.5, Skin; (Vacated 1989 PEL)	0.1 (ceiling) Non-alkyl Mercury Compounds: 0.1 Ceiling, skin (Vacated 1989 PEL)	10	NIOSH REL: STEL = 0.1 (ceiling, skin) DFG MAKs: TWA = 0.1 PEAK = 10•MAK 30 min., momentary value Carcinogen: EPA-D; IARC-3, TLV-A4

NE = Not Established. See Section 16 for Definitions of Terms Used.

NOTE: ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Mercury is a silver-white, odorless, heavy liquid. Mercury is highly toxic, irritating, and causes sensitization and neurological symptoms. The primary health hazard associated with overexposure to this product is the potential for irritation of skin, eyes, or other contaminated tissues. Mercury causes severe, adverse health effects after chronic exposure to low vapor levels; emergency response efforts must be directed to removal of all traces of this product. Mercury is not flammable, and is relatively stable (though it can react with many metals to form amalgams). Emergency responders must wear the personal protective equipment suitable for the situation to which they are responding.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant routes of occupational over-exposure are inhalation and contact with skin and eyes. The symptoms of over-exposure to Mercury, via route of exposure, are as follows:

INHALATION: Long-term exposures to Mercury vapors present a severe health hazard. When inhaled, Mercury will be rapidly distributed throughout the body. During this time, Mercury will cross the blood-brain barrier, and become oxidized to the Hg(II) oxidation state. The oxidized species of Mercury cannot cross the blood-brain barrier and thus accumulates in the brain. Mercury in other organs is removed slowly from the body via the kidneys. The average half-time for clearance of Mercury for different parts of the human body is as follows: lung: 1.7 days; head: 21 days; kidney region: 64 days; chest: 43 days; whole body: 58 days.

Long-term inhalation over-exposures can lead to the development of a wide variety of symptoms, including the following: excessive salivation, gingivitis, anorexia, chills, fever, cardiac abnormalities, anemia, digestive problems, abdominal pains, frequent urination, an inability to urinate, diarrhea, peripheral neuropathy (numbness, weakness, or burning sensations in the hands or feet), tremors (especially in the hands, fingers, eyelids, lips, cheeks, tongue, or legs), alteration of tendon reflexes, slurred speech, visual disturbances, and deafness. Allergic reactions (i.e. breathing difficulty) may also occur in sensitive individuals.

The principal target organ associated with chronic Mercury exposures via inhalation is the central nervous system. Such exposures lead to the development of "Erethism". This syndrome consists of subtle or dramatic changes in behavior and personality: depression, fearfulness, restlessness, irritability, timidity, and indecision. These psychic and behavioral characteristics are often accompanied by insomnia, drowsiness, headache, and fatigue. In advanced cases, memory loss, hallucinations, and mental deterioration may occur.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

HEALTH	(BLUE)	3
FLAMMABILITY	(RED)	0
REACTIVITY	(YELLOW)	0
PROTECTIVE EQUIPMENT		X

EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8

For a variety of applications involving elemental Mercury.

See Section 16 for Definition of Ratings

Another, less common, syndrome associated with Mercury over-exposure is "Acrodynia". Symptoms of this syndrome include a pink color to the extremities, apathy, fever, kidney problems, sensitivity to light, generalized edema, and a painful scaling of the skin of the hands and feet. Other symptoms of chronic over-exposure to Mercury can include loosening of the teeth, inflammation of the mucous membranes, a dark blue line appearing along gingival margins, abnormal blushing, excessive sweating, and rashes. Reproductive effects, sexual disorders, and impotence may also develop in the event of Mercury over-exposure.

Short-term over-exposures to high concentrations of mercury vapors can lead to breathing difficulty, coughing, acute, chemical pneumonia, and pulmonary edema (a potentially fatal accumulation of fluid in the lungs). Depending on the concentration of over-exposure, cardiac abnormalities, damage to the kidney, liver or nerves and effects on the brain may occur.

If this product is heated, and exposure to Mercury fumes occurs, "Metal Fume Fever" may develop. This syndrome is a flu-like illness which occurs when metal oxides below 1.5 microns in size are inhaled. Symptoms of this syndrome may develop 4-12 hours after exposure and begin with the onset of thirst, metallic taste in the mouth, and symptoms of Mercury poisoning as described above. All symptoms generally subside within 24-36 hours after the over-exposure ends.

CONTACT WITH SKIN or EYES: Mercury can be irritating to contaminated skin and eyes. Symptoms of skin exposure can include redness, dry skin, and pain. Prolonged contact may lead to ulceration of the skin. Allergic reactions (i.e. rashes, welts) may occur in sensitive individuals. Dermatitis (redness and inflammation of the skin) may occur after repeated skin exposures. Symptoms of eye exposure can include redness, pain, and watery eyes. A symptom of Mercury exposure is discoloration of the lens of the eyes.

3. HAZARD IDENTIFICATION (Continued)

SKIN ABSORPTION: Skin absorption is a significant route of potential over-exposure to Mercury. Currently, no quantitative estimates of the rate of penetration are available. Symptoms of such over-exposure would include redness and irritation of the contaminated area, as well as the development of symptoms described for "Inhalation".

INGESTION: Ingestion is not anticipated to be a significant route of occupational over-exposure. If Mercury is swallowed, symptoms of such over-exposure can include metallic taste in mouth, nausea, vomiting, central nervous system effects, and damage to the kidneys. Metallic mercury is not usually absorbed sufficiently from the gastrointestinal tract to induce an acute, toxic response. Damage to the tissues of the mouth, throat, esophagus, and other tissues of the digestive system may occur. Ingestion may be fatal, due to effects on gastrointestinal system and kidneys.

INJECTION: Injection is not anticipated to be a significant route of over-exposure for this product. If Mercury is injected (i.e. though abrasions and lacerations of the skin), local redness and pain will occur. Other symptoms of such exposure can include the development of embolisms (Mercury blocking a vein or artery), malaise, chest pain, and difficulty in breathing.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in **Lay Terms**. The most severe health effects associated with Mercury exposure are related to long-term exposures to vapors. In the event of over-exposure, the following symptoms may be observed:

ACUTE: Mercury can be irritating to contaminated skin and eyes. Short-term over-exposures to high concentrations of mercury vapors can lead to breathing difficulty, coughing, acute, and potentially fatal lung disorders. Depending on the concentration of inhalation over-exposure, heart problems, damage to the kidney, liver or nerves and effects on the brain may occur.

CHRONIC: Long-term over-exposure can lead to a wide range of adverse health effects. Anyone using Mercury must pay attention to personality changes, weight loss, skin or gum discolorations, stomach pains, and other signs of Mercury over-exposure. Gradually developing syndromes ("Erethism" and "Acrodynia") are indicative of potentially severe health problems. Mercury can cause the development of allergic reactions (i.e. dermatitis, rashes, breathing difficulty) upon prolonged or repeated exposures. Refer to Section 11 (Toxicology Information) for additional data.

TARGET ORGANS: ACUTE: Skin, eyes, respiratory system, central nervous system, brain. CHRONIC: Skin, respiratory system, central nervous system, brain, blood system, kidneys, and reproductive system.

PART II *What should I do if a hazardous situation occurs?*

4. FIRST-AID MEASURES

Contaminated individuals must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take a copy of label and MSDS to health professional with victim.

SKIN EXPOSURE: If Mercury contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. The contaminated individual must seek immediate medical attention.

EYE EXPOSURE: If Mercury contaminates the eyes, open the victim's eyes while under gently running water. Use sufficient force to open eyelids. Have the contaminated individual "roll" eyes. Minimum flushing is for 15 minutes. The contaminated individual must seek immediate medical attention.

INHALATION: If Mercury vapors are inhaled, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Remove or cover gross contamination to avoid exposure to rescuers. The contaminated individual must seek immediate medical attention.

INGESTION: If Mercury is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. If professional advice is not available, induce vomiting. Have victim rinse mouth with water, or drink several cupfuls of water, if conscious. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or unable to swallow.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Preexisting respiratory problems, dermatitis, central nervous system disorders, kidney problems, and liver dysfunctions can be aggravated by exposure to this product.

RECOMMENDATIONS TO PHYSICIANS: Treatment for Mercury over-exposure must be given. The following treatment protocol for ingestion of Mercury is from Clinical Toxicology of Commercial Products (5th Edition, 1984).

1. As soon as possible, have patient drink milk or slurry of activated charcoal to help precipitate mercury in the stomach.
2. Gastric lavage with tap water, milk, or 2-5% solution of sodium bicarbonate, unless spontaneous vomiting is intense and productive,
3. Administer through the lavage tube 0.5-1.0 oz. of sodium or magnesium sulfate in 6-8 oz. of water (unless spontaneous purging has already begun) and a slurry of activated charcoal.
4. Administer BAL (Dimercaprol; 3 mg/kg or 0.3 mL/10 kg) intramuscularly as a 10% solution in oil. If given within three hours after ingestion, severe renal damage may be prevented. Collect urine before and after BAL therapy for mercury analysis.
5. Demulcents (i.e. milk of magnesia, starch, bismuth subcarbonate) and analgesic drugs may be useful and necessary.

4. FIRST-AID MEASURES (Continued)

RECOMMENDATIONS TO PHYSICIANS (continued):

6. Because the BAL-Mercury Complex excreted in bile may be partly resorbed in the bowel, it is probably useful to administer activated charcoal every few hours, starting as soon as vomiting subsides.
7. Treat shock by correcting dehydration and electrolyte imbalances. If renal insufficiency develops, treat for acute renal failure.
8. The maintenance of an adequate nutritional status may be troublesome if gastrointestinal disorders becomes severe or persistent.
9. If toxic signs or symptoms recur after an apparent recovery, another course of chelation therapy is warranted. BAL is still appropriate, but a trial with D-Penicillamine or N-acetyl-D,L-penicillamine may be preferable. Either penicillamine compound is given by mouth, usually on an empty stomach, in a dose of 250 mg (4 times daily for adults; 3 times daily in children; 5-10 days). Penicillamine should be withheld until mercury is cleared out of the bowels. A chelating agent should be used until the urine-mercury level falls below 50μg/24 hours.

Laboratory Analysis: Determination of β2-Microglobulins has been recommended as a useful test for renal function. Electroencephalographic changes may be correlated closely with the clinical state. Analysis of the blood, hair, urine, or feces can be done to determine the level of Mercury exposure. Mercury deposits in the body can be observed in X-Rays.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not flammable.

AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS (in air by volume, %): Lower (LEL): Not applicable. Upper (UEL): Not applicable.

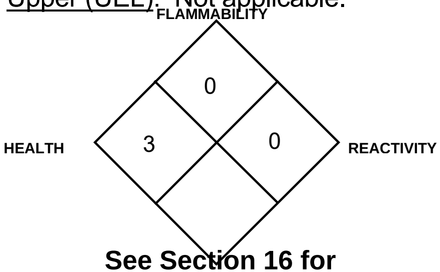
FIRE EXTINGUISHING MATERIALS:

Water Spray: YES
Carbon Dioxide: YES
Foam: YES
Dry Chemical: YES
Halon: YES
Other: Any "ABC" Class.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Mercury vapors and mercury oxides generated during fires involving this product are toxic; additionally, this element can be irritating to contaminated tissue. Therefore, this product presents a severe health hazard to firefighters. Mercury is not flammable, and is relatively stable (though it can react with many metals to form amalgams).

Explosion Sensitivity to Mechanical Impact: Not sensitive.
Explosion Sensitivity to Static Discharge: Not sensitive.

NFPA RATING



See Section 16 for Definition of Ratings

SPECIAL FIRE-FIGHTING PROCEDURES: Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Move fire-exposed containers if it can be done without risk to firefighters. Apply cooling water to sides of containers that are exposed to flame until well after fire is out. Decontaminate all equipment thoroughly after the conclusion of fire-fighting activities. If possible, prevent run-off water from entering storm drains, bodies of water, or other environmentally sensitive areas.

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a Mercury release, clear the affected area, protect people, and respond with trained personnel. In the event of a release under 1 pound of Mercury, the minimum Personal Protective Equipment should be **Level C: triple-gloves (rubber gloves and nitrile gloves over latex gloves), chemical resistant suit and boots, hard-hat, and Air-Purifying Respirator with cartridge appropriate for Mercury. Level B, which includes Self-Contained Breathing Apparatus, must be worn if the amount of Mercury released is over 1 pound or when the concentration of oxygen in atmospheres is less than 19.5% or unknown.** If necessary, dike area of release with suitable absorbent materials. There are a variety of methods which can be used to clean-up Mercury spills. Use a commercially-available Mercury Spill Kit for small spills. A suction pump with aspirator can also be used during clean-up operations. For larger releases, a Mercury vacuum can be used. Calcium polysulfide or excess sulfur can also be used for clean-up. Mercury can migrate into cracks and other difficult-to-clean areas; calcium polysulfide and sulfur can be sprinkled effectively into these areas. Decontaminate the area thoroughly. The area should be inspected visually and with colorimetric tubes for Mercury to ensure all traces of Mercury have been removed prior to re-occupation by non-emergency personnel. Decontaminate all equipment used in response thoroughly. If such equipment cannot be adequately decontaminated, it must be discarded with other spill residue. Place all spill residue in an appropriate container, seal immediately, and label appropriately. Dispose of in accordance with U.S. Federal, State, and local hazardous waste disposal regulations and regulations of Canada and it's Provinces. (see Section 13, Disposal Considerations).

PART III *How can I prevent hazardous situations from occurring?*

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting Mercury ON YOU or IN YOU. Wash thoroughly after handling this product. Avoid breathing vapors or spays of this product. Do not eat or drink while handling this product. Remove contaminated clothing immediately. Report all Mercury releases promptly. Clean-up all releases of this product immediately. Supervisors and other responsible personnel must be aware of personality changes, weight loss, or other signs of Mercury over-exposure in employees using this product; these symptoms can develop gradually and are indicative of potentially severe health effects related to Mercury contamination.

STORAGE AND HANDLING PRACTICES: All employees who handle this material should be trained to handle it safely. Use in a well-ventilated location. Open containers slowly on a stable surface. Drums, flask, and bottles of this product must be properly labeled. Empty containers may contain residual amounts of Mercury; therefore, empty containers should be handled with care. Store drums, flasks, and bottles in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Store away from incompatible materials (see Section 10, Stability and Reactivity). Material should be stored in secondary containers or in a diked area, as appropriate. Keep drums, flasks, and bottles tightly closed when not in use. Storage areas should be made of fire-resistant materials. If appropriate, post warning signs in storage and use areas. Inspect all incoming containers before storage to ensure containers are properly labeled and not damaged.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Always use this product in areas where adequate ventilation is provided. Decontaminate equipment thoroughly before maintenance begins.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation to ensure exposure levels are maintained below the limits provided in Section 2 (Composition and Information on Ingredients), if applicable. Ensure eyewash/safety shower stations are available near areas where this product is used.

RESPIRATORY PROTECTION: Maintain airborne contaminant concentrations below exposure limits listed in Section 2 (Composition and Information on Ingredients), if applicable. If necessary, use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134) or equivalent U.S. State standards, and Canadian CSA Standard Z94.4-93. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998).The following respirator selection guidelines from NIOSH are provided for additional information:

RECOMMENDATIONS FOR MERCURY COMPOUNDS [except (organo) alkyls] (as Hg) CONCENTRATIONS IN AIR:

Up to 0.5 mg/m^3: Chemical cartridge respirator with cartridge(s) to protect against mercury compounds (an End-of-Service Life Indicator is required); or Supplied-Air Respirator (SAR).

Up to 1.25 mg/m^3: SAR operated in a continuous-flow mode; or powered air- purifying respirator with cartridge(s) to protect against mercury compounds (canister) (an End-of-Service Life Indicator is required.)

Up to 2.5 mg/m^3: Full-facepiece chemical cartridge respirator with cartridge(s) to protect against mercury compounds; or gas mask with canister to protect against mercury compounds; or SAR with a tight-fitting facepiece operated in a continuous-flow mode; or powered air-purifying respirator with a tight-fitting facepiece and cartridge(s) to protect against mercury compounds (canister) (an End-of-Service Life Indicator is required); or full-facepiece Self-Contained Breathing Apparatus (SCBA); or full-facepiece SAR.

Up to 10 mg/m^3: Positive pressure SAR.

Emergency or Planned Entry into Unknown Concentrations or IDLH Conditions: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.

Escape: Gas mask with canister to protect against mercury compounds; or escape-type SCBA.

EYE PROTECTION: Splash goggles or safety glasses. For operations involving the use of more than 1 pound of Mercury, or if the operation may generate a spray of Mercury, the use of a faceshield is recommended.

HAND PROTECTION: Wear neoprene gloves for routine industrial use. Use triple gloves for spill response, as stated in Section 6 (Accidental Release Measures) of this MSDS.

BODY PROTECTION: Use body protection appropriate for task (i.e. lab coat, coveralls, Tyvek suit).

9. PHYSICAL and CHEMICAL PROPERTIES

RELATIVE VAPOR DENSITY (air = 1): 6.9 EVAPORATION RATE (n-BuAc = 1): Not determined.

SPECIFIC GRAVITY (water = 1): 13.5939

MELTING/FREEZING POINT: -38.87°C (-37.97°F)

SOLUBILITY IN WATER: Insoluble.

BOILING POINT: 356.72°C (674.1°F)

VAPOR PRESSURE, mm Hg @ 25°C: 0.002

pH: Not applicable.

ODOR THRESHOLD: Not applicable.

COEFFICIENT OF OIL/WATER DISTRIBUTION (PARTITION COEFFICIENT): Not available.

APPEARANCE, ODOR AND COLOR: Mercury is a silver-white, heavy liquid which is odorless.

HOW TO DETECT THIS SUBSTANCE (warning properties): The appearance of this product is a distinguishing characteristic.

