APPENDIX D

CONSTRUCTION HEALTH AND SAFETY PLAN (HASP)

CONSTRUCTION HEALTH AND SAFETY PLAN FOR 177 HARRISON AVENUE BROOKLYN, NEW YORK

NYSDEC VCA INDEX NO. D2-0010-0703
VCA NO. V-00350-2
E-DESIGNATION E-238
CEQR No. 09HPD019K
OER NO. 11EHAN258K

Prepared For:

Congregation YGS
174 Rodney Street
Brooklyn, New York 11211

Prepared By:

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July 2011
Langan Project No. 170091701

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

SECTION 1 CONSTRUCTION HEALTH AND SAFETY PLAN (HASP) SUMMARY

Emergency Contacts:

Emergency contacts are listed on Table 1.

Emergency Procedures:

Emergency procedures are described in Section 7.3.1.

Site Specific Hazards and Training:

Hazards specific to the 177 Harrison Avenue Site in Brooklyn, New York ("Site") are described in Section 3. The Site Safety Coordinator (SSC) will be responsible for providing Site-specific training to personnel that work at the Site. This training will cover but is not limited to the following topics:

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

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

General Health and Safety Requirements:

Personnel will be required to sign and date the HASP and Remedial Action Plan (RAP) Acceptance Form provided in Appendix B prior to working on Site.

Personnel Protective Equipment:

Level D protection will be worn for initial entry on Site and for all activities except as noted in Section 4. Level D protection will consist of:

- Standard work clothes;
- Steel-toe safety boots;

- Safety glasses or goggles (must be worn when splash hazard is present);
- Nitrile outer gloves and polyvinyl chloride (PVC) or nitrile inner gloves (must be worn during all sampling activities); and
- Hard hat (must be worn during all Site activities).

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

Level C protection, unless otherwise specified in Section 4, will consist of Level D equipment and the following additional equipment:

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

Level B protection, unless otherwise specified in Section 4, will consist of Level D equipment and the following additional equipment:

- Hard hat (must be worn during all Site activities);
- Positive Pressure self-contained breathing apparatus (SCBA) or positive pressure air line and respirator with escape SCBA;
- PE-coated Tyvek coverall;
- Nitrile outer and PVC or nitrile inner gloves (must be worn during all sampling activities); and
- Nitrile boot covers.

If the concentration of total volatile organics, as measured with a photoionization detector (PID) equals or exceeds the specified action levels, all field personnel at the Site and associated with the project will immediately retreat to a location up-wind of the source of contamination. At this point the SSC must consult with the Langan Health and Safety Officer (HSO) to discuss appropriate actions.

Air Monitoring:

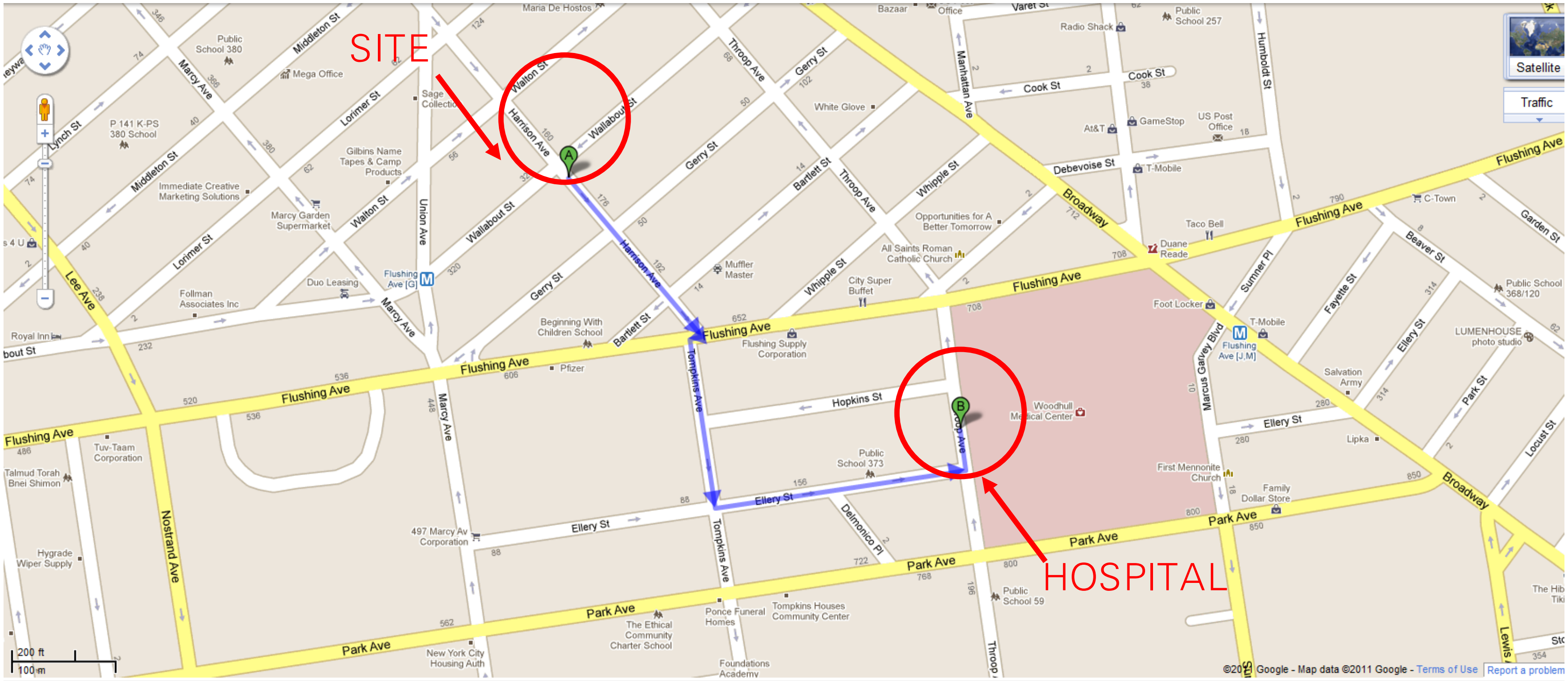
A summary of the action levels and restrictions is presented in Table 2.

FIGURE 1: MAP / ROUTE to HOSPITAL
(Woodhull Medical Center in Brooklyn, New York)

Site Location: 177 Harrison Avenue, Brooklyn, New York 11206

Hospital Location: 760 Broadway, Brooklyn, New York 11206

Hospital Information Line: (718) 963-8588



Route to Hospital:

From Site at **177 Harrison Avenue, Brooklyn, New York** to Woodhull Medical Center located at **760 Broadway, Brooklyn, New York**:

1.	Head **southeast** on **Harrison Ave** toward **Gerry St**	0.1 miles
2.	Turn right at **Flushing Ave**	39 feet
3.	Take the 1st left onto **Tompkins Ave**	0.1 miles
4.	Turn left at **Ellery St**	0.2 miles
5.	Turn left at **Throop Ave**	128 feet
6.		95 feet
7.	End at **760 Broadway, Brooklyn, New York**	--

Total Estimated Time: 3 minutes
Total Estimated Distance: 0.4 miles

TABLE 1
EMERGENCY CONTACTS

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

Emergency Contacts:	**Phone Number**	
Fire Department:	911	
Police:	911	
New York City-Long Island One Call Center: (3 day notice required for utility mark outs)	(800) 272-4480	
Poison Control Center:	(800) 222-1222	
Pollution Toxic Chemical Oil Spills:	(800) 424-8802	
Medical Emergency:		
Ambulance Service:	911	
Hospital Name:	Woodhull Medical Center	
Hospital Phone Number:	(718) 963-8588	
Hospital Address:	760 Broadway, Brooklyn, New York 11206	
Route to Hospital:	See Page 4 and 5	
Travel Time From Site:	3 minutes	
Langan Contacts:		
Senior Associate:	Joel Landes, P.E.	(212) 479-5404
Project Manager (PM):	Stuart Knoop, P.G.	(212) 479-5461
HSO:	Tony Moffa	(215) 756-2523
SSC:	TBD	(
FTL:	TBD	
Quality Assurance Officer (QAO):	John Gavras, P.G.	(212) 479-5406

TABLE 2
SUMMARY OF ACTION LEVELS AND RESTRICTIONS

Conditions for Level D:

All areas

- PID readings < 25 parts per million (ppm) and benzene < 1 ppm,
- No visible fugitive dust emissions from Site activities,
- Oxygen readings > 19.5% to 21.5%.

Conditions for Level C:

All areas

- PID readings > 25 ppm (sustained for 15 minutes in the breathing zone) to 200 ppm and benzene < 5 ppm,
- Any visible fugitive dust emissions from Site activities that disturb contaminated soil,
- Oxygen readings > 19.5% to 21.5%.

Conditions for Level B (or retreat):

All areas

- PID readings > 200 ppm or benzene > 25 ppm,
- Visible fugitive dust emissions from Site activities cloud the surrounding air,
- Oxygen readings < 19.5%.

SECTION 2 INTRODUCTION

2.1 Purpose and Policy

This HASP has been developed by Langan Engineering & Environmental Services, P.C. (Langan) to comply with Occupational Safety and Health Administration (OSHA) Standard 29 Code of Federal Regulations (CFR) 1910.120, Hazardous Waste Operations and Emergency Response.

The purpose of the HASP is to establish personnel protection standards and mandatory safety practices and procedures for the remediation activities at the Site which may include the potential encounter with: (1) hazardous, lead-contaminated soil; (2) non-hazardous soil that exceeds several New York State Department of Environmental Conservation (NYSDEC) 6 NYCRR Part 375 Soil Cleanup Objectives (SCO) for semi-volatile organic compounds (SVOC) and metals; and (3) non-hazardous groundwater exceeding NYSDEC Ambient Water Quality Standards and Guidance Values (SGV) for BTEX and chlorinated volatile organic compounds (VOC). This plan assigns responsibilities, establishes standard operating procedures, and provides for contingencies that may arise while operations are being conducted during the construction operations at the Site.

The provisions of the plan are mandatory for all on-site personnel. Any supplemental plans used by subcontractors shall conform to this plan at a minimum. All personnel who engage in project activities must be familiar with this plan, comply with its requirements, and sign the Plan Acceptance Form (Appendix B, page number B-5), prior to working on the Site. The Plan Acceptance Form must be submitted to the Langan HSO. In addition to this plan, all work shall be performed in accordance with all applicable federal, state, and local regulations.

2.2 Site Background

2.2.1 Site Description

The Site is located in the County of Kings, Brooklyn, New York and is identified as Block 2266 and Lot 1 on the New York City Tax Map. The Brooklyn, N.Y. United States Geological Survey (USGS) topographical quadrangle map (Figure 1) shows the Site location. The Site is situated on a 15,000-square-foot parcel, which combined with the adjoining northern NYCBCP Parcel, comprises a 29,200-square-foot (0.7-acre) area to be developed into a high school. The development site (Lot 1) is bounded by a poultry market, Wallabout Street, and multiple-family residences to the north, multiple-family residential buildings along Wallabout Street and a vacant lot (Tax Block 2266, Lot 46) along Gerry Street to the northeast; Gerry Street and a facility formerly used by Pfizer Inc. to the southeast across Gerry Street; and Harrison Avenue and a parking lot to the southwest across Harrison Avenue (see Figure 2).

The Site underwent review by the New York City Planning Commission (CPC) Uniform Land Use Review Procedure (ULURP) application. As determined through this review, development-related activities at the Site are subject to review and approval by NYCOER in accordance with City Environmental Quality Review (CEQR) procedure (CEQR Number 09HPD019K). An E-Designation for Hazardous Materials (E-238) was placed on the Site by the New York City Department of City Planning (NYCDCP) as part of the Broadway Triangle rezoning action.

The southern portion of Lot 1 (Site) constitutes Operable Unit #2 (OU-2) (the western portion) of the Pfizer Inc Site B property, which is subject to a Voluntary Cleanup Agreement (VCA Index No. D2-0010-0703, Site No. V-00350-2) between Pfizer Inc. (former lessee of the Site and current owner of the adjacent Lot 46 property) and the New York State Department of Environmental Conservation (NYSDEC). Congregation YGS owns the Site. The eastern, off-site portion of Pfizer Inc Site B occupies the southern portion of Block 2266, Lot 46.

The Site was occupied by a variety of different types of structures/purposes including residential dwellings, a junk lot, a recreational facility and light manufacturing between the 1900s and the 1930s; a lumber yard between the 1940s and the 1950s; and private parking after 1950 to 2010. Pfizer leased the site for parking. The Site was backfilled with fill from an unidentified source and brought to its current grade elevation prior to the 1970s.