10. STABILITY and REACTIVITY

STABILITY: Stable

DECOMPOSITION PRODUCTS: If this product is exposed to extremely high temperatures in the presence of oxygen or air, toxic vapors of mercury and mercury oxides will be generated.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Mercury is incompatible with acetylene and acetylene derivatives, amines, ammonia, 3-bromopropyne, boron diiodophosphide, methyl azide, sodium carbide, heated sulfuric acid, methylsilane/oxygen mixtures; nitric acid/alcohol mixtures, tetracarbonylnickel/oxygen mixtures, alkyne/silver perchlorate mixtures, halogens (i.e. chlorine, bromine) and strong oxidizers (i.e. chlorine dioxide, perchlorates). Mercury can attack copper and copper alloys. Additionally, mercury can react with many metals (i.e. calcium, lithium, potassium, sodium, rubidium, aluminum) to form amalgams.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Avoid exposure or contact to extreme temperatures, incompatible chemicals

PART IV *Is there any other useful information about this material?*

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The specific toxicology data available for Mercury are as follows.

TDLo (Subcutaneous-Man) 254 mg/kg: Skin and Appendages: dermatitis, other (after systemic exposure)

TDLo (Oral-Man) 43 mg/kg: Behavioral: tremor; Liver: jaundice, other or unclassified, other changes

TDLo (Skin-Man) 129 mg/kg/5 hours-continuous: Sense Organs and Special Senses (Ear): tinnitus; Behavioral: headache; Skin and Appendages: dermatitis, allergic (after systemic exposure)

TDLo (Intravenous-Man) 571 µL/kg: Peripheral Nerve and Sensation: paresthesia; Lungs, Thorax, or Respiration: dyspnea; Skin and Appendages: sweating

TDLo (Intraperitoneal-Rat) 400 mg/kg/14 days-intermittent: Tumorigenic: equivocal tumorigenic agent by RTECS criteria, tumors at site of application

TCLo (Inhalation-Woman) 150 µg/m^3/46 days: Behavioral: wakefulness, anorexia (human); Gastrointestinal: hypermotility, diarrhea

TCLo (Inhalation-Man) 44300 µg/m^3/8 hours: Behavioral: muscle weakness; Liver: other changes; Nutritional and Gross Metabolic: body temperature increase

TCLo (Inhalation-Rat) 4 mg/m^3/2 hours/11 days-intermittent: Brain and Coverings: other degenerative changes; Kidney, Ureter, Bladder: other changes; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: other Enzymes

TCLo (Inhalation-Rat) 1 mg/m^3/24 hours/5 weeks-continuous: Kidney, Ureter, Bladder: proteinuria

TCLo (Inhalation-Rat) 8 µg/m^3/6.5 hours/41 weeks-intermittent: Behavioral: alteration of classical conditioning

TCLo (Inhalation-Rat) 17 mg/m^3/2 hours/30 days-continuous: Brain and Coverings: other degenerative changes; Behavioral: alteration of classical conditioning, alteration of operant conditioning

TCLo (Inhalation-Rat) 890 ng/m^3/24 hours: male 16 week(s) pre-mating: Reproductive: Paternal Effects: spermatogenesis (incl. genetic material, sperm morphology, motility, and count)

TCLo (Inhalation-Rat) 7440 ng/m^3/24 hours: male 16 week(s) pre-mating: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants)

TCLo (Inhalation-Rat) 1 mg/m^3/24 hours: female 1-20 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus)

TCLo (Inhalation-Rat) 300 µg/m^3/4 hours: female 7-21 day(s) after conception: Reproductive: Specific Developmental Abnormalities: Central Nervous System

LCLo (Inhalation-Rabbit) 29 mg/m^3/30 hours

Cytogenetic Analysis (Unreported-Man) 150 µg/m^3

SUSPECTED CANCER AGENT: Mercury is listed as follows by agencies tracking carcinogenic potential:

> ACGIH TLV-A4 (Not Classifiable as a Human Carcinogen: Agents which cause concern that they could be carcinogenic for humans, but which cannot be assessed conclusively because of a lack of data); EPA- D (Not Classifiable as to Human Carcinogenicity-Inadequate human and animal evidence of carcinogenicity or no data are available); IARC-3 (Possibly Carcinogenic to Humans)

Mercury is not found on the following lists: FEDERAL OSHA Z LIST, NTP, or CAL/OSHA and therefore is not considered to be, nor suspected to be, a cancer-causing agent by these agencies.

11. TOXICOLOGICAL INFORMATION (Continued)

IRRITANCY OF PRODUCT: Mercury can be irritating to skin, eyes, or other contaminated tissue.

SENSITIZATION TO THE PRODUCT: Mercury is a sensitizer capable of causing allergic reactions (i.e. breathing difficulty, dermatitis, rashes) after prolonged or repeated over-exposures.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Mercury on the human reproductive system.

Mutagenicity: Human mutation data are available for Mercury; these data were obtained during clinical studies on specific human tissues exposed to high doses of this element.

Embryotoxicity: This product may cause embryotoxic effects in humans. Refer to the paragraph on "Teratogenicity" for additional information.

Teratogenicity: This product may cause teratogenic effects in humans. Intrauterine exposure may result in tremors and involuntary movements in the fetus. Mercury has also been reported to produce teratogenic effects in test animals.

Reproductive Toxicity: This product is reported to cause reproductive effects in humans. Impotence has been reported in over-exposed males. Women occupationally exposed have reported menstrual disturbances, reduced ovulation, and spontaneous abortions. Mercury is excreted in breast milk. Mercury has also been reported to produce adverse reproductive effects in test animals.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

BIOLOGICAL EXPOSURE INDICES: The following Biological Exposure Indices (BEIs) have been determined for Mercury.

CHEMICAL DETERMINANT	SAMPLING TIME	BEI
MERCURY		
• Total inorganic mercury in urine	• Preshift	• 35 µg/g creatinine
• Total inorganic mercury in blood	• End of shift at end of workweek	• 15 µg/L

Note: Women of child-bearing potential, whose blood Pb exceeds 10 µg/dl, are at risk of delivering a child with a blood Pb over the current Center for Disease Control Quideline of 10 µg/dl. If the blood Pb of such children remains elevated, they may be at increased risk of cognitive deficits. The blood Pb of these children should be closely monitored and appropriate steps should be taken to minimize the child's exposure to environmental lead.

12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

ENVIRONMENTAL STABILITY: Mercury is stable, and persists for long periods in ambient environmental conditions. The following environmental data are available for this element:

The biological half-life of mercury in fish is approximately 2 to 3 years. Mercury bioaccumulates and concentrates in the food chain. Concentration may be as much as 10,000 times that of water. Mercury is concentrated by animals, plants and fishes. Chinook salmon fed contaminated fingerlings concentrated Mercury in the liver and kidneys. Methyl mercury is formed naturally in aquatic and terrestrial environments from elemental mercury. Methylation is likely to occur in upper sedimentary layers of sea or lake bottoms.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Mercury can be harmful or fatal to contaminated plant or animal life.

EFFECT OF CHEMICAL ON AQUATIC LIFE: Mercury can be harmful or fatal to contaminated aquatic plant or animal life in contaminated bodies of water. The following aquatic toxicity data are available for Mercury:

MERCURY:

LC_{50} (Catfish) = 0.35 mg/L/ 96 hours (conditions of bioassay not specified)
LC_{50} (*Modiolus carvalhoi*) (mollusk) = 0.5 ppm / 48 hours; 0.19 ppm - 96 hours (conditions of bioassay not specified)
LC_{50} (*Rana hexadactyla*) (tadpoles) = 0.051 ppm / 96 hours (conditions of bioassay not specified)

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. This product, if unaltered by use, should be recycled. If altered by use, recycling may be possible. Consult Bethlehem Apparatus Company for information. If Mercury must be disposed of as hazardous waste, it must be handled at a permitted facility or as advised by your local hazardous waste regulatory authority.

EPA WASTE NUMBER: Depending on the nature of the waste, one of the following RCRA codes will be applicable: U151 (Toxic Commercial Chemical Products/Mercury); D009 (Characteristic; Toxicity Characteristic Leaching Procedure; Regulated Level: 0.2 mg/L).

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME:	Mercury
HAZARD CLASS NUMBER and DESCRIPTION:	8 (Corrosive Material)
UN IDENTIFICATION NUMBER:	UN 2809
PACKING GROUP:	PG III
DOT LABEL(S) REQUIRED:	Corrosive

NOTE: For transport by aircraft, Mercury must be packaged in packagings which meet the requirements of Packing Group I Performance Level. For transportation by other modes, Mercury must be packaged in packagings which meet the requirements of Packing Group III Performance Level or in non-specification reusable metal packagings. Refer to 49 CFR 173.164 for specific packaging requirements.

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MARINE POLLUTANT: Mercury is not listed as a Marine Pollutant, per Appendix B to 49 CFR 172.101.

TRANSPORT CANADA, TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This material is considered as dangerous goods, per regulations of Transport Canada. Use the above U.S. DOT information for the preparation of Canadian Shipments.

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: Mercury is subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

CHEMICAL NAME	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Mercury	No	YES	YES

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for Mercury. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lbs. (4,540 kg) therefore applies, per 40 CFR 370.20.

U.S. TSCA INVENTORY STATUS: Mercury is listed on the TSCA Inventory.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Mercury = 1 lb (0.454 kg)

OTHER U.S. FEDERAL REGULATIONS: Mercury is regulated as follows (other regulations may be applicable):

EPA: Mercury is listed as a Hazardous Air Pollutant (HAP) generally known or suspected to cause serious health problems. The Clean Air Act, as amended in 1990, directs EPA to set standards requiring major sources to sharply reduce routine emissions of toxic pollutants. EPA is required to establish and phase in specific performance based standards for all air emission sources that emit one or more of the listed pollutants. Mercury is included on this list.

FDA: The action level of 1.0 ppm total mercury in fish has been revised on September 12, 1984 by FDA to apply only to methyl mercury.

FIFRA: All uses of mercury are cancelled except the following: 1) as a fungicide in the treatment of textiles and fabrics intended for continuous outdoor use; 2) as a fungicide to control brown mold on freshly sawn lumber; 3) as a fungicide treatment to control Dutch elm disease; 4) as an in-can preservative in water based paints and coatings; 5) as a fungicide in water-based paints and coatings used for exterior application; 6) as a fungicide to control "winter turf diseases" such as Sclerotinia boreales, and gray and pink snow mold subject to the following: a. the use of these products shall be prohibited within 25 feet of any water body where fish are taken for human consumption. b. these products can be applied only by or under the direct supervision of golf course superintendents. These types of Mercury-containing products will be classified as restricted use pesticides when they are reregistered and classified in accordance with Section 4(C) of FEPCA.

U.S. STATE REGULATORY INFORMATION: Mercury is covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: Mercury.
California - Permissible Exposure Limits for Chemical Contaminants: Mercury.
Florida - Substance List: Mercury.
Illinois - Toxic Substance List: Mercury.
Kansas - Section 302/313 List: Mercury.
Massachusetts - Substance List: Mercury.
Michigan – Critical Materials Register: Mercury.
Minnesota - List of Hazardous Substances: Mercury.
Missouri - Employer Information/Toxic Substance List: Mercury.
New Jersey - Right to Know Hazardous Substance List: Mercury.
North Dakota - List of Hazardous Chemicals, Reportable Quantities: Mercury.
Pennsylvania - Hazardous Substance List: Mercury.
Rhode Island - Hazardous Substance List: Mercury.
Texas - Hazardous Substance List: Mercury.
West Virginia - Hazardous Substance List: Mercury.
Wisconsin - Toxic and Hazardous Substances: Mercury.

15. REGULATORY INFORMATION (Continued)

ADDITIONAL U.S. REGULATIONS (continued):

CALIFORNIA PROPOSITION 65: Mercury is on the California Proposition 65 lists. WARNING: Contains a chemical known to the State of California to cause birth defects or other reproductive harm.

LABELING (Precautionary Statements) ANSI LABELING (Z129.1):: **DANGER!** HIGHLY TOXIC AFTER LONG-TERM EXPOSURE. DANGER OF CUMULATIVE EFFECTS. MAY CAUSE DAMAGE TO THE NERVOUS SYSTEM, BLOOD SYSTEM, KIDNEYS, LIVER. REPRODUCTIVE HAZARD. HARMFUL OR FATAL IF INHALED OR SWALLOWED. MAY CAUSE ALLERGIC SKIN AND RESPIRATORY REACTION. CAUSES SKIN AND EYE IRRITATION Do not get on skin, in eyes, or on clothing. Avoid prolonged contact with the skin. Avoid breathing vapors and fumes. Do not take internally. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Wear gloves, goggles, face-shield, body protection, and NIOSH-approved respiratory protection, as appropriate. FIRST-AID: In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. If inhaled, remove to fresh air. If ingested, induce vomiting. Get medical attention immediately. IN CASE OF FIRE: Use water fog, dry chemical, CO_2, or “alcohol” foam. IN CASE OF SPILL: Vacuum released material, or use a Mercury Spill Kit. Containerize residue immediately, and label appropriately. Consult Material Safety Data Sheet for additional information.

ADDITIONAL CANADIAN REGULATIONS:

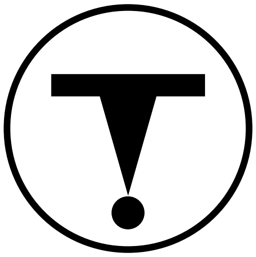
CANADIAN DSL/NDSL INVENTORY STATUS: Mercury is listed on the DSL Inventory.

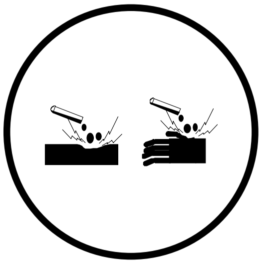
OTHER CANADIAN REGULATIONS: Not applicable.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: Mercury is not on the CEPA Priorities Substances Lists.

CANADIAN WHMIS SYMBOLS:

CANADIAN WHMIS SYMBOLS:	D1B:	Materials Causing Immediate and Serious Toxic Effects/Toxic Material
	D2A:	Materials Causing Other Toxic Effects/Very Toxic Material
	D2B:	Materials Causing Other Toxic Effects/Toxic Material
	E:	Corrosive Material





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16. OTHER INFORMATION

PREPARED BY:

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The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Bethlehem Apparatus Company responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, Bethlehem Apparatus Company for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

CAS #: This is the Chemical Abstract Service Number which uniquely identifies each constituent.

EXPOSURE LIMITS IN AIR:

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV -** Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average **(TWA)**, the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level **(C)**. Skin absorption effects must also be considered.

OSHA - U.S. Occupational Safety and Health Administration.

PEL - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, “Vacated 1989 PEL,” is placed next to the PEL which was vacated by Court Order. **IDLH -** Immediately Dangerous to Life and Health **-** This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. **The DFG - MAK** is the Republic of Germany’s Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). NIOSH issues exposure guidelines called Recommended Exposure Levels (**REL**s). When no exposure guidelines are established, an entry of **NE** is made for reference.

HAZARD RATINGS:

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: Health Hazard: **0** (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]. Reactivity Hazard: **0** (normally stable); 1 (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures).

NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard: **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure causes death or major residual injury). Flammability Hazard and Reactivity Hazard: Refer to definitions for “Hazardous Materials Identification System”.

FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (**NFPA**). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Human and Animal Toxicology: Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD_{50}** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC_{50}** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m^3** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **Cancer Information:** The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. **Other Information: BEI** - ACGIH Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. **Ecological Information:** EC is the effect concentration in water. **BCF** = Bioconcentration Factor, which is used to determine if a substance will concentrate in lifeforms which consume contaminated plant or animal matter. Coefficient of Oil/Water Distribution is represented by **$\log K_{ow}$** or **$\log K_{oc}$** and is used to assess a substance’s behavior in the environment.

REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **U.S.: EPA** is the U.S. Environmental Protection Agency. **DOT** is the U.S. Department of Transportation. **SARA** is the Superfund Amendments and Reauthorization Act. **TSCA** is the U.S. Toxic Substance Control Act. **CERCLA (or Superfund)** refers to the Comprehensive Environmental Response, Compensation, and Liability Act. Labeling is per the American National Standards Institute (**ANSI Z129.1**). **CANADA: CEPA** is the Canadian Environmental Protection Act. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **TC** is Transport Canada. **DSL/NDSL** are the Canadian Domestic/Non-Domestic Substances Lists. **The CPR is the Canadian Product Regulations.** This section also includes information on the precautionary warnings which appear on the materials package label.

MATERION

MATERIAL SAFETY DATA SHEET

MATERIAL SAFETY DATA SHEET - NO. M10

1. PRODUCT AND COMPANY IDENTIFICATION

Beryllium Solid

MANUFACTURER
Materion Brush Inc.
14710 West Portage River Road South
Elmore, Ohio 43416
Phone: (419) 862-2745
Fax: (419) 862-4477

SYNONYMS:
Metallic Beryllium
I220H
S200F
S200FC
S65
PF10
O-30
UHP Beryllium
.9999 Beryllium
Be
Glucinium
IF-1
S200FH
SR200
PS200
PF60
I-70
I-70H
B-26D

24-HR. EMERGENCY ASSISTANCE
Transportation Emergency
Call Chemtrec at:
Domestic: (800) 424-9300
International: (703) 527-3887
Other Emergency
Call: (800) 862-4118

Revised: 03-08-11
Replaces: MSDS M10 (01-01-10)

CHEMICAL FAMILY Beryllium

CUSTOMER SERVICE
Materion Brush Inc.
Product Stewardship Department
6070 Parkland Boulevard
Mayfield Heights, Ohio 44124
Phone: (800) 862-4118 or (216) 486-4200
Fax: (216) 383-4091
Website: www.materion.com

2. HAZARD IDENTIFICATION

2.1 EMERGENCY OVERVIEW

Metallic product which poses little or no immediate hazard in solid form. See label in Section 16. If the material is involved in a fire; pressure-demand self-contained breathing apparatus and protective clothing must be worn by persons potentially exposed to the airborne particulate during or after a fire.

2.2 POTENTIAL HEALTH EFFECTS

Exposure to the elements listed in Section 3 by inhalation, ingestion, and skin contact can occur when melting, casting, dross handling, pickling, chemical cleaning, heat treating, abrasive cutting, welding, grinding, sanding, polishing, milling, crushing, or otherwise heating or abrading the surface of this material in a manner which generates particulate.

Exposure may also occur during repair or maintenance activities on contaminated equipment such as: furnace rebuilding, maintenance or repair of air cleaning equipment, structural renovation, welding, etc.

Particulate depositing on hands, gloves, and clothing, can be transferred to the breathing zone and inhaled during normal hand to face motions such as rubbing of the nose or eyes, sneezing, coughing, etc.

2.2.1. Inhalation

Particulate containing those elements listed in Section 3 can cause irritation to the nose, throat, lungs and mucous membranes.

Beryllium: The beryllium in this product is not known to cause acute health effects. Inhaling particulate containing beryllium may cause a serious, chronic lung disease called Chronic Beryllium Disease (CBD) in some individuals. See Section 2.2.5 Chronic (long-term health effects).

2.2.2. Ingestion

Ingestion can occur from hand, clothing, food and drink contact with particulate during hand to mouth activities such as eating, drinking, smoking, nail biting, etc.

Beryllium: The health effect of ingestion of beryllium in the form found in this product is unknown.

2.2.3. Skin

Beryllium: Particulate that becomes lodged under the skin has the potential to induce sensitization and skin lesions.

2.2.4. Eyes

Exposure may result from direct contact with airborne particulate or contact to the eye with contaminated hands or clothing. Damage can result from irritation or mechanical injury to the eyes by particulate.

2.2.5. Chronic (long-term health effects)

Beryllium: Inhaling particulate containing beryllium may cause a serious, chronic lung disease called chronic beryllium disease (CBD) in some individuals. Over time, lung disease can be fatal. Chronic beryllium disease is a hypersensitivity or allergic condition in which the tissues of the lungs become inflamed. This inflammation, sometimes with accompanying fibrosis (scarring), may restrict the exchange of oxygen between the lungs and the bloodstream. Medical science suggests that CBD may be related to genetic factors.

2.2.6. Carcinogenic References

Beryllium: The International Agency for Research on Cancer (IARC) lists beryllium as a Group 1 – Known Human Carcinogen. The National Toxicology Program (NTP) lists beryllium as known to be human carcinogens.

IARC lists beryllium as a known human carcinogen (Group 1) and notes that the work environment of workers involved in refining, machining and producing beryllium metal was associated with an increased risk of lung cancer, “the greater excess was in workers hired before 1950 when exposures to beryllium in the work place were relatively uncontrolled and much higher than in subsequent decades”; and “the highest risk for lung cancer being observed among individuals diagnosed with acute beryllium-induced pneumonitis, who represent a group that had the most intense exposure to beryllium.” IARC further noted that “Prior to 1950, exposure to beryllium in working environments was usually very high, and concentrations exceeding 1 mg/m^3 [1000 micrograms per cubic meter] were not unusual.”

2.2.7. 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 particulate is inhaled. If prior damage or disease to the neurologic (nervous), circulatory, hematologic (blood), or urinary (kidney) systems 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 exposure.

Beryllium: The effects of chronic beryllium disease on the lungs and heart are additive to the effects of other health conditions.

2.3 POTENTIAL ENVIRONMENTAL EFFECTS

See Ecological Information (Section 12)

3. COMPOSITION/INFORMATION ON INGREDIENTS

CHEMICAL COMPOSITION (Percent by Weight)

PRODUCT		
CONSTITUENTS	CAS Numbers	Beryllium Solid
Beryllium	7440-41-7	~100

Hazard Communication regulations of the U.S. Occupational Safety and Health Administration apply to this product.

NOTE: As used in this Material Safety Data Sheet, the term “particulate” refers to dust, mist, fume, fragments, particles and/or powder.

4. FIRST AID MEASURES

4.1 FIRST AID PROCEDURES

INHALATION: Breathing difficulty caused by inhalation of particulate requires immediate removal to fresh air. If breathing has stopped, perform artificial respiration and obtain medical help.

INGESTION: Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

SKIN: Thoroughly wash skin cuts or wounds to remove all particulate debris from the wound. Seek medical attention for wounds that cannot be thoroughly cleansed. Treat skin cuts and wounds with standard first aid practices such as cleansing, disinfecting and covering to prevent wound infection and contamination before continuing work. Obtain medical help for persistent irritation. Material accidentally implanted or lodged under the skin must be removed.

EYES: Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

4.2 NOTE TO PHYSICIANS

Treatment of Chronic Beryllium Disease: There is no known treatment which will cure chronic beryllium disease. Prednisone or other corticosteroids are the most specific treatment currently available. They are directed at suppressing the immunological reaction and can be effective in diminishing signs and symptoms of chronic beryllium disease. In cases where steroid therapy has had only partial or minimal effectiveness, other immunosuppressive agents, such as cyclophosphamide, cyclosporine, or methotrexate, have been used. These latter agents remain investigational. Further, in view of the potential side effects of all the immunosuppressive medications, including steroids such as prednisone, they should be used only under the direct care of a physician. In general, these medications should be reserved for cases with significant symptoms and/or significant loss of lung function. Other symptomatic treatment, such as oxygen, inhaled steroids or bronchodilators, may be prescribed by some physicians and can be effective in selected cases.

The decision about when and with what medication to treat is a judgment situation for individual physicians. For the most part, treatment is reserved for those persons with symptoms and measurable loss of lung function. The value of starting oral steroid treatment, before signs or symptoms are evident, remains a medically unresolved issue.

The effects of continued low exposure to beryllium are unknown for individuals who are sensitized to beryllium or who have a diagnosis of chronic beryllium disease. It is generally recommended that persons who are sensitized to beryllium or who have CBD terminate their occupational exposure to beryllium.

5. FIRE FIGHTING MEASURES

Flash Point	Not Applicable to Solids
Explosive Limits	Not Applicable to Solids
Extinguishing Media	Only in powder or other finely divided form does this material present a special fire problem. To extinguish a metal powder fire, use Class D fire extinguishing powder.
Unusual Fire and Explosion Hazards	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 metal particulate or chips releasing flammable hydrogen gas which could burn and result in an explosion. Ventilation duct work which has accumulated a fine coating of this material as a particulate on its internal surface poses a potentially serious fire hazard. Extinguish 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 from machining of other materials, welding spark, etc. must not be allowed to enter the ventilation duct work. Also, duct work must be made of non-combustible material. See Section 8 for further information regarding personal protective measures.
Special Fire Fighting Procedures	Pressure-demand self-contained breathing apparatus must be worn by firefighters or any other persons potentially exposed to the particulate released during or after a fire.

6. ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED

If this material is a particulate, 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 (see Section 8). Cleanup spills with a vacuum system utilizing a high efficiency particulate air (HEPA) filtration system followed by wet cleaning methods. Special precautions must be taken when changing filters on HEPA vacuum cleaners used to clean up hazardous materials. Be careful to minimize airborne generation of particulate and avoid contamination of air and water. Depending upon the quantity of material released into the environment, the incident may be required to be reported to the National Response Center at (800) 424-8802 as well as the State Emergency Response Commission and Local Emergency Planning Committee.

7. HANDLING AND STORAGE

7.1 HANDLING

Particulate may enter the body through cuts, abrasions or other wounds on the surface of the skin. Wear gloves when handling parts with loose surface particulate or sharp edges.

7.2 STORAGE

Store in a dry area.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

8.1 VENTILATION AND ENGINEERING CONTROLS

Whenever possible, the use of local exhaust ventilation or other engineering controls is the preferred method of controlling exposure to airborne particulate. Where utilized, exhaust inlets to the ventilation system must be positioned as close as possible to the source of airborne generation. Avoid disruption of the airflow in the area of a local exhaust inlet by equipment such as a man-cooling fan. Check ventilation equipment regularly to ensure it is functioning properly. Provide training on the use and operation of ventilation to all users. Use qualified professionals to design and install ventilation systems.

8.2 WORK PRACTICES

Develop work practices and procedures that prevent particulate from coming in contact with worker skin, hair, or personal clothing. If work practices and/or procedures are ineffective in controlling airborne exposure or visual particulate from deposition on skin, hair, or clothing, provide appropriate cleaning/washing facilities. Procedures should be written that clearly communicate the facility’s requirements for protective clothing and personal hygiene. These clothing and personal hygiene requirements help keep particulate from being spread to non-production areas or from being taken home by the worker. Never use compressed air to clean work clothing or other surfaces.

Fabrication processes may leave a residue of particulate on the surface of parts, products or equipment that could result in employee exposure during subsequent material handling activities. As necessary, clean loose particulate from parts between processing steps. As a standard hygiene practice, wash hands before eating or smoking.

To prevent exposure, remove surface scale or oxidation formed on cast or heat treated products in an adequately ventilated process prior to working the surface.

8.3 WET METHODS

Machining operations conducted under a flood of liquid coolant require complete hooded containment and local exhaust ventilation. Openings into the hood must be baffled to prevent release of fast moving particulate. The cycling through a machine of liquid lubricant/coolant containing finely divided beryllium particulate in suspension can result in the concentration building to a point where the particulate may become airborne during use. Prevent coolant from splashing onto floor areas, external structures or operators’ clothing. Utilize a coolant filtering system to remove particulate from the coolant.

8.4 RESPIRATORY PROTECTION

When airborne exposures exceed or have the potential to exceed the occupational limits shown in Section 8.15, approved respirators must be used as specified by an Industrial Hygienist or other qualified professional. Respirator users must be medically evaluated to determine if they are physically capable of wearing a respirator. Quantitative and/or qualitative fit testing and respirator training must be satisfactorily completed by all personnel prior to respirator use. Users of tight fitting respirators must be clean shaven on those areas of the face where the respirator seal contacts the face. Exposure to unknown concentrations of particulate requires the wearing of a pressure-demand airline respirator or pressure-demand self-contained breathing apparatus (SCBA). Use pressure-demand airline respirators when performing jobs with high potential exposures such as changing filters in a baghouse air cleaning device.

8.5 OTHER PROTECTIVE EQUIPMENT

Protective overgarments or work clothing must be worn by persons who may become contaminated with particulate during activities such as machining, furnace rebuilding, air cleaning equipment filter changes, maintenance, furnace tending, etc. Contaminated work clothing and overgarments must be managed in a controlled manner to prevent secondary exposure to workers of third parties, to prevent the spread of particulate to other areas, and to prevent particulate from being taken home by workers.

8.6 PROTECTIVE GLOVES

Wear gloves to prevent contact with particulate or solutions. Wear gloves to prevent metal cuts and skin abrasions during handling.

8.7 EYE PROTECTION

Wear safety glasses, goggles, face shield or welder's helmet when risk of eye injury is present, particularly during melting, casting, machining, grinding, welding, powder handling, etc.

8.8 HOUSEKEEPING

Use vacuum and wet cleaning methods for particulate removal from surfaces. Be certain to de-energize electrical systems, as necessary, before beginning wet cleaning. Use vacuum cleaners with high efficiency particulate air (HEPA). Do not use compressed air, brooms, or conventional vacuum cleaners to remove particulate from surfaces as this activity can result in elevated exposures to airborne particulate. Follow the manufacturer's instructions when performing maintenance on HEPA filtered vacuums used to clean hazardous materials.

8.9 MAINTENANCE

During repair or maintenance activities the potential exists for exposures to particulate in excess of the occupational standards. Under these circumstances, protecting workers can require the use of specific work practices or procedures involving the combined use of ventilation, wet and vacuum cleaning methods, respiratory protection, decontamination, special protective clothing, and when necessary, restricted work zones.

8.10 WELDING

In accordance with OSHA regulation 29 CFR 1910.252 welding of materials containing beryllium is regulated as follows: Welding or cutting indoors, outdoors, or in confined spaces involving beryllium containing base or filler metals shall be done using local exhaust ventilation and pressure-demand airline respirators unless atmospheric tests under the most adverse conditions have established that the workers' exposure is within the acceptable concentrations defined by 29 CFR 1910.1000. In all cases, workers in the immediate vicinity of the welding or cutting operations shall be protected as necessary by local exhaust ventilation or airline respirators.

8.11 CORROSION PROTECTION

Beryllium is corrosion-resistant in air and water up to 600°C. This is attributed to the formation of an adherent oxide layer on the surface.

The presence of salts in water, particularly chloride, dramatically accelerates the corrosion of beryllium. This corrosion can be further accelerated (galvanic corrosion) if beryllium is in contact with a less reactive metal. Contrarily, beryllium can be protected from corrosion by contact with a more reactive metal (anodic protection).

Generally, some corrosion protection should be applied to beryllium. Salts from handling beryllium without gloves along with humidity in the air are sufficient to cause "finger print" corrosion on a bare beryllium part. A chromate conversion coating is an effective protection for non-severe service.

For applications where beryllium is exposed to salt spray or mist, an integral coating is needed to prevent corrosion. The conversion coating alone will not protect beryllium in salt spray applications. Conversion coating in combination with anodic protection with manganese or magnesium has been effective in protecting beryllium brake components on aircraft carrier based planes. Electroless nickel, epoxy paint and other integral coatings are effective corrosion barriers in salt spray applications.

8.12 EXPOSURE CHARACTERIZATION

Determine exposure to airborne particulate by air sampling in the employee breathing zone, work area, and department. Utilize an Industrial Hygienist or other qualified professional to specify the frequency and type of air sampling. Develop and utilize a sampling strategy which identifies the extent of exposure variation and provides statistical confidence in the results. Conduct an exposure risk assessment of processes to determine if conditions or situations exist which dictate the need for additional controls or improved work practices. Make air sample results available to employees.

8.13 MEDICAL SURVEILLANCE

Beryllium: Medical surveillance for beryllium health effects includes (1) skin examination, (2) respiratory history, (3) examination of the lungs, (4) lung function tests (FVC and FEV1), and (5) periodic chest x-ray. In addition, a specialized, specific, immunological blood test, the beryllium blood lymphocyte proliferation test (BLPT), is available to assist in the diagnosis of beryllium related reactions. Individuals who have an abnormal BLPT are normally referred to a lung specialist for additional specific tests to determine if chronic beryllium disease is present. Note: Substantial inter- and intra-laboratory disagreement exists among the laboratories that conduct this test. The BLPT does not at this time meet the criteria for a screening test. Despite its limitations, however, the BLPT remains a useful disease surveillance tool.

8.14 RISK FACTORS

Specific genetic factors have been identified and have been shown to increase an individual’s susceptibility to CBD. Medical testing is available to detect genetic factors in individuals.

8.15 OCCUPATIONAL EXPOSURE LIMITS

Following good industrial hygiene practice, which includes reducing airborne exposures to the lowest feasible level for all constituents in this product, is recommended. It is also recommended that users of beryllium-containing materials maintain worker exposures to airborne beryllium to levels reliably below its recommended exposure guideline (REG) of 0.0002 milligrams beryllium per cubic meter of air.

CONSTITUENTS	OSHA*			ACGIH*		NIOSH RTECS NUMBER
	PEL	CEILING	PEAK	TLV	TLV-STEL	
Beryllium	0.002	0.005	0.025	0.00005	N/A	DS1750000

*ALL CONCENTRATIONS ARE IN MILLIGRAMS PER CUBIC METER OF AIR
(at the concentrations noted above, these constituents may not be visible to the human eye)

A leading scientific body recommending occupational standards is the American Conference of Governmental Industrial Hygienists (ACGIH). The ACGIH recommends standards for all listed substances. The ACGIH defines a threshold limit value (standard) as follows: “Threshold Limit Values refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects. Because of wide variation in individual susceptibility, however, a small percentage of workers may experience discomfort from some substances at concentrations at or below the threshold limit; a smaller percentage may be affected more seriously by aggravation of a pre-existing condition or by development of an occupational illness.” “Individuals may also be hypersusceptible or otherwise unusually responsive to some industrial chemicals because of genetic factors, age, personal habits (smoking, alcohol, or other drugs), medication, or previous exposures. Such workers may not be adequately protected from adverse health effects from certain chemicals at concentrations at or below the threshold limits.”

ACGIH = American Conference of Governmental Industrial Hygienists
OSHA = Occupational Safety and Health Administration
PEL = Eight-Hour Average Permissible Exposure Limit (OSHA)
CEILING = Not To Be Exceeded Except for Peak Limit (OSHA)
PEAK = 30-Minute Maximum Duration Concentration Above Ceiling Limit (OSHA)
TLV = Eight-Hour Average Threshold Limit Value (ACGIH)
TLV-STEL = 15-Minute Short Term Exposure Limit (ACGIH)
CAS = Chemical Abstract Service
NIOSH = National Institute for Occupational Safety and Health
RTECS = Registry of Toxic Effects of Chemical Substances
N/A = Not Applicable

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL PROPERTIES

Boiling Point (°F):	5378	Radioactivity:	Not Applicable
Evaporation Rate:	Not Applicable	Solubility:	None
Freezing Point (°F):	Not Applicable	Sublimes At (°F):	Not Applicable
Odor:	None	Vapor Density (Air = 1):	Not Applicable
pH:	Not Applicable	Vapor Pressure (mmHg):	Not Applicable
Physical State:	Solid	% Volatiles By Volume:	None
Color:	Gray Metallic	Melting Point (°F):	2345
Density (lb/in3):	0.067	Atomic Number	4
Atomic Weight	9.01	Molecular Weight	9.01

10. STABILITY AND REACTIVITY

General Reactivity	This Material is Stable
Incompatibility (materials to avoid)	Avoid contact with mineral acids and strong bases which generate hydrogen gas. Hydrogen gas can be an explosion hazard.
Hazardous Decomposition Products	None under normal conditions of use.
Hazardous Polymerization	Will not occur

11. TOXICOLOGICAL INFORMATION

For questions concerning toxicological information, write to: Medical Director, Materion Brush Inc., 14710 West Portage River South Road, Elmore, Ohio 43416-9502.