2.2.2 Proposed Development

The proposed use of the Site will consist of a new five-story, private high school building. The school building will consist of slab-on-grade construction, contain no basement, and have approximately 80 feet of frontage along Wallabout Street and 200- and 150-foot frontages along Harrison Avenue and Gerry Street, respectively. The building footprint will be approximately 25,000 square feet. The remainder of the Site will consist of a concrete-paved walkway and an approximately 2,500-square foot play yard on the northeastern portion of the property. Soil will be excavated to accommodate utilities and building foundation elements. The maximum excavation depth is estimated to be five feet below ground surface (bgs) below the foundation slab and nine feet bgs below elevator pits, and the total estimated volume of soil to be excavated is 4,300 cubic yards. Based on the approximate depth of groundwater at 5 to 8 feet bgs, groundwater may be encountered during excavation activities.

2.2.3 Environmental Conditions

Beginning in 1996, Roux completed a series of subsurface investigations on the Site and adjacent Pfizer property. The investigations primarily focused on the southern portion of Lot 1 (i.e., VCA Parcel) The investigation on the Harrison Avenue property included groundwater sampling from onsite monitoring wells, Geoprobe points, soil vapor sampling locations, and soil sampling at multiple depths from onsite locations (primarily on the south side of the property).

Langan conducted environmental sampling at the Site between October 26 and 30, 2009 as part of a pre-construction investigation. The investigation focused on the southern, VCA Parcel and northern portion of Lot 1 ("the NYCBCP Parcel"). Based on comments received from NYCOER and NYSDEC, Langan conducted a follow-up Remedial Investigation (RI) at the Site (VCA and NYCBCP Parcels) in May and June 2011.

Findings of Pfizer Inc Site B Investigations and Langan's 2009 Pre-Construction Investigation

1. The elevation of the property ranges from el 9 to el 12 Borough President of Brooklyn Datum (BPBD).
2. The depth to groundwater across Lot 1 varies from approximately 5 to 8 feet bgs. General groundwater flow direction across the Site is from the southeast (Gerry Street) to the northwest (Wallabout Street).
3. The depth to bedrock is greater than 100 feet bgs.
4. The Site stratigraphy, from the surface down, consists of approximately 10 feet of fill material comprised of sand and gravel with variable proportions of cinders, metal debris, and concrete, brick, and glass fragments. The fill material is underlain by approximately 2 to 3 feet of clay and silt and approximately 90 feet of sand, silt, and clay.
5. A geophysical survey and 19 test pit excavations did not reveal evidence of buried structures (e.g., petroleum storage tanks or vaults) on the northern or southern portions of Lot 1.
6. Samples of fill collected on the southern, VCA Parcel contained concentrations of SVOCs and metals above Part 375 Unrestricted and Commercial Use SCOs. Based on

the depth and distribution of the SVOC- and metals-impacted soil, the elevated concentrations are likely attributable to conditions in the fill.

7. Groundwater samples collected during multiple investigations contained concentrations of petroleum and chlorinated volatile organic compounds (VOCs) above NYSDEC Ambient Water Quality Standards and Guidance Values (AWQS/GV). The off-site source of petroleum VOCs was removed during remedial activities (i.e., soil excavation and groundwater removal on Lot 46) that were conducted in accordance with the VCA. The up-gradient, off-site source for the chlorinated VOCs is subject to ongoing investigation under the VCA. These chemicals are typical of those used in dry cleaning. Remediation of groundwater contamination on the adjacent Lot 46 is ongoing.
8. Groundwater samples collected from monitoring wells on Lot 46 (i.e., the eastern portion of the VCA parcel) during the latest round of sampling (February 2011) contained total chlorinated VOC concentrations ranging from 1.2 µg/L to 1,695 µg/L. Total chlorinated VOC concentrations in off-site monitoring wells located in the Harrison Avenue and Wallabout Street sidewalks adjacent to Lot 1 ranged from 1 µg/L in MW-11 to 2,064 µg/L in MW-18.
9. Six soil vapor extraction (SVE) wells were located on the southern, VCA portion of Lot 1 (VCA Parcel) between March 2007 and February 2011. The wells were connected to an air sparge (AS)/SVE blower system installed on Lot 46 as part of the VCA. The system was shut down after contaminant removal concentrations reached asymptotic levels.
10. Soil vapor samples collected in 2005 contained petroleum and chlorinated VOCs. Tetrachloroethene (PCE) was detected at all five soil vapor sampling points at concentrations above the current New York State Department of Health (NYSDOH) Air Guideline Value (AGV). A maximum PCE concentration of 470 µg/m^3 was detected in a sample collected from the eastern portion of the Site.