12. ECOLOGICAL INFORMATION

This material can be recycled; contact your Sales Representative.

13. DISPOSAL CONSIDERATIONS

13.1 BYPRODUCT RECYCLING

When recycled (used in a process to recover metals), this material is not classified as hazardous waste under federal law. Seal particulate or particulate containing materials inside two plastic bags, place in a DOT approved container, and label appropriately.

13.2 SOLID WASTE MANAGEMENT

When spent products are declared solid wastes (no longer recyclable), they must be labeled, managed and disposed of, in accordance with federal, state and local requirements. This material is not classified a hazardous waste under federal law.

The U.S. Environmental Protection Agency has classified beryllium powder (P015) as a hazardous waste under the Resource Conservation and Recovery Act (RCRA). In Section 40 CFR 261.33(e) of RCRA, beryllium powder is considered hazardous when it is in the form of a “discarded commercial chemical product, off-specification species, container residue and spill residue, thereof.” This designation only applies to commercially pure products or manufacturing intermediates in which beryllium is the “sole active ingredient.” Due to the limited scope of this definition, we believe the only form of beryllium to which it applies is waste commercially pure metallic beryllium powder.

Beryllium scrap, chips, and powder are normally recycled as by-products and are not classified a waste. In cases where this is not justified, seal any off-specification metallic beryllium powder in two plastic bags and then place in a DOT container approved for flammable solids. If being disposed, the outer container must be labeled with the appropriate EPA hazardous waste label and DOT hazard warning label(s) and shipped under a uniform hazardous waste manifest to an approved hazardous waste management facility. Dispose of dust collector filters contaminated with metallic beryllium powder following the above procedure, with the exception of the hazardous waste manifest and hazardous waste container label.

14. TRANSPORT INFORMATION

There are no U.S. Department of Transportation hazardous material regulations which apply to the packaging and labeling of this product as shipped.

Hazard Communication regulations of the U.S. Occupational Safety and Health Administration require this product be labeled.

15. REGULATORY INFORMATION

15.1 UNITED STATES FEDERAL REGULATIONS

15.1.1. Occupational Safety and Health Administration (OSHA)

Air contaminants, 29 CFR 1910.1000
Hazard Communication Standard, 29 CFR 1910.1200

15.1.2. Environmental Protection Agency (EPA)

AMBIENT AIR EMISSIONS: Beryllium-containing materials are subject to the National Emission Standard for Beryllium as promulgated by EPA (40 CFR 61, Subpart C). The National Emission Standard for beryllium is 0.01 micrograms per cubic meter (30-day average) in ambient air for those production facilities which have been qualified to be regulated through ambient air monitoring. Other facilities must meet a 10 gram per 24-hour total site emission limit. Most process air emission sources will require an air permit from a local and/or state air pollution control agency. The use of air cleaning equipment may be necessary to achieve the permissible emission. Tempered makeup air should be provided to prevent excessive negative pressure in a building. Direct recycling of cleaned process exhaust air is not recommended. Plant exhausts should be located so as not to re-enter the plant through makeup air or other inlets. Regular maintenance and inspection of air cleaning equipment and monitoring of operating parameters is recommended to ensure adequate efficiency is maintained.

WASTEWATER: Wastewater regulations can vary considerably. Contact your local and state governments to determine their requirements.

TOXIC SUBSTANCES CONTROL ACT: Component(s) of this material is/are listed on the TSCA Chemical Substance Inventory of Existing Chemical Substances

SARA TITLE III REPORTING REQUIREMENTS: On February 16, 1988, the U.S. Environmental Protection Agency (EPA) issued a final rule that implements the requirements of the Superfund Amendments and Reauthorization Act (SARA) Title III, Section 313 (53) Federal Register 4525. Title III is the portion of SARA concerning emergency planning and community right-to-know issues. Section 313 covers annual emission reporting on specific chemicals which are manufactured, processed or used at certain U.S. Industrial facilities.

This product is reportable under the Section 313.

You may obtain additional information by calling the EPA SARA Title III Hotline at 1-800-535-0202 (or 703-412-9810).

15.2 STATE REGULATIONS

Beryllium

- Is listed on the following state right-to-know lists: California, New Jersey, Florida, Pennsylvania, Minnesota and Massachusetts.
- The following statement is made in order to comply with the California State Drinking Water Act - Warning: This product contains BERYLLIUM, a chemical known to the state of California to cause cancer.
- California No Significant Risk Level: CAS# 7440-41-7: No significant risk level = 0.1 µg/day

15.3 CANADA

Constituent	DSL/NDSL	WHMIS Classification	Ingredient Disclosure List
Beryllium	Yes/No	D2A,D2B	Yes

16. OTHER INFORMATION

Following is the label which accompanies this product during shipment.

M10

Beryllium Solid

⚠ WARNING ⚠

INHALING DUST OR FUMES MAY CAUSE CHRONIC BERYLLIUM DISEASE, A SERIOUS CHRONIC LUNG DISEASE, IN SOME INDIVIDUALS. CANCER HAZARD. OVER TIME, LUNG DISEASE AND CANCER CAN BE FATAL. TARGET ORGAN IS PRIMARILY THE LUNG.

READ THE MATERIAL SAFETY DATA SHEET (MSDS) ON FILE WITH YOUR EMPLOYER BEFORE WORKING WITH THIS MATERIAL.

Overexposure to beryllium by inhalation may cause chronic beryllium disease, a serious chronic lung disease.

- If processing or recycling produces airborne dust, fumes, or mists, use exhaust ventilation or other controls designed to prevent exposure to workers. Examples of such activities include melting, machining, welding, grinding, abrasive sawing, sanding and polishing. Any activity which abrades the surface of this material can generate airborne dust.
- The Occupational Safety and Health Administration (OSHA) has set mandatory limits on occupational exposures.
- Beryllium metal, in solid form and as contained in finished products presents no special health risks.
- Sold for manufacturing purposes only. This product can be recycled; contact your sales representative.

The Occupational Safety and Health Administration requires employers to provide training in the proper use of this product.

For further information, please telephone or write to: Product Stewardship Department, Materion Brush Inc., 6070 Parkland Boulevard, Mayfield Heights, Ohio 44124, telephone: (800) 862-4118, www.materion.com.
For transportation emergency call Chemtrec at (800) 424-9300.

M10

*Label may vary in size
*Label color (light gray edge with black lettering)

This MSDS has been revised following the guidelines outlined in the American National Standard for Hazardous Industrial Chemicals -“Material Safety Data Sheets - Preparation.” Z400.1-2004

MSDS Status: Change in company name

IMPORTANT: If you have any questions or require additional information regarding the materials described in this Material Safety Data Sheet, please telephone or write to the Product Stewardship Department at the location given on page 1. Additional product safety information, such as Safety Facts, is available from your sales representative or at http://www.materion.com/.

Additional information and guidance on the safe use and handling of these materials is available in the “Interactive Guide to Working Safely with Beryllium and Beryllium-containing Materials.” This innovative, computer based tool can be accessed online at www.berylliumsafety.com. A copy of the Interactive Guide on compact disc (CD) can be obtained by contacting the Product Stewardship Department at the location given on page 1.

Material Safety Data Sheet

Antimony Metal

ScholAR Chemistry

MSDS # 66.00

Section 1: Product and Company Identification

Antimony Metal

Synonyms/General Names: Stibium
Product Use: For educational use only
Manufacturer: Columbus Chemical Industries, Inc., Columbus, WI 53925.

24 Hour Emergency Information Telephone Numbers
CHEMTREC (USA): 800-424-9300 **CANUTEC (Canada): 613-424-6666**
ScholAR Chemistry; 5100 W. Henrietta Rd, Rochester, NY 14586; (866) 260-0501; www.Scholarchemistry.com

Section 2: Hazards Identification

Silver metal lumps; no odor.

CAUTION! Slightly toxic by ingestion.
Target organs: Respiratory and cardiovascular systems, liver, kidneys.

HMIS (0 to 4)

Health	**1**
Fire Hazard	**0**
Reactivity	**0**

This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Section 3: Composition / Information on Ingredients

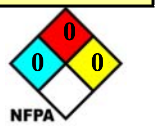
Antimony Metal (744-36-0), 100%

Section 4: First Aid Measures

Always seek professional medical attention after first aid measures are provided.

Eyes:	Immediately flush eyes with excess water for 15 minutes, lifting lower and upper eyelids occasionally.
Skin:	Immediately flush skin with excess water for 15 minutes while removing contaminated clothing.
Ingestion:	Call Poison Control immediately. Rinse mouth with cold water. Give victim 1-2 cups of water or milk to drink. Induce vomiting immediately.
Inhalation:	Remove to fresh air. If not breathing, give artificial respiration.

Section 5: Fire Fighting Measures



Non-flammable solid. When heated to decomposition, emits acrid fumes.
Protective equipment and precautions for firefighters: Use foam or dry chemical to extinguish fire. Firefighters should wear full fire fighting turn-out gear and respiratory protection (SCBA). Cool container with water spray. Material is not sensitive to mechanical impact or static discharge.

Section 6: Accidental Release Measures

Use personal protection recommended in Section 8. Isolate the hazard area and deny entry to unnecessary and unprotected personnel. Sweep up spill and place in sealed bag or container for disposal. Wash spill area after pickup is complete. See Section 13 for disposal information.

Section 7: Handling and Storage Green

Handling: Use with adequate ventilation and do not breathe dust or vapor. Avoid contact with skin, eyes, or clothing. Wash hands thoroughly after handling.
Storage: Store in General Storage Area [Green Storage] with other items with no specific storage hazards. Store in a cool, dry, well-ventilated, locked store room away from incompatible materials.

Section 8: Exposure Controls / Personal Protection

Use ventilation to keep airborne concentrations below exposure limits. Have approved eyewash facility, safety shower, and fire extinguishers readily available. Wear chemical splash goggles and chemical resistant clothing such as gloves and aprons. Wash hands thoroughly after handling material and before eating or drinking. Use NIOSH-approved respirator with a dust cartridge. Exposure guidelines: Antimony compounds: OSHA PEL: 0.5 mg/m^3, ACGIH: TLV: 0.5 mg/m^3, STEL: Not Available.

Section 9: Physical and Chemical Properties

Molecular formula	Sb.	**Appearance**	Silver metal lumps.
Molecular weight	121.75.	**Odor**	No odor.
Specific Gravity	6.68 g/mL @ 20°C.	**Odor Threshold**	N/A.
Vapor Density (air=1)	N/A.	**Solubility**	Insoluble .
Melting Point	630°C.	**Evaporation rate**	N/A *(Butyl acetate = 1).*
Boiling Point/Range	1380 °C.	**Partition Coefficient**	N/A *(log P_{OW}).*
Vapor Pressure (20°C)	N/A.	**pH**	N/A.
Flash Point:	N/A.	**LEL**	N/A.
Autoignition Temp.:	N/A.	**UEL**	N/A.

N/A = Not available or applicable

Section 10: Stability and Reactivity

Avoid heat and ignition sources.
Stability: Stable under normal conditions of use and storage.
Incompatibility: Acids, chlorine, fluorine, bromine.
Shelf life: Indefinite if stored properly.

Section 11: Toxicology Information

Acute Symptoms/Signs of exposure: ***Eyes***: Redness, tearing, itching, burning, conjunctivitis. ***Skin***: Redness, itching. ***Ingestion***: Irritation and burning sensations of mouth and throat, nausea, vomiting and abdominal pain. ***Inhalation***: Irritation of mucous membranes, coughing, wheezing, shortness of breath,
Chronic Effects: No information found.
Sensitization: none expected
Antimony: LD50 [oral, rat]; NA; LC50 [rat]; N/A; LD50 Dermal [rabbit]; N/A
Material has not been found to be a carcinogen nor produce genetic, reproductive, or developmental effects.

Section 12: Ecological Information

Ecotoxicity (aquatic and terrestrial): Contains a heavy metal – toxic to terrestrial and aquatic plants and animals. Do not release to environment.

Section 13: Disposal Considerations

Check with all applicable local, regional, and national laws and regulations. Local regulations may be more stringent than regional or national regulations. Use a licensed chemical waste disposal firm for proper disposal.

Section 14: Transport Information

DOT Shipping Name:	Antimony powder.	**Canada TDG:**	Antimony powder.
DOT Hazard Class:	6.1, pg III.	**Hazard Class:**	6.1, pg III.
Identification Number:	UN2871.	**UN Number:**	UN2871.

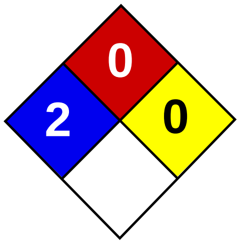
Section 15: Regulatory Information

EINECS: Not listed
TSCA: All components are listed or are exempt
WHMIS Canada: Not WHMIS Controlled.
California Proposition 65: Not listed

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

Section 16: Other Information

Current Issue Date: January 23, 2009



Health	2
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Nickel metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Nickel metal

Catalog Codes: SLN2296, SLN1342, SLN1954

CAS#: 7440-02-0

RTECS: QR5950000

TSCA: TSCA 8(b) inventory: Nickel metal

CI#: Not applicable.

Synonym: Nickel Metal shot; Nickel metal foil.

Chemical Name: Nickel

Chemical Formula: Ni

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Nickel metal	7440-02-0	100

Toxicological Data on Ingredients: Nickel metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

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

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer), of ingestion, of inhalation (lung sensitizer). CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to skin. The substance may be toxic to kidneys, lungs, liver, upper respiratory tract. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact: Not available.

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

Serious Inhalation: Not available.

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

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

Fire Fighting Media and Instructions:
Flammable solid. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Material in powder form, capable of creating a dust explosion. This material is flammable in powder form only.

Special Remarks on Explosion Hazards:
Material in powder form, capable of creating a dust explosion. Mixtures containing Potassium Perchlorate with Nickel & Titanium powders & infusorial earth can explode. Adding 2 or 3 drops of approximately 90% peroxyformic acid to powdered nickel will result in explosion. Powdered nickel reacts explosively upon contact with fused ammonium nitrate at temperatures below 200 deg. C.

Section 6: Accidental Release Measures

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

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

Section 7: Handling and Storage

Precautions:
Keep locked up.. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Keep away from incompatibles such as oxidizing agents, combustible materials, metals, acids.

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

Section 8: Exposure Controls/Personal Protection

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

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 1 (mg/m3) from ACGIH (TLV) [United States] Inhalation Respirable. TWA: 0.5 (mg/m3) [United Kingdom (UK)] TWA: 1 (mg/m3) from OSHA (PEL) [United States] InhalationConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

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

Odor: Odorless.

Taste: Not available.

Molecular Weight: 58.71 g/mole

Color: Silvery.

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

Boiling Point: 2730°C (4946°F)

Melting Point: 1455°C (2651°F)

Critical Temperature: Not available.

Specific Gravity: Density: 8.908 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:

Insoluble in cold water, hot water. Insoluble in Ammonia. Soluble in dilute Nitric Acid. Slightly soluble in Hydrochloric Acid, Sulfuric Acid.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, combustible materials, metals, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Incompatible with strong acids, selenium, sulfur, wood and other combustibles, nickel nitrate, aluminum, aluminum trichloride, ethylene, p-dioxan, hydrogen, methanol, non-metals, oxidants, sulfur compounds, aniline, hydrogen sulfide, flammable solvents, hydrazine, and metal powders (especially zinc, aluminum, and magnesium), ammonium nitrate, nitryl fluoride, bromine pentafluoride, potassium perchlorate + titanium powder + indusorial earth.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

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

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP. Causes damage to the following organs: skin. May cause damage to the following organs: kidneys, lungs, liver, upper respiratory tract.

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

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose/Conc: LDL [Rat] **-** Route: Oral; Dose: 5000 mg/kg LDL [Guinea Pig] **-** Route: Oral; Dose: 5000 mg/kg

Special Remarks on Chronic Effects on Humans: May cause cancer based on animal test data

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Nickel dust and fume can irritate skin. Eyes: Nickel dust and fume can irritate eyes. Inhalation: Inhalation of dust or fume may cause respiratory tract irritation with non-productive cough, hoarseness, sore throat, headache, vertigo, weakness, chest pain, followed by delayed effects, including tachypnea, dyspnea, and ARDS. Death due to ARDS has been reported following inhalation of high concentrations of respirable metallic nickel dust. Later effects may include pulmonary edema and fibrosis. Ingestion: Metallic nickel is generally considered not to be acutely toxic if ingested. Ingestion may cause nausea, vomiting, abdominal , and diarrhea. Nickel may damage the kidneys(proteinuria), and may affect liver function. It may also affect behavior (somnolence), and cardiovascular system (increased cornary artery resistance, decreased myocardial contractility, myocardial damage, regional or general arteriolar or venus dilation). Chronic Potential Health Effects: Skin: May cause skin allergy. Nickel and nickel compounds are among the most common sensitizers inducing allergic contact dermatitis. Inhalation: Chronic inhalation nickel dust or fume can cause chronic hypertrophic rhinitis, sinusitis, nasal polyps, perforation of the nasal septum, chronic pulmonary irritation, fibrosis, pulmonary edema, pulmonary eosinophilia, Pneumoconiosis, allergies (asthma-like allergy), and cancer of the nasal sinus cavities, lungs, and possibly other organs. Future exposures can cause asthma attacks with shortness of breath, wheezing, cough, and/or chest tightness. Chronic inhalation of nickel dust or fume may also affect the liver (impaired liver function tests), and blood (changes in red blood cell count). Ingestion: Prolonged or repeated ingestion of nickel can be a source chronic urticaria and other signs of allergy.