<u>Findings and Conclusions of 2011 Remedial Investigation</u>

1. SVOC concentrations exceeded the Part 375 Unrestricted Use SCOs in 6 of the 12 analyzed soil samples collected from the northern, NYCBCP Parcel. Total SVOC concentrations exceeded 500,000 µg/kg in a sample collected from 3 to 5 feet below ground surface (bgs) on the northeastern portion of the parcel.

2. All but two of the soil samples collected from the NYCBCP Parcel contained multiple metals at concentrations above the Part 375 Unrestricted Use SCOs. Five metals (arsenic, barium, lead, mercury, and copper) were detected at concentrations above the Part 375 Commercial Use SCOs in one or more samples. With the exception of two samples collected from the 3- to 5-foot and 6 to 8-foot depth intervals, the exceedances of the commercial standards were observed in samples collected from the upper 2 foot depth interval.
3. Two pesticides, 4,4’-DDE and 4,4’-DDT, were detected at concentrations above the Part 375 Unrestricted Use SCOs in four samples collected from the upper 2 foot depth interval on NYCBCP Parcel. Evidence of PCB or VOC impacts to soil was not observed on the NYCBCP Parcel.
4. Multiple metals were detected at concentrations above the Part 375 Unrestricted Use SCOs in soil samples collected from the southern, VCA Parcel. Seventeen (17) soil samples contained at least one of five metals (barium, arsenic, cadmium, lead, and mercury) at concentrations above the Part 375 Commercial Use SCOs. The maximum depth intervals of samples exceeding the commercial use SCOs were 8 to 10 feet bgs at MW-25 (barium) and 7 to 10 feet bgs at MW-26 (mercury).
5. Four samples collected from the VCA Parcel contained hazardous concentrations of lead.
6. One metal, arsenic, was detected at a concentration above the TOGS AWQS in one filtered groundwater sample collected from off-site well MW-1R on the Harrison Avenue sidewalk. SVOCs were not detected in the filtered groundwater samples; however, one unfiltered sample (MW-26), which was noted to contain visible sediment, contained five SVOCs at concentrations above the TOGS AWQS/GV. Based on this data, groundwater at the Site is not considered to be impacted by SVOCs or metals.

Areas of Concern

- The southern portion of Lot 1 contains six localized areas of concern (below the minimum depth of construction excavation of 2 feet bgs) at the following boring locations based on total SVOC concentrations above 500 mg/kg, concentrations of metals above the Part 375 Commercial Use SCOs, and/or hazardous concentrations of lead: MW-25 (lead, mercury, barium, and SVOCs at 5 to 10 feet bgs), MW-26 (lead, mercury, and arsenic at 5 to 10 feet bgs), SBB-01 (lead at 5 to 7 feet bgs), SBB-07 (lead, mercury, barium, and SVOCs at 5 to 7 feet bgs), SBB-08 (lead and barium at 3 to 5 feet bgs), and SBB-28 (arsenic, lead, barium, and SVOCs at 6 to 8 feet bgs).

- The northern portion of Lot 1 contains three localized areas of concern (below the minimum depth of construction excavation of 2 feet bgs) at the following boring locations based on total SVOC concentrations above 500 mg/kg or concentrations of metals above the Part 375 Commercial Use SCOs: B6 (barium at 3 to 5 feet bgs), B7 (SVOCs at 3 to 5 feet bgs), and B9 (mercury at 6 to 8 feet bgs).
- Groundwater on the eastern portion of the Site contains concentrations of benzene, vinyl chloride, and cis-1,2-DCE above the AWQS/GV.
- Soil vapor on the VCA and NYCBCP Parcels contains concentrations of PCE and TCE above the NYSDOH AGVs.