Chronic ingestion of NIckel may also affect respiration and cause pneumoconiosis or fibrosis. Note: In the general population, sensitization occurs from exposure to nickel-containing coins, jewelry, watches,

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

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

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

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

Section 14: Transport Information

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

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Nickel metal California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Nickel metal Connecticut hazardous material survey.: Nickel metal Illinois toxic substances disclosure to employee act: Nickel metal Illinois chemical safety act: Nickel metal New York release reporting list: Nickel metal Rhode Island RTK hazardous substances: Nickel metal Pennsylvania RTK: Nickel metal Michigan critical material: Nickel metal Massachusetts RTK: Nickel metal Massachusetts spill list: Nickel metal New Jersey: Nickel metal New Jersey spill list: Nickel metal Louisiana spill reporting: Nickel metal California Director's List of Hazardous Substances: Nickel metal TSCA 8(b) inventory: Nickel metal

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

Other Classifications:

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

DSCL (EEC):
R40- Possible risks of irreversible effects. R43- May cause sensitization by skin contact. S22- Do not breathe dust. S36- Wear suitable protective clothing.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

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

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:42 PM

Last Updated: 11/01/2010 12:00 PM

PERFLUOROOCTANOIC ACID
Safety Data Sheet
Prepared: 4/24/2015
Revised: 3/16/2017

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name: PERFLUOROOCTANOIC ACID
Synonyms: Pentadecafluorooctanoic acid
Perfluorocaprylic acid
Product number: C8AC
CAS-No.: 335-67-1

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

Identified uses: Laboratory chemicals, manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company: Exfluor Research Corporation
2350 Double Creek Drive
ROUND ROCK, TEXAS 78664
USA

Telephone: +1 512-310-9044

1.4 24-hour Emergency telephone number

Contact INFOTRAC at:
1-800-535-5053 (US, Canada)
1-352-323-3500 (International)
ER # 84263

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, oral	(Category 4)	H302
Acute aquatic toxicity	(Category 3)	H402
Chronic aquatic toxicity	(Category 3)	H412
Skin corrosion	(Category 1B)	H314
Serious eye damage	(Category 1)	H318

2.2 GHS Label Elements, including precautionary statements

Pictogram 

Signal word Danger

Hazard statement(s)

H302	Harmful if swallowed.
H314	Causes severe skin burns and eye damage.
H318	Causes serious eye damage.
H402	Harmful to aquatic life.
H412	Harmful to aquatic life with long lasting effects

Precautionary statement(s)

P260	Do not breathe fume/ gas /mist/ vapor.
P264	Wash hands thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P273	Avoid release to the environment
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312	IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell.
P301 + P330 + P331	IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do—continue rinsing.
P310	Immediately call a POISON CENTER or doctor/ physician.
P362	Take off contaminated clothing and wash before reuse.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

none

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3. COMPOSITION / INFORMATION ON INGREDIENTS

3.1 Substances

Formula:	$C_8HF_{15}O_2$
Molecular Weight:	414.07 g/mol
Component:	Perfluorooctanoic acid
CAS-No.:	335-67-1
EC-No.:	206-397-9
Concentration:	98%

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4. FIRST AID MEASURES

4.1 Description of first-aid measures

General advice

Move out of dangerous area. Consult a physician. Show this safety sheet to the doctor in attendance.

If inhaled

Remove victim to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

In case of skin contact

Flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes.

In case of eye contact

Immediately flush eyes with plenty of water for at least 15 minutes. Ensure adequate flushing of the eyes by separating the eyelids with fingers.

If swallowed

Do not induce vomiting. Never give anything by mouth to an unconscious person. Allow victim to rinse his mouth with water. Allow victim to drink 2 – 4 cupfuls of water. Call Poison Control center.

4.2 Most important symptoms and effects, both acute and delayed

See § 2.2 and § 11.

4.3 Indication of any immediate medical attention and special treatment needed

Note to physician: Treat symptomatically and supportively.

5. FIRE FIGHTING MEASURES

5.1 Extinguishing media

Water spray, carbon dioxide, dry chemical powder, or polymer foam.

5.2 Special hazards arising from the substance or mixture

Releases toxic fumes of carbon oxides and hydrogen fluoride.

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment, and emergency measures

Use personal protective equipment. Avoid breathing vapors, mist, or gas. Ensure adequate ventilation. Keep people away from and upwind of spill/ leak. Restrict access to area until completion of clean-up.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not allow material to enter drains. If necessary, dike ahead of spill to prevent runoff into drains, sewers, or any natural waterway or drinking supply.

If applicable: If a spill/ release in excess of the EPA reportable quantity is made into the environment, immediately notify the national response center in the US at 1-800-424-8802.

6.3 Methods and materials for containment and cleaning up

Soak up the spill with an inert absorbent material. Contaminated absorbent material may pose the same hazards as the spilled product. Place in container for disposal according to local regulations.

6.4 Reference to other sections

Refer to protective measures listed in § 7 and § 8.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

For precautions, see § 2.2.
Do not handle until all safety precautions have been read and understood. Wear protective gloves and eye/face protection. Use only in well-ventilated areas. Avoid inhalation of vapor or mist. Avoid contact with skin, eyes, and clothing. Keep away from heat and open flames. Do not eat, drink, or smoke when using this product. Wash hands thoroughly after handling.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed. Store in cool, dry, and well-ventilated place. Empty containers retain residue (powder and/or vapor) and can be dangerous. Store and handle in accordance with all current regulations and standards. Keep separated from incompatible substances (see § 10.5).

7.3 Specific use(s)

Apart from the uses mentioned in § 1.2 no other specific uses are stipulated.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Use only in well-ventilated areas. Provide local exhaust or a process enclosure ventilation system. Avoid contact with skin, eyes and clothing.

Personal protective equipment

Eye/face protection

Wear safety glasses or chemical safety goggles and face shield. Provide an emergency eye wash station and quick drench shower in the immediate work area.

Skin protection

Handle with appropriate chemical-resistant 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.

Body protection

The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

General hygiene considerations

Do not breathe vapors. Avoid contact with skin, eyes, and clothing. Do not eat, drink, or smoke when using this product. Wash hands before breaks and immediately after handling the product. Remove and wash contaminated clothing before re-use. Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	colorless flakes
b)	Odor	no data available
c)	Odor threshold	no data available
d)	pH	2.6 at 1 g/L
e)	Melting/freezing point	55 - 56 °C (131 - 133 °F) - lit.
f)	Initial boiling point/range	189 °C (372 °F) at 981 hPa (736 mmHg) - lit.
g)	Flash point	N/A
h)	Evaporation rate	no data available
i)	Flammability (solid, gas)	no data available
j)	Upper/lower flammability or explosive limits	no data available
k)	Vapor pressure	0.69 hPa (0.52 mmHg) at 25 °C (77 °F)
l)	Vapor density	no data available
m)	Relative density	0.900 g/cm3
n)	Solubility	no data available
o)	Partition coefficient: n-octanol/water	no data available

p)	Auto-ignition temperature	no data available
q)	Decomposition temperature	no data available
r)	Viscosity	no data available
s)	Explosive properties	no data available
t)	Oxidizing properties	no data available

9.2 Other safety information

none

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10. STABILITY AND REACTIVITY

10.1 Reactivity

No unusual reactivity. See § 10.5.

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reaction

No data available

10.4 Conditions to avoid

No data available

10.5 Incompatible materials

Strong oxidizing and reducing agents, Strong bases.

10.6 Hazardous decomposition products

Other decomposition products – no data available
In event of fire: see § 5

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11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

Inhalation: no data available
Dermal: no data available
LD50 Intraperitoneal – rat – 189 mg/kg

Skin corrosion/ irritation

No data available

Serious eye damage/ irritation

No data available

Respiratory or skin sensitization

No data available

Germ cell mutagenicity

Rat – DNA damage

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

Specific target organ toxicity – single exposure
No data available

Specific target organ toxicity -- repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional information

RTECS: RH0781000
Cough, Shortness of breath, Headache, Nausea, Vomiting
Stomach irregularities based on human evidence

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12. ECOLOGICAL INFORMATION

12.1 Toxicity

No data available

12.2 Persistence and degradability

No data available

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted.

12.6 Other adverse effects

Harmful to aquatic life.

---

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Refer to protective measures listed in § 7 and § 8.
Dispose of in accordance with all applicable federal, state, and local regulations.
Place in a chemical secured landfill or incinerate at 1200°C with a 2 second dwell time or at 1600°C with a 1.5 second dwell time. Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Empty containers retain residue and can be dangerous. Disposal must be made according to official regulations.

14. TRANSPORTATION INFORMATION

DOT (US) / IMDG / IATA

Proper Shipping Name:	Corrosive solid, acidic, organic, n.o.s. (Perfluorooctanoic acid)
UN / ID #:	3261
Hazard Class:	8
Packing Group:	II
Labels:	8

15. REGULATORY INFORMATION

US federal information

Listed on TSCA Inventory.

16. OTHER INFORMATION

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. Exfluor Research Corporation shall not be held liable for any damage resulting from handling or from contact with the above product.

SYNQUEST LABORATORIES

Perfluorooctanesulfonic acid

Safety Data Sheet 6164308

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Date of issue: 12/10/2015 Version: 1.0

SECTION 1: Identification

1.1. Identification

Product form	:	Substance
Substance name	:	Perfluorooctanesulfonic acid
CAS No	:	1763-23-1
Product code	:	6164-3-08
Formula	:	C8HF17O3S
Synonyms	:	1,1,2,2,3,3,4,4,5,5,6,6,7,7,8,8,8-Heptadecafluorooctane-1-sulfonic acid
Other means of identification	:	MFCD00042454

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

Use of the substance/mixture	:	Laboratory chemicals Manufacture of substances Scientific research and development

1.3. Details of the supplier of the safety data sheet

SynQuest Laboratories, Inc.
P.O. Box 309
Alachua, FL 32615 - United States of America
T (386) 462-0788 - F (386) 462-7097
info@synquestlabs.com - www.synquestlabs.com

1.4. Emergency telephone number

Emergency number	:	(844) 523-4086 (3E Company - Account 10069)

SECTION 2: Hazard(s) identification

2.1. Classification of the substance or mixture

Classification (GHS-US)

Acute Tox. 4 (Oral)	H302 -	Harmful if swallowed
Skin Corr. 1B	H314 -	Causes severe skin burns and eye damage
Eye Dam. 1	H318 -	Causes serious eye damage
STOT SE 3	H335 -	May cause respiratory irritation

Full text of H-phrases: see section 16

2.2. Label elements

GHS-US labeling

Hazard pictograms (GHS-US) :

GHS05

GHS07

Signal word (GHS-US)	:	Danger
Hazard statements (GHS-US)	:	H302 - Harmful if swallowed H314 - Causes severe skin burns and eye damage H335 - May cause respiratory irritation
Precautionary statements (GHS-US)	:	P260 - Do not breathe dust, mist, spray P264 - Wash skin thoroughly after handling P270 - Do not eat, drink or smoke when using this product P271 - Use only outdoors or in a well-ventilated area P280 - Wear protective gloves/protective clothing/eye protection/face protection P301+P312 - If swallowed: Call a POISON CENTER or doctor/ physician if you feel unwell P301+P330+P331 - If swallowed: rinse mouth. Do NOT induce vomiting P303+P361+P353 - If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower P304+P340 - If inhaled: Remove person to fresh air and keep comfortable for breathing P305+P351+P338 - If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing P310 - Immediately call a POISON CENTER or doctor/ physician P321 - Specific treatment (see supplemental first aid instructions on this label) P330 - Rinse mouth

P363 - Wash contaminated clothing before reuse
P403+P233 - Store in a well-ventilated place. Keep container tightly closed
P405 - Store locked up
P501 - Dispose of contents/container to an approved waste disposal plant

2.3. Other hazards

No additional information available

2.4. Unknown acute toxicity (GHS US)

Not applicable

SECTION 3: Composition/information on ingredients

3.1. Substance

Substance type : Mono-constituent

Name	Product identifier	%	Classification (GHS-US)
Perfluorooctanesulfonic acid (Main constituent)	(CAS No) 1763-23-1	<= 100	Acute Tox. 4 (Oral), H302 Skin Corr. 1B, H314 Eye Dam. 1, H318 STOT SE 3, H335

Full text of H-phrases: see section 16

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Move the affected personnel away from the contaminated area.

First-aid measures after inhalation : Remove person to fresh air and keep comfortable for breathing. If not breathing, give artificial respiration. Get immediate medical advice/attention.

First-aid measures after skin contact : Wash with plenty of soap and water. Remove contaminated clothing and shoes. Get immediate medical advice/attention.

First-aid measures after eye contact : Immediately flush eyes thoroughly with water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get immediate medical advice/attention.

First-aid measures after ingestion : Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth out with water. Get immediate medical advice/attention.

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

Symptoms/injuries : The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11.

Symptoms/injuries after inhalation : Material is destructive to tissue of the mucuous membranes and upper respiratory tract. Cough, shortness of breath, headache, nausea.

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

Treat symptomatically.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Alcohol resistant foam. Carbon dioxide. Dry powder. Water spray. Use extinguishing media appropriate for surrounding fire.

5.2. Special hazards arising from the substance or mixture

Fire hazard : Thermal decomposition generates: Carbon oxides. Hydrogen fluoride. Sulfur oxides.

5.3. Advice for firefighters

Firefighting instructions : In case of fire: Evacuate area.

Protection during firefighting : Wear gas tight chemically protective clothing in combination with self contained breathing apparatus. For further information refer to section 8: "Exposure controls/personal protection".

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Evacuate unnecessary personnel. Ensure adequate air ventilation. Do not breathe dust.

6.1.1. For non-emergency personnel

Emergency procedures : Only qualified personnel equipped with suitable protective equipment may intervene.

6.1.2. For emergency responders

Protective equipment : Do not attempt to take action without suitable protective equipment. For further information refer to section 8: "Exposure controls/personal protection".

6.2. Environmental precautions

Avoid release to the environment. Notify authorities if product enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

For containment : Stop leak if safe to do so.
Methods for cleaning up : Sweep or shovel spills into appropriate container for disposal. Minimize generation of dust.
Other information : For disposal of solid materials or residues refer to section 13 : "Disposal considerations".

6.4. Reference to other sections

No additional information available

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Do not handle until all safety precautions have been read and understood. Ensure good ventilation of the work station. Do not breathe dust, mist, spray. Wear personal protective equipment. Avoid contact with skin and eyes.
Hygiene measures : Handle in accordance with good industrial hygiene and safety procedures. Do not eat, drink or smoke when using this product. Always wash hands after handling the product.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures : Comply with applicable regulations.
Storage conditions : Keep container closed when not in use. Hygroscopic. Keep contents under inert gas.
Incompatible materials : Refer to Section 10 on Incompatible Materials.
Storage area : Store in dry, cool, well-ventilated area.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

No additional information available

8.2. Exposure controls

Appropriate engineering controls : Ensure good ventilation of the work station. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.
Hand protection : Protective gloves. 29 CFR 1910.138: Hand Protection.
Eye protection : Chemical goggles or safety glasses. Face shield. 29 CFR 1910.133: Eye and Face Protection.
Skin and body protection : Wear suitable protective clothing.
Respiratory protection : In case of inadequate ventilation wear respiratory protection. 29 CFR 1910.134: Respiratory Protection.
Other information : Safety shoes. 29 CFR 1910.136: Foot Protection.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Solid
Color : No data available
Odor : No data available
Odor threshold : No data available
pH : No data available
Melting point : No data available
Freezing point : No data available
Boiling point : 145 °C (@ 10 mm Hg)
Flash point : No data available
Relative evaporation rate (butyl acetate=1) : No data available
Flammability (solid, gas) : No data available
Explosion limits : No data available
Explosive properties : No data available

Oxidizing properties	: No data available
Vapor pressure	: No data available
Relative density	: 1.25 (@ 25 °C)
Relative vapor density at 20 °C	: No data available
Molecular mass	: 500.13 g/mol
Solubility	: No data available
Log Pow	: No data available
Auto-ignition temperature	: No data available
Decomposition temperature	: No data available
Viscosity	: No data available
Viscosity, kinematic	: No data available
Viscosity, dynamic	: No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

No additional information available

10.2. Chemical stability

The product is stable at normal handling and storage conditions.

10.3. Possibility of hazardous reactions

No additional information available

10.4. Conditions to avoid

Keep away from heat, sparks and flame.

10.5. Incompatible materials

Strong bases. Strong oxidizing agents.

10.6. Hazardous decomposition products

Under normal conditions of storage and use, hazardous decomposition products should not be produced. Hazardous decomposition products in case of fire, see Section 5.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity	: Oral: Harmful if swallowed.
Skin corrosion/irritation	: Causes severe skin burns and eye damage.
Serious eye damage/irritation	: Causes serious eye damage.
Respiratory or skin sensitization	: Not classified
Germ cell mutagenicity	: Not classified
Carcinogenicity	: Not classified
Reproductive toxicity	: Not classified
Specific target organ toxicity (single exposure)	: May cause respiratory irritation.
Specific target organ toxicity (repeated exposure)	: Not classified
Aspiration hazard	: Not classified
Symptoms/injuries after inhalation	: Material is destructive to tissue of the mucuous membranes and upper respiratory tract. Cough, shortness of breath, headache, nausea.