2.3 Scope of Work

The remediation activities will primarily consist of soil excavation and off-site disposal for construction and hot-spot remediation, installation of a vapor barrier membrane and active sub-slab depressurization system (SSDS), groundwater dewatering, air monitoring, and importation of tested, clean soil for the play area (if appropriate) and hot-spot remediation areas. The proposed remedial action will consist of:

1. Implementation of a Community Air Monitoring Program for particulates and volatile organic compounds.
2. Soil excavation, as required, to bring the Site to the development grade and accommodate foundation elements for the school building development. Construction excavation to a minimum depth of 2 feet bgs will be required to accommodate the building foundation slab and sub-slab depressurization system (SSDS). Construction excavation to approximately 9 feet bgs will be required to accommodate the two elevator pits on the northwestern and southeastern portions of the Site.
3. Targeted excavation of six (6) AOCs (on the VCA Parcel) to depths below construction sub-grade to remove all soil containing hazardous lead, metals exceeding Part 375 Commercial Use SCOs, and total SVOCs at a concentration above 500 mg/kg.

4. Construction and maintenance of an engineered composite cover consisting of a concrete walkway, building slab, and 2 feet of clean fill in the play yard to prevent human exposure to soil/fill under the Site.
5. Installation of a vapor barrier system beneath the building slab and along exterior foundation sidewalls to prevent contaminated soil vapors from migrating into the building.
6. Installation of an active SSDS to prevent accumulation and potential migration of contaminated soil vapors into the building.
7. Import of materials to be used for backfill and cover in compliance with this plan and in accordance with applicable laws and regulations. Imported soil will be sampled and analyzed prior to import to the Site and will meet the lesser of the Part 375 Restricted Residential Use SCOs and the Part 375 Protection of Groundwater SCOs.
8. Sampling and analysis of excavated soil/fill in accordance with the requirements of the selected disposal facilities. The excavated soil/fill will be classified and segregated, based on the analytical results of the soil characterization sampling.
9. Collection and analysis of soil end-point samples in accordance with NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, dated 2010.
10. Transportation and off-site disposal of soil/fill material at permitted facilities in accordance with this plan, disposal facility requirements, and applicable laws and regulations for handling, transport, and disposal.
11. Screening of imported soil and excavated soil/fill during intrusive work for indications of contamination by visual means, odor, and monitoring with a photoionization detector (PID).
12. Site mobilization involving Site security setup, equipment mobilization, utility mark outs and marking & staking excavation areas.
13. Implementation of storm-water pollution prevention measures in compliance with applicable laws and regulations.
14. Performance of activities required for the remedial action, including permitting requirements and dewatering pretreatment requirements, in compliance with applicable laws and regulations.

15. Submittal of a Remedial Action Report (RAR) that describes the remedial activities, certifies that the remedial requirements have been achieved, describes all Engineering and Institutional Controls to be implemented at the Site, and lists any deviations from this RAWP.

Hazards associated with soil handling and dewatering activities are described below.

2.3.1 Soil Handling

Based on current development plans, the project will include excavation to bring the Site to the development grade and to accommodate utilities and foundation elements for the school development. In addition, hot-spot areas (discussed above) will be over-excavated below the construction sub-grade. The maximum construction excavation depth is estimated to be 5 feet below ground surface (bgs) below the foundation slab and 9 feet bgs below the elevator pits. The maximum construction excavation depth in the hot-spot remediation areas is estimated to be 10 feet bgs, subject to field conditions. The total estimated volume of soil to be excavated is 4,300 cubic yards. All soil removal operations will be conducted in accordance with 6 NYCRR Part 360 Solid Waste Regulations. The excavation will include removal of approximately 500 cubic yards of hazardous lead-contaminated soil from the southern portion of Lot 1. Material with petroleum odor, staining, or elevated PID readings will be excavated to the extent practicable and stockpiled separately. The maximum extent of the excavation will be contingent on the analytical results of end-point sampling. All excavated soil will be disposed off-site in accordance with all applicable federal, state, and city regulations.

2.3.2 Dewatering

Based on the estimated depth of groundwater at 5 to 8 feet bgs, dewatering is anticipated during construction for portions of the excavation. If encountered, groundwater dewatered from excavations will be managed and handled and/or treated in accordance with all applicable federal, state, and local regulations. All recovered groundwater will be discharged into the New York City Sewer in compliance with a NYCDEP discharge permit obtained prior to any discharge.