SECTION 12: Ecological information

12.1. Toxicity

No additional information available

12.2. Persistence and degradability

No additional information available

12.3. Bioaccumulative potential

No additional information available

12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

No additional information available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste treatment methods : Remove to an authorized incinerator equipped with an afterburner and a flue gas scrubber.

Waste disposal recommendations : Dispose of contents/container in accordance with licensed collector’s sorting instructions.

Additional information : Recycle the material as far as possible.

SECTION 14: Transport information

Department of Transportation (DOT)

In accordance with DOT

Transport document description : UN3261 Corrosive solid, acidic, organic, n.o.s., 8, II

UN-No.(DOT) : UN3261

Proper Shipping Name (DOT) : Corrosive solid, acidic, organic, n.o.s.

Transport hazard class(es) (DOT) : 8 - Class 8 - Corrosive material 49 CFR 173.136

Hazard labels (DOT) : 8 - Corrosive

Packing group (DOT) : II - Medium Danger

DOT Packaging Non Bulk (49 CFR 173.xxx) : 212

DOT Packaging Bulk (49 CFR 173.xxx) : 240

DOT Symbols : G - Identifies PSN requiring a technical name

DOT Special Provisions (49 CFR 172.102) : IB8 - Authorized IBCs: Metal (11A, 11B, 11N, 21A, 21B, 21N, 31A, 31B and 31N); Rigid plastics (11H1, 11H2, 21H1, 21H2, 31H1 and 31H2); Composite (11HZ1, 11HZ2, 21HZ1, 21HZ2, 31HZ1 and 31HZ2); Fiberboard (11G); Wooden (11C, 11D and 11F); Flexible (13H1, 13H2, 13H3, 13H4, 13H5, 13L1, 13L2, 13L3, 13L4, 13M1 or 13M2).
IP2 - When IBCs other than metal or rigid plastics IBCs are used, they must be offered for transportation in a closed freight container or a closed transport vehicle.
IP4 - Flexible, fiberboard or wooden IBCs must be sift-proof and water-resistant or be fitted with a sift-proof and water-resistant liner.
T3 - 2.65 178.274(d)(2) Normal............ 178.275(d)(2)
TP33 - The portable tank instruction assigned for this substance applies for granular and powdered solids and for solids which are filled and discharged at temperatures above their melting point which are cooled and transported as a solid mass. Solid substances transported or offered for transport above their melting point are authorized for transportation in portable tanks conforming to the provisions of portable tank instruction T4 for solid substances of packing group III or T7 for solid substances of packing group II, unless a tank with more stringent requirements for minimum shell thickness, maximum allowable working pressure, pressure-relief devices or bottom outlets are assigned in which case the more stringent tank instruction and special provisions shall apply. Filling limits must be in accordance with portable tank special provision TP3. Solids meeting the definition of an elevated temperature material must be transported in accordance with the applicable requirements of this subchapter.

DOT Packaging Exceptions (49 CFR 173.xxx) : 154

DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27) : 15 kg

DOT Quantity Limitations Cargo aircraft only (49 CFR 175.75) : 50 kg

DOT Vessel Stowage Location	:	B - (i) The material may be stowed ‘‘on deck’’ or ‘‘under deck’’ on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers, or one passenger per each 3 m of overall vessel length; and (ii) ‘‘On deck only’’ on passenger vessels in which the number of passengers specified in paragraph (k)(2)(i) of this section is exceeded.
Other information	:	No supplementary information available.

TDG

No additional information available

Transport by sea

UN-No. (IMDG)	:	3261
Proper Shipping Name (IMDG)	:	CORROSIVE SOLID, ACIDIC, ORGANIC, N.O.S.
Class (IMDG)	:	8 - Corrosive substances
Packing group (IMDG)	:	II - substances presenting medium danger

Air transport

UN-No. (IATA)	:	3261
Proper Shipping Name (IATA)	:	Corrosive solid, acidic, organic, n.o.s.
Class (IATA)	:	8 - Corrosives
Packing group (IATA)	:	II - Medium Danger

SECTION 15: Regulatory information

15.1. US Federal regulations

Perfluorooctanesulfonic acid (1763-23-1)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
EPA TSCA Regulatory Flag	S - S - indicates a substance that is identified in a proposed or final Significant New Uses Rule.

All components of this product are listed, or excluded from listing, on the United States Environmental Protection Agency Toxic Substances Control Act (TSCA) inventory

This product or mixture does not contain a toxic chemical or chemicals in excess of the applicable de minimis concentration as specified in 40 CFR §372.38(a) subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

15.2. International regulations

CANADA

Perfluorooctanesulfonic acid (1763-23-1)
Listed on the Canadian NDSL (Non-Domestic Substances List)

EU-Regulations

No additional information available

National regulations

Perfluorooctanesulfonic acid (1763-23-1)
Listed on IECSC (Inventory of Existing Chemical Substances Produced or Imported in China) Listed on the Japanese ENCS (Existing & New Chemical Substances) inventory Japanese Pollutant Release and Transfer Register Law (PRTR Law) Listed on INSQ (Mexican national Inventory of Chemical Substances)

15.3. US State regulations

California Proposition 65 - This product does not contain any substances known to the state of California to cause cancer and/or reproductive harm

SECTION 16: Other information

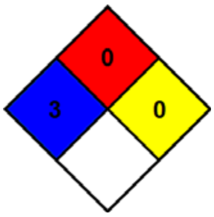
Full text of H-phrases:

Acute Tox. 4 (Oral)	Acute toxicity (oral) Category 4
Eye Dam. 1	Serious eye damage/eye irritation Category 1
Skin Corr. 1B	Skin corrosion/irritation Category 1B
STOT SE 3	Specific target organ toxicity (single exposure) Category 3
H302	Harmful if swallowed
H314	Causes severe skin burns and eye damage
H318	Causes serious eye damage
H335	May cause respiratory irritation

NFPA health hazard : 3 - Short exposure could cause serious temporary or residual injury even though prompt medical attention was given.

NFPA fire hazard : 0 - Materials that will not burn.

NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health : 3 Serious Hazard - Major injury likely unless prompt action is taken and medical treatment is given

Flammability : 0 Minimal Hazard - Materials that will not burn

Physical : 0 Minimal Hazard - Materials that are normally stable, even under fire conditions, and will NOT react with water, polymerize, decompose, condense, or self-react. Non-Explosives.

SDS US (GHS HazCom 2012)

cdhfinechemical.com

Selenium (Metal) Powder
CAS No 7782-49-2

MATERIAL SAFETY DATA SHEET
SDS/MSDS

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

1.1 Product identifiers

Product name : **Selenium** (Metal) Powder

CAS-No. : 7782-49-2

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

Identified uses : Laboratory chemicals, Industrial & for professional use only.

1.3 Details of the supplier of the safety data sheet

Company : Central Drug House (P) Ltd
7/28 Vardaan House
New Delhi-10002
INDIA

Telephone : +91 11 49404040
Email : care@cdhfinechemical.com

1.4 Emergency telephone number

Emergency Phone # : +91 11 49404040 (9:00am - 6:00 pm) [Office hours]

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008
Acute toxicity, Inhalation (Category 3), H331
Acute toxicity, Oral (Category 3), H301
Specific target organ toxicity - repeated exposure (Category 2), H373
Chronic aquatic toxicity (Category 4), H413

For the full text of the H-Statements mentioned in this Section, see Section 16.

Classification according to EU Directives 67/548/EEC or 1999/45/EC

T	Toxic	R23/25 R33 R53

For the full text of the R-phrases mentioned in this Section, see Section 16.

2.2 Label elements

Labelling according Regulation (EC) No 1272/2008
Pictogram

Signal word Danger

Hazard statement(s)

H301	Toxic if swallowed.
H331	Toxic if inhaled.
H373	May cause damage to organs through prolonged or repeated exposure.
H413	May cause long lasting harmful effects to aquatic life.

Precautionary statement(s)

P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P311	Call a POISON CENTER or doctor/ physician.

Supplemental Hazard Statements	none

2.3 Other hazards - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Formula : Se
Molecular weight : 78,96 g/mol
CAS-No. : 7782-49-2
EC-No. : 231-957-4
Index-No. : 034-001-00-2

Hazardous ingredients according to Regulation (EC) No 1272/2008

Component		Classification	Concentration
Selenium			
CAS-No.	7782-49-2	Acute Tox. 3; STOT RE 2; Aquatic Chronic 4; H301 + H331, H373, H413	<= 100 %
EC-No.	231-957-4		
Index-No.	034-001-00-2		

Hazardous ingredients according to Directive 1999/45/EC

Component		Classification	Concentration
Selenium			
CAS-No.	7782-49-2	T, R23/25 - R33 - R53	<= 100 %
EC-No.	231-957-4		
Index-No.	034-001-00-2		

For the full text of the H-Statements and R-Phrases mentioned in this Section, see Section 16

SECTION 4: First aid measures

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.

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.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Selenium/selenium oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 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.

6.3 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.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 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.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Store in cool place. Keep container tightly closed in a dry and well-ventilated place.

Store under inert gas.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Components with workplace control parameters

8.2 Exposure controls

Appropriate engineering controls
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face 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 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.

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.

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).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a) Appearance	Form: powder Colour: light grey
b) Odour	No data available
c) Odour Threshold	No data available
d) pH	No data available
e) Melting point/freezing point	Melting point/range: 217 °C - lit.
f) Initial boiling point and boiling range	684,9 °C - lit.
g) Flash point	Not applicable
h) Evaporation rate	No data available
i) Flammability (solid, gas)	No data available
j) Upper/lower flammability or explosive limits	No data available
k) Vapour pressure	No data available
l) Vapour density	No data available
m) Relative density	4,81 g/cm3 at 25 °C
n) Water solubility	No data available
o) Partition coefficient: n-octanol/water	No data available
p) Auto-ignition temperature	No data available
q) Decomposition temperature	No data available
r) Viscosity	No data available

s) Explosive properties	No data available
t) Oxidizing properties	No data available

9.2 Other safety information

No data available

SECTION 10: Stability and reactivity

10.1 Reactivity

No data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

No data available

10.4 Conditions to avoid

No data available

10.5 Incompatible materials

Strong oxidizing agents, Do not store near acids.

10.6 Hazardous decomposition products

Other decomposition products - No data available
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 6.700 mg/kg

Remarks: Behavioral:Somnolence (general depressed activity). Lungs, Thorax, or Respiration:Dyspnea. Nutritional and Gross Metabolic:Changes in:Other changes.

Skin corrosion/irritation

No data available

Serious eye damage/eye irritation

No data available

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

Carcinogenicity - Mouse - Oral
Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Skin and Appendages: Other: Tumors.

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (Selenium)

Reproductive toxicity

Developmental Toxicity - Mouse - Oral

Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Embryo or Fetus: Fetal death.

Specific target organ toxicity - single exposure

No data available

Specific target organ toxicity - repeated exposure

May cause damage to organs through prolonged or repeated exposure.

Aspiration hazard
No data available

Additional Information
RTECS: VS7700000

anemia, Vomiting, Diarrhoea, Cough, Difficulty in breathing, Acute selenium poisoning produces central nervous system effects, which include nervousness, convulsions, and drowsiness. Other signs of intoxication can include skin eruptions, lassitude, gastrointestinal distress, teeth that are discolored or decayed, odorous ("garlic") breath, and partial loss of hair and nails. Chronic exposure by inhalation can produce symptoms that include pallor, coating of the tongue, anemia, irritation of the mucosa, lumbar pain, liver and spleen damage, as well as any of the other previously mentioned symptoms. Chronic contact with selenium compounds may cause garlic odor of breath and sweat, dermatitis, and moderate emotional instability., Dermatitis, garlic-like breath odor, pallor, nervousness, depression

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish	mortality NOEC - Cyprinodon variegatus (sheepshead minnow) - 2 mg/l - 96,0 h
	mortality LOEC - Oncorhynchus mykiss (rainbow trout) - 7,8 mg/l - 96,0 h
Toxicity to daphnia and other aquatic invertebrates	LC50 - Daphnia magna (Water flea) - 0,43 mg/l - 48 h
Toxicity to algae	EC50 - Pseudokirchneriella subcapitata - 99 mg/l - 72 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential

Bioaccumulation	Lepomis macrochirus - 60 d - 640 µg/l Bioconcentration factor (BCF): 7,7

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
Very toxic to aquatic life with long lasting effects.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. 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.

SECTION 14: Transport information

14.1 UN number

ADR/RID: 3288	IMDG: 3288	IATA: 3288

14.2 UN proper shipping name

ADR/RID:	TOXIC SOLID, INORGANIC, N.O.S. (Selenium)
IMDG:	TOXIC SOLID, INORGANIC, N.O.S. (Selenium)
IATA:	Toxic solid, inorganic, n.o.s. (Selenium)

14.3 Transport hazard class(es)

ADR/RID: 6.1	IMDG: 6.1	IATA: 6.1

14.4 Packaging group

ADR/RID: III	IMDG: III	IATA: III

14.5 Environmental hazards

ADR/RID: yes	IMDG Marine pollutant: yes	IATA: no

14.6 Special precautions for user

No data available

SECTION 15: Regulatory information

This safety datasheet complies with the requirements of Regulation (EC) No. 190 7/2006.

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

No data available

15.2 Chemical Safety Assessment

For this product a chemical safety assessment was not carried out

SECTION 16: Other information

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Chronic	Chronic aquatic toxicity
H301	Toxic if swallowed.
H301 + H331	Toxic if swallowed or if inhaled
H331	Toxic if inhaled.
H373	May cause damage to organs through prolonged or repeated exposure.
H413	May cause long lasting harmful effects to aquatic life.

Full text of R-phrases referred to under sections 2 and 3

T	Toxic
R23/25	Toxic by inhalation and if swallowed.
R33	Danger of cumulative effects.
R53	May cause long-term adverse effects in the aquatic environment.

Further information

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.

Sodium Metal

MSDS # 682.00

Section 1: Product and Company Identification

Sodium Metal

Synonyms/General Names: Natrium
Product Use: For educational use only
Manufacturer: Columbus Chemical Industries, Inc., Columbus, WI 53925.

24 Hour Emergency Information Telephone Numbers

CHEMTREC (USA): 800-424-9300 **CANUTEC (Canada): 613-424-6666**

ScholAR Chemistry; 5100 W. Henrietta Rd, Rochester, NY 14586; (866) 260-0501; www.Scholarchemistry.com

Section 2: Hazards Identification

Silvery-white metal cubes, sticks or lumps, no odor
WARNING! Flammable solid, dangerous when wet. Flammable solid, keep away from all ignition sources. Contact with water produces flammable gas.
Target organs: None available

HMIS (0 to 4)

Health	**2**
Fire Hazard	**3**
Reactivity	**3**

This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Section 3: Composition / Information on Ingredients

Sodium (7440-23-5), >99%

Section 4: First Aid Measures

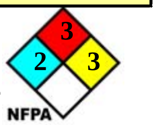
Always seek professional medical attention after first aid measures are provided.

Eyes:	Immediately flush eyes with excess water for 15 minutes, lifting lower and upper eyelids occasionally.
Skin:	Immediately flush skin with excess water for 15 minutes while removing contaminated clothing.
Ingestion:	Call Poison Control immediately. Rinse mouth with cold water. Give victim 1-2 tbsp of activated charcoal mixed with 8 oz water.
Inhalation:	Remove to fresh air. If not breathing, give artificial respiration.

Section 5: Fire Fighting Measures

Flammable solid. When heated to decomposition, emits acrid fumes of NaO_2.

Protective equipment and precautions for firefighters: Do Not Use carbon dioxide, foam, water or halogenated extinguishing agents. Use class D extinguisher or smother with soda ash, dry sand, dry clay, dry sodium chloride or dry graphite. Firefighters should wear full fire fighting turn-out gear and respiratory protection (SCBA). Material is not sensitive to mechanical impact or static discharge.



Section 6: Accidental Release Measures

Use personal protection recommended in Section 8. Isolate the hazard area and deny entry to unnecessary and unprotected personnel. Remove all ignition sources and ventilate area. Sweep up spill and place material in a dry container and cover completely with pure mineral oil for disposal.
See Section 13 for disposal information.

Section 7: Handling and Storage Red

Handling: Use with adequate ventilation and do not breathe dust or vapor. Avoid contact with skins, eyes, or clothing. Wash hands thoroughly after handling.

Storage: Store in Flammable Area [Red Storage] with other flammable materials and away from any strong oxidizers. Store in a dedicated flammables cabinet. Store in a cool, dry, well-ventilated, locked store room away from incompatible materials. Keep sodium metal immersed in mineral oil.

Section 8: Exposure Controls / Personal Protection

Use ventilation to keep airborne concentrations below exposure limits. Have approved eyewash facility, safety shower, and fire extinguishers readily available. Wear chemical splash goggles and chemical resistant clothing such as gloves and aprons. Wash hands thoroughly after handling material and before eating or drinking. Use NIOSH-approved respirator with a dust cartridge.
Exposure guidelines: Sodium: OSHA PEL: N/A and ACGIH TLV: N/A, STEL: N/A.

Section 9: Physical and Chemical Properties

Molecular formula	Na.	**Appearance**	Silvery-white metal cubes, or lumps.
Molecular weight	22.99.	**Odor**	No odor.
Specific Gravity	0.97 g/mL @ 20°C.	**Odor Threshold**	N/A.
Vapor Density (air=1)	N/A.	**Solubility**	Reacts violently.
Melting Point	98°C.	**Evaporation rate**	N/A. *(Butyl acetate = 1).*
Boiling Point/Range	883°C.	**Partition Coefficient**	N/A. *(log P_{OW}).*
Vapor Pressure (20°C)	N/A.	**pH**	N/A.
Flash Point:	N/A.	**LEL**	N/A.
Autoignition Temp.:	473°C (883°F).	**UEL**	N/A.