Langan Project Team Organization

Table 3 describes the responsibilities of Langan on-site personnel associated with this project. The names of principal personnel associated with this project are:

Senior Associate:	Joel Landes, P.E.	(212) 479-5404
PM:	Stuart Knoop	(212) 479-5461
HSO:	Tony Moffa	(215) 756-2523
SSC:	TBD	
FTL:	TBD	
QAO:	John Gavras	(212) 479-5406

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

TABLE 3
ON-SITE PERSONNEL AND RESPONSIBILITIES

Project Manager - Assumes total control over Site activities; reports to upper-level management; and has authority to direct response operations.

Responsibilities:

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

Site Safety Coordinator - Advises the HSO and PM on all aspects of health and safety on-site; and stops work if any operation threatens worker or public health or safety.

Responsibilities:

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

TABLE 3 - CONTINUED
ON-SITE PERSONNEL AND RESPONSIBILITIES

Site Safety Coordinator Responsibilities (continued):

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

Field Team Leader - Advises the PM on all aspects of health and safety on-site; stops work if any operation threatens worker or public health or safety; and is directly responsible for the field team and the safety of Site operations.

Responsibilities:

- Manages field operations.
- Executes the RAP and schedule.
- Enforces safety procedures.
- Coordinates with the SSC in determining protection level.
- Enforces Site control.
- Documents field activities and sample collection.
- Serves as a liaison with public officials.

WORK TEAM - Operators, laborers, samplers; and the work party must consist of at least two people.

Responsibilities:

- Safely completes the on-site tasks required to fulfill the RAP.
- Complies with Site HASP.
- Notifies SSC or supervisor of suspected unsafe condition.

SECTION 3 RISK ANALYSIS

3.1 CHEMICAL HAZARDS

The primary potential chemical hazard is exposure to SVOCs and metals in the soil (including hazardous lead-contaminated soil and elevated mercury and arsenic levels), and chlorinated VOCs and BTEX in groundwater and soil vapor. Potential contaminants that may be encountered in the soil while conducting intrusive activities at the Site include SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, and chrysene), metals (arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, magnesium, mercury, nickel, selenium, and zinc), and chlorinated VOCs (tetrachloroethene, trichloroethene, vinyl chloride, and cis-1,2-dichloroethene). Relevant properties of these compounds are outlined in Table 4 and Material Safety Data Sheets (MSDS) for these substances are included in Appendix C.

Soil will be wetted during the remediation and development activities as needed; therefore, it is not anticipated that significant dust with chemical constituents will be generated. However, the air will be monitored for particulates and a photoionization detector (PID) will be used to monitor for VOCs.

In addition to the compounds detected on-site, some of the solvents used in decontamination of equipment are potentially hazardous to human health if they are not used properly. Other compounds that may be encountered are Site equipment fuels (gasoline, diesel, etc.) that contain volatile components. MSDSs for substances that will be used on-site are included in Appendix C.

TABLE 4
RELEVANT PROPERTIES OF VOLATILES, METALS, AND SEMI-VOLATILES KNOWN OR SUSPECTED AT THE SITE

Compound (Synonym)	OSHA PEL(1) (ppm)	IDLH (ppm)	LEL (%)	Odor Threshold(2) (ppm)	Odor Character	Vapor Pressure (mm Hg)	Physical State	Detectable w/ 10.6 eV lamp PID (I.P. eV)
PAHs	0.2(mg/m3) [Ca]	80(mg/m3)	Varies	Varies	Varies	Very Low	Combustible Solid	No

(1)	29 CFR 1910, June 30, 1993 (8-hour Time weighted average unless otherwise specified.)
(2)	ACGIH 1989 Highest reported value of acceptable odor threshold range.
[OSHA PEL]	Occupational Safety and Health Administration Permissible Exposure Limit.
[IDLH]	Immediately dangerous to life or health.
[LEL]	Lower Explosive Limit.
[CA]	Suspect carcinogen - Minimize all possible exposures.
NA	Not Applicable