N/A = Not available or applicable

Section 10: Stability and Reactivity

Avoid heat and ignition sources. Contact with water produces flammable hydrogen gas.
Stability: Stable under normal conditions of use.
Incompatibility: Water, acids, oxidizing agents, oxygen, nitrogen and carbon dioxide.
Shelf life: Indefinite if stored properly.

Section 11: Toxicology Information

Acute Symptoms/Signs of exposure: ***Eyes***: Stinging pain, burns, watering of eyes, inflammation of eyelids and conjunctivitis. Avoid looking at burning magnesium. ***Skin***: Irritation, redness, burns. Powdered metal ignites readily on skin causing burns. ***Ingestion***: Nausea, vomiting and headache. ***Inhalation***: Rapid irregular breathing, headache, burns to mucous membranes. Inhalation of dust or fumes causes metal fume fever.
Chronic Effects: Repeated/prolonged skin contact may cause dryness or rashes.
Sensitization: none expected
Magnesium: LD50 [oral, rat]; Not Available; LC50 [rat]; Not Available; LD50 Dermal [rabbit]; Not Available
Material has not been found to be a carcinogen nor produce genetic, reproductive, or developmental effects.

Section 12: Ecological Information

Ecotoxicity (aquatic and terrestrial): Ecological impact has not been determined.

Section 13: Disposal Considerations

Check with all applicable local, regional, and national laws and regulations. Local regulations may be more stringent than regional or national regulations. Use a licensed chemical waste disposal firm for proper disposal.

Section 14: Transport Information

DOT Shipping Name:	Sodium.	**Canada TDG:**	Sodium .
DOT Hazard Class:	4.3, pg I.	**Hazard Class:**	4.3, pg I.
Identification Number:	UN1428.	**UN Number:**	UN1428.

Section 15: Regulatory Information

EINECS: Listed (231-132-9) .
TSCA: All components are listed or are exempt.
WHMIS Canada: B6, E: Reactive flammable material, Corrosive.
California Proposition 65: Not listed.
The product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

Section 16: Other Information

Current Issue Date: January 23, 2009
Disclaimer: Scholar Chemistry and Columbus Chemical Industries, Inc., ("S&C") believes that the information herein is factual but is not intended to be all inclusive. The information relates only to the specific material designated and does not relate to its use in combination with other materials or its use as to any particular process. Because safety standards and regulations are subject to change and because S&C has no continuing control over the material, those handling, storing or using the material should satisfy themselves that they have current information regarding the particular way the material is handled, stored or used and that the same is done in accordance with federal, state and local law. ***S&C makes no warranty, expressed or implied, including (without limitation) warranties with respect to the completeness or continuing accuracy of the information contained herein or with respect to fitness for any particular use.***

Trichloroethylene
CAS No 79-01-6

MATERIAL SAFETY DATA SHEET
SDS/MSDS

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

1.1 Product identifiers

Product name : **Trichloroethylene**

CAS-No. : 79-01-6

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

Identified uses : Laboratory chemicals, Industrial & for professional use only.

1.3 Details of the supplier of the safety data sheet

Company : Central Drug House (P) Ltd
7/28 Vardaan House
New Delhi-10002
INDIA

Telephone : +91 11 49404040
Email : care@cdhfinechemical.com

1.4 Emergency telephone number

Emergency Phone # : +91 11 49404040 (9:00am - 6:00 pm) [Office hours]

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008
Skin irritation (Category 2), H315
Eye irritation (Category 2), H319
Germ cell mutagenicity (Category 2), H341
Carcinogenicity (Category 1B), H350
Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336
Chronic aquatic toxicity (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

Classification according to EU Directives 67/548/EEC or 1999/45/EC

		R45
		R68
Xi	Irritant	R36/38
		R67
		R52/53

For the full text of the R-phrases mentioned in this Section, see Section 16.

2.2 Label elements

Labelling according Regulation (EC) No 1272/2008

Pictogram

Signal word Danger

Hazard statement(s)

H315	Causes skin irritation.
H319	Causes serious eye irritation.
H336	May cause drowsiness or dizziness.
H341	Suspected of causing genetic defects.
H350	May cause cancer.
H412	Harmful to aquatic life with long lasting effects.

Precautionary statement(s)

P201	Obtain special instructions before use.
P261	Avoid breathing vapours.
P273	Avoid release to the environment.
P281	Use personal protective equipment as required.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.

Supplemental Hazard Statements	none

Restricted to professional users.

2.3 Other hazards

This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms	:	TCE Trichloroethene
Formula	:	C_2HCl_3
Molecular weight	:	131,39 g/mol
CAS-No.	:	79-01-6
EC-No.	:	201-167-4
Index-No.	:	602-027-00-9

Hazardous ingredients according to Regulation (EC) No 1272/2008

Component		Classification	Concentration
Trichloroethylene Included in the Candidate List of Substances of Very High Concern (SVHC) according to Regulation (EC) No. 1907/2006 (REACH)			
CAS-No. EC-No. Index-No.	79-01-6 201-167-4 602-027-00-9	Skin Irrit. 2; Eye Irrit. 2; Muta. 2; Carc. 1B; STOT SE 3; Aquatic Chronic 3; H315, H319, H336, H341, H350, H412	<= 100 %

Hazardous ingredients according to Directive 1999/45/EC

Component		Classification	Concentration
Trichloroethylene Included in the Candidate List of Substances of Very High Concern (SVHC) according to Regulation (EC) No. 1907/2006 (REACH)			
CAS-No. EC-No. Index-No.	79-01-6 201-167-4 602-027-00-9	T, Carc.Cat.2, Mut.Cat.3, R45 - R36/38 - R52/53 - R67	<= 100 %

For the full text of the H-Statements and R-Phrases mentioned in this Section, see Section 16

SECTION 4: First aid measures

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.

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
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Carbon oxides, Hydrogen chloride gas

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
For personal protection see section 8.

6.2 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.

6.3 Methods and materials for containment and cleaning up

Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Avoid exposure - obtain special instructions before use.Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Store in cool place. 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.

Light sensitive. Handle and store under inert gas.
Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Components with workplace control parameters

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face 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 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.

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.

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).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid, clear Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: -84,8 °C - lit.
f)	Initial boiling point and boiling range	86,7 °C - lit.
g)	Flash point	No data available
h)	Evaporation rate	No data available

i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 10,5 %(V) Lower explosion limit: 8 %(V)
k)	Vapour pressure	81,3 hPa at 20,0 °C
l)	Vapour density	No data available
m)	Relative density	1,463 g/mL at 25 °C
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	log Pow: 2,29log Pow: 5
p)	Auto-ignition temperature	410,0 °C
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

No data available

SECTION 10: Stability and reactivity

10.1 Reactivity

No data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

No data available

10.4 Conditions to avoid

No data available

10.5 Incompatible materials

Oxidizing agents, Strong bases, Magnesium

10.6 Hazardous decomposition products

Other decomposition products - No data available
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 4.920 mg/kg

LC50 Inhalation - Mouse - 4 h - 8450 ppm

LD50 Dermal - Rabbit - > 20.000 mg/kg

Skin corrosion/irritation

Skin - Rabbit
Result: Severe skin irritation - 24 h

Serious eye damage/eye irritation

Eyes - Rabbit
Result: Eye irritation - 24 h

Respiratory or skin sensitisation
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: 1 - Group 1: Carcinogenic to humans (Trichloroethylene)

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: KX4550000

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea, Vomiting, Exposure to and/or consumption of alcohol may increase toxic effects., Gastrointestinal disturbance, Kidney injury may occur., narcosis

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 41 mg/l - 96,0 h
	LOEC - other fish - 11 mg/l - 10,0 d
	NOEC - Oryzias latipes - 40 mg/l - 10,0 d
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 18,00 mg/l - 48 h
Toxicity to algae	IC50 - Pseudokirchneriella subcapitata (green algae) - 175,00 mg/l - 96 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
Does not bioaccumulate.

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

12.6 Other adverse effects
Harmful to aquatic life with long lasting effects.

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

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

SECTION 14: Transport information

14.1 UN number

ADR/RID: 1710	IMDG: 1710	IATA: 1710

14.2 UN proper shipping name

ADR/RID:	TRICHLOROETHYLENE
IMDG:	TRICHLOROETHYLENE
IATA:	Trichloroethylene

14.3 Transport hazard class(es)

ADR/RID: 6.1	IMDG: 6.1	IATA: 6.1

14.4 Packaging group

ADR/RID: III	IMDG: III	IATA: III

14.5 Environmental hazards

ADR/RID: no	IMDG Marine pollutant: no	IATA: no

14.6 Special precautions for user

No data available

SECTION 15: Regulatory information

This safety datasheet complies with the requirements of Regulation (EC) No. 190 7/2006.

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

Authorisations and/or restrictions on use

Trichloroethylene CAS-No.: 79-01-6
REACH - Candidate List of Substances of Very High Concern for Authorisation (Article 59).
Carcinogenic (article 57a)
ED/30/2010

15.2 Chemical Safety Assessment

For this product a chemical safety assessment was not carried out

SECTION 16: Other information

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
Eye Irrit.	Eye irritation
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H336	May cause drowsiness or dizziness.
H341	Suspected of causing genetic defects.
H350	May cause cancer.
H412	Harmful to aquatic life with long lasting effects.
Muta.	Germ cell mutagenicity

Full text of R-phrases referred to under sections 2 and 3

T	Toxic
R36/38	Irritating to eyes and skin.
R45	May cause cancer.
R52/53	Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R67	Vapours may cause drowsiness and dizziness.
R68	Possible risk of irreversible effects.

Further information

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. Central Drug House (P) Ltd and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.cdhfinechemical.com for additional terms and conditions of sale.

Teck

ZINC METAL
SAFETY DATA SHEET

SECTION 1. IDENTIFICATION

Product Identity: Zinc Metal

Trade Names and Synonyms: High Grade Zinc; Special High Grade Zinc; Zinc, Zn, CGG Alloy <1% Aluminum.

Manufacturer:
Teck Metals Ltd.
Trail Operations
Trail, British Columbia
V1R 4L8
Emergency Telephone: 250-364-4214

Supplier:
In U.S.:
Teck American Metal Sales Incorporated
501 North Riverpoint Blvd, Suite 300
Spokane, WA
USA, 99202

Other than U.S.:
Teck Metals Ltd.
#1700 – 11 King Street West
Toronto, Ontario
M5H 4C7

Preparer:
Teck Metals Ltd.
Suite 3300 – 550 Burrard Street
Vancouver, British Columbia
V6C 0B3

Date of Last Review: August 14, 2018.

Date of Last Edit: August 14, 2018.

Product Use: Zinc metal is used to coat steel for corrosion protection (galvanizing, electroplating, electrogalvanizing), as an alloying element in bronze, brass, aluminum and other metal alloys, for zinc die casting alloys, for zinc dry cell and zinc/air batteries, for the production of zinc sheet for architectural and coinage applications, as a reducing agent in organic chemistry and for other chemical applications.

SECTION 2. HAZARDS IDENTIFICATION

CLASSIFICATION:

NOTE: In the form in which it is sold this product is not regulated as a Hazardous Product in the U.S. or Canada.
This Safety Data Sheet is provided for information purposes only.

Health		Physical	Environmental
Acute Toxicity (Oral, Inhalation)	– Does not meet criteria	Does not meet criteria for any Physical Hazard	Aquatic Toxicity – (Short Term/Long Term) Does not meet any criteria
Skin Corrosion/Irritation	– Does not meet criteria		
Eye Damage/Eye Irritation	– Does not meet criteria		
Respiratory or Skin Sensitization	– Does not meet criteria		
Mutagenicity	– Does not meet criteria		
Carcinogenicity	– Does not meet criteria		
Reproductive Toxicity	– Does not meet criteria		
Specific Target Organ Toxicity:			
Acute Exposure	– Does not meet criteria		
Chronic Exposure	– Does not meet criteria		

LABEL:

Symbols: None required	**Signal Word:** None required
Hazard Statements	**Precautionary Statements:**
None required	None required

Emergency Overview: A lustrous bluish-silver metal that does not burn in bulk but may form explosive mixtures if dispersed in air as a fine powder. Zinc oxide fume is formed when zinc metal is heated to or near the boiling point, or is burned. Contact with acids or alkalis generates flammable hydrogen gas which can accumulate in poorly ventilated areas. DO NOT use water or foam on burning zinc metal. Apply dry chemical, sand or special powder extinguishing media. Zinc is relatively non-toxic and poses little immediate hazard to the health of emergency response personnel or to the environment in an emergency situation.

Potential Health Effects: Zinc is essentially non-toxic to humans. However, zinc oxide fumes may cause mild local irritation to eyes, nose, throat and upper airways. Acute over-exposure to zinc oxide fume may cause metal fume fever, characterized by flu-like symptoms such as chills, fever, nausea, and vomiting which may be delayed 3 – 10 hours in onset. In most cases, dermal exposure to zinc or zinc compounds does not result in any noticeable toxic effects. Zinc is not listed as a carcinogen by OSHA, NTP, IARC, ACGIH or the EU (see Toxicological Information, Section 11).

Potential Environmental Effects: Zinc metal has relatively low bioavailability and poses no immediate ecological risks. Depending on physico-chemical characteristics (e.g., pH, water hardness), compounds of zinc metal can be toxic, particularly in the aquatic environment. Zinc also has the potential to bioaccumulate in plants and animals in both aquatic and terrestrial environments (see Ecological Information, Section 12).

SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS

COMPONENTS	CAS Registry No.	CONCENTRATION (% wt./wt.)
Zinc	7440-66-6	99+%

Note: See Section 8 for Occupational Exposure Guidelines.

SECTION 4. FIRST AID MEASURES

Eye Contact: *Symptoms:* Mild eye irritation, redness. Do not rub eye(s). Let the eye(s) water naturally for a few minutes. Look right and left, then up and down. If particle/dust does not come out, cautiously rinse eye(s) with lukewarm, gently flowing water for 5 minutes or until particle/dust is removed, while holding eyelid(s) open. If eye irritation persists, get medical advice/attention. DO NOT attempt to manually remove anything from the eye.

Skin Contact: *Symptoms:* Soiling of skin. No health effects expected. Rinse with lukewarm, gently flowing water for 5 minutes or until the product is removed. If skin irritation occurs or you feel unwell, get medical advice/attention.
Molten Metal: Flush contact area to solidify and cool but do not attempt to remove encrusted material or clothing. Cover burns and seek medical attention immediately.

Inhalation: *Symptoms:* Coughing and irritation in heavy dust/fume clouds. If symptoms are experienced remove source of contamination or move victim from exposure area to fresh air immediately and obtain medical advice. NOTE: Metal fume fever may develop 3-10 hours after exposure to zinc oxide fumes. If symptoms of metal fume fever (flu-like symptoms) develop, obtain medical attention.

Ingestion: *Symptoms:* Stomach upset, nausea, diarrhea. If swallowed, no specific intervention is indicated as this material is not likely to be hazardous by ingestion. However, if you are concerned or you feel unwell, obtain medical advice.

SECTION 5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Massive metal is difficult to ignite and is not considered a fire hazard. However, finely-divided metallic dust may form flammable or explosive dust clouds when dispersed in the air at high concentrations and exposed to heat, flame, or other ignition sources. Bulk dust in a damp state may heat spontaneously and ignite on exposure to air. Contact with acids and alkali hydroxides results in evolution of hydrogen gas which is potentially explosive. Mixtures with potassium chlorate or fused ammonium nitrate may explode on impact.

Extinguishing Media: Apply dry chemical, dry sand, or special powder extinguishing (Class D) media. Do NOT use water, carbon dioxide or foam on molten metals. Water may be ineffective for extinguishing a fire but should be used to keep fire-exposed billets, ingots and castings cool.

Fire Fighting: If possible, move material not yet involved in the fire from the fire area. If this is not possible, cool fire-exposed zinc by applying hose streams or fogs. Apply only dry chemical, sand, or special powder extinguishing media to any molten or burning zinc metal. Take extreme caution to prevent water contact with molten or burning zinc. Zinc foil in particular may ignite in the presence of water. Zinc oxide fumes may evolve in fires. Fire fighters should be fully trained and wear full protective clothing including an approved, self-contained breathing apparatus which supplies a positive air pressure within a full face-piece mask.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Procedures for Cleanup: Control source of release if possible to do so safely. Clean up spilled material immediately observing precautions in Section 8, Personal Protection. Molten metal should be allowed to cool and harden before cleanup. Once solidified wear gloves, pick up and return to process. Powder or dust should be cleaned up by sweeping/shoveling, etc. Solid metal is recyclable. Return uncontaminated spilled material to the process if possible. Place contaminated material in clean, dry, suitably labelled containers for later recovery or disposal. Treat or dispose of waste material in accordance with all local, state/provincial, and national requirements.

Personal Precautions: Protective clothing, gloves, and a respirator are recommended for persons responding to an accidental release (see also Section 8). Close-fitting safety goggles may be necessary in some circumstances to prevent eye contact with zinc dust and fume. Where molten metal is involved, wear heat-resistant gloves and suitable clothing for protection from hot-metal splash.

Environmental Precautions: Zinc metal has relatively low bioavailability and poses no immediate ecological risks. Depending on physico-chemical characteristics (e.g., pH, water hardness), compounds of zinc metal can be toxic, particularly in the aquatic environment. Zinc also has the potential to bioaccumulate in plants and animals in both aquatic and terrestrial environments. Releases of the product to water and soil should be prevented.

SECTION 7. HANDLING AND STORAGE

Precautions for Safe Handling: Zinc ingots suspected of containing moisture should be THOROUGHLY DRIED before being added to a molten bath. Ingots may contain cavities that collect moisture. Entrained moisture will expand explosively when immersed in a molten bath.

Conditions for Safe Storage: Store zinc in a DRY covered area, separate from incompatible materials. No special packaging materials are required.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Occupational Exposure Guidelines: *(Time-Weighted Average (TWA) concentration over 8 hr unless otherwise indicated)*

Component	ACGIH TLV	OSHA PEL	NIOSH REL
Zinc	None established†	None established†	None established†

NOTE: OEGs for individual jurisdictions may differ from those given above. Check with local authorities for the applicable OEGs in your jurisdiction.
ACGIH - American Conference of Governmental Industrial Hygienists; OSHA - Occupational Safety and Health Administration; NIOSH - National Institute for Occupational Safety and Health. TLV – Threshold Limit Value, PEL – Permissible Exposure Limit, REL – Recommended Exposure Limit.

† NOTE: While there is no established OEL for zinc as such, there are OELs for zinc oxide which may be formed during burning, welding or other fuming processes.

The OSHA PEL final rule limits for zinc oxide dust are 10 mg/m^3 (total) and 5 mg/m^3 (respirable); the OSHA PEL final rule limit for zinc oxide fume is 5 mg/m^3. Note that the OSHA PEL final rule limits are currently non-enforceable due to a court decision. The OSHA PEL transitional limits therefore remain in force at present. They are 15 mg/m^3 (total) and 5 mg/m^3 (respirable) while the transitional PEL for zinc oxide fume is 5 mg/m^3. The ACGIH TLV for zinc oxide is 2 mg/m^3 (respirable fraction) with a Short Term Exposure Limit (STEL) of 10 mg/m^3 (respirable fraction). The NIOSH REL for zinc oxide (dust or fume) is 5 mg/m^3 10 hr TWA with a 15 mg/m^3 ceiling limit (15 minute sample) for zinc oxide dust and a 10 mg/m^3 STEL for zinc oxide fume (15 minute sample).

NOTE: The selection of the necessary level of engineering controls and personal protective equipment will vary depending upon the conditions of use and the potential for exposure. The following are therefore only general guidelines that may not fit all circumstances. Control measures to consider include:

Ventilation: Use adequate local or general ventilation to maintain the concentration of zinc oxide fumes in the working environment well below recommended occupational exposure limits. Supply sufficient replacement air to make up for air removed by the exhaust system. Where metallic particles of zinc are being collected and transported by a ventilation system, use a non-sparking, grounded ventilation system separate from other exhaust ventilation systems. Locate dust collectors and fans outdoors if possible and provide dust collectors with explosion vents or blow out panels. Refer to appropriate NFPA Standards 484, 654, and/or 68 for specific guidance.

Protective Clothing: Gloves and coveralls, shop coat or other work clothing are recommended to prevent prolonged or repeated direct skin contact when zinc is processed. Eye protection should be worn where fume or dust is generated. Respiratory protection may be required where zinc oxide fume is generated. Where hot or molten metal is handled, heat-resistant gloves, face shield, and clothing to protect from hot metal splash should be worn. Safety type boots are recommended.

Respirators: Where zinc oxide dust or fumes are generated and cannot be controlled to within acceptable levels, use appropriate NIOSH-approved respiratory protection equipment (a 42CFR84 Class N, R or P-95 particulate filter cartridge).

General Hygiene Considerations: Always practice good personal hygiene. Refrain from eating, drinking, or smoking in work areas. Thoroughly wash hands before eating, drinking, or smoking in appropriate designated areas.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Bluish-silver lustrous metal	**Odour:** None	**Odour Threshold:** None	**pH:** Not Applicable
Vapour Pressure: 1 mm at 487ºC Negligible at 20ºC	**Vapour Density:** Not Applicable	**Melting Point/Range:** 420º C	**Boiling Point/Range:** 908º C
Relative Density (Water = 1)**:** 7.1	**Evaporation Rate:** Not Applicable	**Coefficient of Water/Oil Distribution:** Log P (oct) = -0.47 (estimated)	**Solubility:** Insoluble in Water (0.2 mg/l @ pH 7)
Flammability: Non-combustible solid.	**Flammable Limits** (LEL/UEL)**:** LEL (Zinc Dust): 500 g/m^3; UEL Not Determined.	**Auto-ignition Temperature:** Approx 680ºC (dust cloud in air), Approx 460ºC (dust layer).	**Decomposition Temperature:** Oxidation starts approx 450°C

SECTION 10. STABILITY AND REACTIVITY

Stability & Reactivity: Massive metal is stable and not considered reactive under normal temperatures and pressures. Hazardous polymerization or runaway reactions will not occur. Zinc metal slowly becomes covered with a white coating of a hydrated basic zinc carbonate on exposure to moist air. Freshly formed, fine, condensed zinc dust or powder may heat spontaneously and ignite on exposure to air when damp. Zinc metal will react with acids and strong alkalis to generate flammable hydrogen gas. A violent, explosive reaction may occur when powdered zinc is heated with sulphur. Powdered zinc will become incandescent or ignite in the presence of fluorine, chlorine, bromine or interhalogens (e.g., chlorine trifluoride). Powdered zinc can also react explosively with halogenated hydrocarbons if heated. Mixtures with potassium chlorate or fused ammonium nitrate may explode on impact.

Incompatibilities: Contact with acids and alkalis will generate highly flammable hydrogen gas. Contact with acidic solutions of arsenic and antimony compounds may evolve highly toxic ARSINE or STIBINE gas. Incompatible with strong oxidizing agents such as chlorine, fluorine, bromine, sodium, potassium or barium peroxide, sodium or potassium chlorate, chromium trioxide and fused ammonium nitrate. Also incompatible with elemental sulphur dust, halogenated hydrocarbons or chlorinated solvents, chlorinated rubber, and ammonium sulphide or calcium disulphide.

Hazardous Decomposition Products: High temperature operations such as oxy-acetylene cutting, electric arc welding or overheating a molten bath will generate zinc oxide fume which, on inhalation in sufficient quantity, can produce metal fume fever, a transient influenza-like illness.

SECTION 11. TOXICOLOGICAL INFORMATION

General: Zinc, especially in the metal form, is relatively non-toxic. However, it can react with other materials, such as oxygen or acids, to form compounds that can be potentially hazardous and/or toxic. The primary route of exposure would be through the generation and inhalation of zinc oxide fume.

Acute:
Skin/Eye: In most cases, dermal exposure to zinc or zinc compounds does not result in any noticeable toxic effects. Zinc metal is not chemically irritating to the eyes.

Inhalation: If excessive quantities of zinc oxide fume are inhaled, it can result in the condition called metal fume fever. The symptoms of metal fume fever will occur within 3 to 10 hours, and include immediate dryness and irritation of the throat, tightness of the chest and coughing, which may later be followed by flu-like symptoms of fever, malaise, perspiration, frontal headache, muscle cramps, low back pain, occasionally blurred vision, nausea, and vomiting. The symptoms are temporary and generally disappear, without medical intervention, within 24 to 48 hours of onset. There are no recognized complications, after affects, or chronic affects that result from this condition.

Ingestion: Zinc is not expected to be harmful if ingested. When ingested in excessive quantities, zinc can irritate the stomach resulting in nausea, vomiting, abdominal pain and diarrhea. Ingestion is not a typical route of occupational exposure.

Chronic:
There is no chronic form of metal fume fever but in rare instances an acute incident may be followed by complaints such as bronchitis or pneumonia. Some workers may develop a short-term immunity (resistance) so that repeated exposure to zinc oxide fumes does not cause metal fume fever. This immunity (resistance) however is quickly lost after short absences from work

(weekends or vacations). Workers exposed to finely-divided metallic zinc for up to 35 years revealed no acute or chronic illnesses attributable to zinc. Prolonged or repeated skin contact with zinc dust or powder may cause dryness, irritation and cracking (dermatitis) since zinc is astringent and may tend to draw moisture from the skin. Zinc is not listed as a human carcinogen by the Occupational Safety and Health Administration (OSHA), the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), the American Conference of Governmental Industrial Hygienists (ACGIH) or the European Union (EU).

Animal Toxicity:

Ingredient:	Acute Oral Toxicity:	Acute Dermal Toxicity:	Acute Inhalation Toxicity:
Zinc	>5,000 mg/kg†	No data available	>5.41 mg/L‡
	† LD_{50}, Mouse, Oral,		‡LC_{50}, Rat, Inhalation, 4 hour

SECTION 12. ECOLOGICAL INFORMATION

Zinc metal is relatively insoluble; however, processing of the product or extended exposure in aquatic and terrestrial environments may lead to the release of zinc compounds in bioavailable forms. Zinc is highly mobile, and can be toxic in the aquatic environment with water hardness, pH and dissolved organic carbon content being major regulating factors. Zinc also has the potential to bioaccumulate in plants and animals in both aquatic and terrestrial environments. In soils, zinc is moderately mobile in accordance with soil properties (e.g., cation exchange capacity, pH, redox potential, chemical species); these properties also influence its bioavailability to terrestrial plants.

SECTION 13. DISPOSAL CONSIDERATIONS

If material cannot be returned to process or salvage, dispose of in accordance with applicable regulations.

SECTION 14. TRANSPORT INFORMATION

PROPER SHIPPING NAME .... Not applicable – not regulated.
U.S. DOT AND TRANSPORT CANADA HAZARD CLASSIFICATION.... Not applicable
U.S. DOT AND TRANSPORT CANADA PID .... Not applicable
MARINE POLLUTANT... No
IMO CLASSIFICATION .... Not regulated

SECTION 15. REGULATORY INFORMATION

U.S.
INGREDIENT LISTED ON TSCA INVENTORY .... Yes

HAZARDOUS UNDER HAZARD COMMUNICATION STANDARD .... No

CERCLA SECTION 103 HAZARDOUS SUBSTANCES......................... Zinc ......Yes .... RQ: 1,000 lb. (454 kg.)*
* reporting not required when diameter of the pieces of solid metal released is equal to or exceeds 100 micrometers (0.004 inches).

EPCRA SECTION 302 EXTREMELY HAZARDOUS SUBSTANCE........ No

EPCRA SECTION 311/312 HAZARD CATEGORIES............................ No Hazard Categories Apply

EPCRA SECTION 313 TOXIC RELEASE INVENTORY:........................ This product does not contain any toxic chemicals subject to the Toxic Release reporting requirements. However, potential by-products from working with this product - "Zinc (Fume or Dust)" CAS 7440-66-6 are reportable.

SECTION 16. OTHER INFORMATION

Date of Original Issue:	July 23, 1997	**Version:**	01 *(First edition)*
Date of Latest Revision:	August 14, 2018	**Version:**	15

The information in this Safety Data Sheet is based on the following references:

- American Conference of Governmental Industrial Hygienists, 2004, Documentation of the Threshold Limit Values and Biological Exposure Indices, 7th Edition plus updates.

- American Conference of Governmental Industrial Hygienists, 2018, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.
- American Conference of Governmental Industrial Hygienists, 2018, Guide to Occupational Exposure Values.
- Bretherick's Handbook of Reactive Chemical Hazards, 20th Anniversary Edition (P. G. Urben, Ed), 1995.
- Canadian Centre for Occupational Health and Safety (CCOHS) Hamilton, ON, CHEMINFO Record No. 239 – Zinc Metal.
- European Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures, amending and repealing directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (REACH).
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- National Library of Medicine, National Toxicology Information Program, Hazardous Substance Data Bank (on-line version).
- Oak Ridge National Laboratory, Oak Ridge, Tennessee – Toxicity Summary for Zinc and Zinc Compounds, April 1992.
- Patty's Toxicology, 5th Edition, 2001 E. Bingham, B. Cohrssen & CH Powell (Eds.).
- U.S. Dept. of Health and Human Services, National Institute of Environmental Health Sciences, National Toxicology Program (NTP), 14th Report on Carcinogens, November 2016.
- U.S. Dept. of Health and Human Services, National Institute for Occupational Safety and Health, NIOSH Pocket Guide to Chemical Hazards (on-line edition).
- U.S. Dept. of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Toxicological Profile for Zinc - August 2005.
- U.S. Dept. of Health and Human Services, National Institute for Occupational Safety and Health, Registry of Toxic Effects of Chemical Substances (RTECS), CCOHS on-line version.
- U.S. Occupational Safety and Health Administration, 1989, Code of Federal Regulations, Title 29, Part 1910.1000 and 1910.1200.

Acronyms not spelled out elsewhere in the SDS:
CAS: Chemical Abstracts Service
CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act
DOT: Department of Transportation
EPCRA: Emergency Planning and Community Right- to-Know Act
IMO: International Maritime Organization
LD50, LC50: Lethal Dose 50%, Lethal Concentration 50%
OEGs: Occupational Exposure Guidelines
TSCA: Toxic Substances Control Act
Wt.: Weight

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Appendix D:

Community Air Monitoring Plan

SESI
CONSULTING ENGINEERS

COMMUNITY AIR MONITORING PLAN

108 Main Port Chester Steam Laundry Site
108 South Main Street
Port Chester, Westchester County, New York
NYSDEC BCP Site # C360224

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TABLE 3.1 NYS PROJECT PERSONNEL

LIST OF ACRONYMS

Acronym	Definition
CAMP	Community Air Monitoring Plan
IRMWP	Interim Remedial Measures Work Plan
mcg/m^3	micrograms per cubic meter
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PID	Photoionization Detector
PM-10	Less than 10 micrometers
ppm	Parts Per Million
VOC	Volatile Organic Compound

1.0 INTRODUCTION

This document presents the Community Air Monitoring Plan (CAMP) for the Interim Remedial Measures Workplan (IRMWP) for the proposed development at 108 Main Port Chester Steam Laundry, located at 108 South Main Street, Port Chester, New York (the "Site").

The Site is identified on local tax maps as Block 1, Lot 57. The Site previously consisted of Lots 35, 37, and part of 28 (including a portion of a demapped undeveloped street called Myneta Place). However, the Village of Port Chester recently merged the Site lots into one (1) parcel, re-designated as Section 142.38, Block 1, Lot 57. The Site also was previously identified with two (2) addresses: 108 Main Street and 112 William Street. Former Lot 35 was previously used for parking before the Volunteer's recent Site acquisition but has been vacant since August 2021. Former Lot 37, once identified as 112 William Street, is a recently demolished residence that is currently vacant. The part of former Lot 28 included in this Site is also vacant.

The Site is in a residential/commercial setting and is surrounded by residences and commercial properties, including a church. The Site is bound by residences to the north, a church with additional storefronts to the west, an auto repair shop and storefronts to the south, and commercial office space and storefronts to the east.

2.0 OBJECTIVES

The objective of the CAMP is to provide a measure of protection for the downwind community from potential airborne contaminant releases that may arise during all ground intrusive activities, and potentially contaminated soil and material handling and staging. In addition, the CAMP is intended to minimize dust and contaminants from leaving the work zone.

3.0 METHODS

The CAMP will include continuous monitoring for particulate matter (e.g., airborne "dust") and volatile organic compounds (VOCs) during the planned interim remedial measure activities. Any CAMP exceedances will be reported to the New York State Department of Environmental Conservation (NYSDEC) and New York State Department of Health (NYSDOH) on the same business day and as soon as possible. Notification of the exceedance will be sent via email along with the reason for the exceedance, the measure(s) taken to address the exceedance, and if the exceedance was resolved. In addition, the following NYSDEC and NYSDOH personnel will be provided weekly CAMP data summaries for review.

Table 3.1—NYS Project Personnel

Name	Contact Information
TBD NYSDEC	TBD
TBD NYSDOH	TBD

3.1 CONTINUOUS MONITORING

Continuous monitoring for particulates and VOCs will be conducted during all ground intrusive activities including soil borings, monitoring well installations, and soil vapor probe installations.

3.2 PERIODIC MONITORING

Periodic monitoring for VOCs will be conducted 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 consists of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

4.0 VOC MONITORING, RESPONSE LEVELS, AND ACTIONS

VOCs must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work will be performed using a photoionization detector (PID) equipped with a 10.6 ev lamp. The equipment will be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.
- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shut down.
- All 15-minute readings must be recorded and be available for State (NYSDEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

5.0 PARTICULATE MONITORING, RESPONSE LEVELS, AND ACTIONS

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m3 above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m3 of the upwind level and in preventing visible dust migration.

All readings must be recorded and be available for State (NYSDEC and NYSDOH) personnel to review.

6.0 SPECIAL REQUIREMENTS FOR WORK WITHIN 20 FEET OF POTENTIALLY EXPOSED INDIVIDUAL STRUCTURES

When work areas are within 20 feet of potentially exposed populations or occupied structures, the continuous monitoring locations for VOCs and particulates must reflect the nearest potentially exposed individuals and the location of ventilation system intakes for nearby structures. The use of engineering controls such as vapor/dust barriers, temporary negative-pressure enclosures, or special ventilation devices should be considered to prevent exposures related to the work activities and to control dust and odors. Consideration should be given to implementing the planned activities when potentially exposed populations are at a minimum, such as during weekends or evening hours in non-residential settings.

- If total VOC concentrations opposite the walls of occupied structures or next to intake vents exceed 1 ppm, monitoring should occur within the occupied structure(s). Depending upon the nature of contamination, chemical-specific colorimetric tubes of sufficient sensitivity may be necessary for comparing the exposure point concentrations with appropriate pre-determined response levels (response actions should also be pre-determined). Background readings in the occupied spaces must be taken prior to commencement of the planned work. Any unusual background readings should be discussed with NYSDOH prior to commencement of the work.
- If total particulate concentrations opposite the walls of occupied structures or next to intake vents exceed 150 mcg/m^3, work activities should be suspended until controls are implemented and are successful in reducing the total particulate concentration to 150 mcg/m3 or less at the monitoring point.
- Depending upon the nature of contamination and remedial activities, other parameters (e.g., explosivity, oxygen, hydrogen sulfide, carbon monoxide) may also need to be monitored. Response levels and actions should be pre-determined, as necessary, for each site.