TABLE 4 - CONTINUED
RELEVANT PROPERTIES OF VOLATILES, METALS, AND SEMI-VOLATILES KNOWN OR SUSPECTED AT THE SITE

Compound (Synonym)	OSHA PEL(1) (mg/m3)	IDLH (mg/m3)	LEL (%)	Odor Threshold(2) (ppm)	Odor Character	Vapor Pressure (mm Hg)	Physical State	Detectable w/ 10.6 eV lamp PID (I.P. eV)
Arsenic	0.01	5 [CA]	NA	NA	NA	0 (Approx)	Noncombustible Solid 1	NA
Barium	0.5	50	NA	NA	NA	Low	Noncombustible Solid	NA
Beryllium	0.002	4 [CA]	NA	NA	NA	0 (Approx)	Noncombustible Solid 2	NA
Cadmium	0.005	9 [CA]	NA	NA	NA	0 (Approx)	Noncombustible Solid 3	NA
Chromium	1	250	NA	NA	NA	0 (Approx)	Noncombustible Solid 4	NA
Copper	1	100	NA	NA	NA	0 (Approx)	Noncombustible Solid 5	NA
Iron Oxide Dust	10	2500	NA	NA	NA	0 (Approx)	Noncombustible Solid	NA
Lead	0.050	100	NA	NA	NA	0 (Approx)	Noncombustible Solid	NA
Tetrachloroethene	170	NA	NA	NA	Faint Petroleum	17.5	Noncombustible Liquid	NA
Trichloroethene	25 (ppm) [Ca]	1000	8	20	NA	58	Colourless Liquid	NA
Vinyl Chloride	1 (ppm) [Ca]	NA	3	NA	NA	2580	Colourless Gas	NA
Cis-1,2-dichloroethene	NA[Ca]	NA	9.7	26	NA	200	Colourless Liquid	NA
Benzene	10 (ppm) [Ca]	NA	1.2	4.68	Gasoline	10 KPa	Colourless Liquid	NA
Toluene	200 (ppm) [Ca]	500	1	0.17	Gasoline	22	Colourless Liquid	NA

Detectable Compound (Synonym)	OSHA PEL(1) (mg/m3)	IDLH (mg/m3)	LEL (%)	Odor Threshold(2) (ppm)	Odor Character	Vapor Pressure (mm Hg)	Physical State	w/ 10.6 eV lamp PID (I.P. eV)
Xylenes	435[Ca]	900	1.1	NA	Aromatic	6.72	Colourless Liquid	NA

(1)	29 CFR 1910, June 30, 1993 (8-hour Time weighted average unless otherwise specified.)
(2)	ACGIH 1989 Highest reported value of acceptable odor threshold range.
[OSHA PEL]	Occupational Safety and Health Administration Permissible Exposure Limit.
[IDLH]	Immediately dangerous to life or health.
[LEL]	Lower Explosive Limit.
[CA]	Suspect carcinogen - Minimize all possible exposures.
1	Noncombustible Solid in bulk form, but a slight explosion hazard in the form of dust when exposed to flame
2	Noncombustible Solid in bulk form, but a slight explosion hazard in the form of a powder or dust
3	Noncombustible Solid in bulk form, but will burn in powder form
4	Noncombustible Solid in bulk form, but finely divided dust burns rapidly if heated in a flame
5	Noncombustible Solid in bulk form, but powdered form may ignite
NA	Not Applicable

TABLE 4 - CONTINUED
RELEVANT PROPERTIES OF VOLATILES, METALS, AND SEMI-VOLATILES KNOWN OR SUSPECTED AT THE SITE

Compound (Synonym)	OSHA PEL(1) (mg/m3)	IDLH (mg/m3)	LEL (%)	Odor Threshold(2) (ppm)	Odor Character	Vapor Pressure (mm Hg)	Physical State	Detectable w/ 10.6 eV lamp PID (I.P. eV)
Mercury	0.01	10	NA	NA	NA	0.0012	Noncombustible Liquid	NA
Magnesium	5	500	NA	NA	NA	0 (Approx)	Combustible Solid	NA
Nickel	1	10	NA	NA	NA	0 (Approx)	Combustible Solid 1	NA
Selenium	0.2	1	NA	NA	NA	0 (Approx)	Combustible Solid	NA
Zinc	5	50	NA	NA	NA	0 (Approx)	Combustible Solid 3	NA

(1)	29 CFR 1910, June 30, 1993 (8-hour Time weighted average unless otherwise specified.)
(2)	ACGIH 1989 Highest reported value of acceptable odor threshold range.
[OSHA PEL]	Occupational Safety and Health Administration Permissible Exposure Limit.
[IDLH]	Immediately dangerous to life or health.
[LEL]	Lower Explosive Limit.
1	Sponge catalyst may ignite spontaneously in the air
2	Noncombustible Solid, but may increase intensity of fire when in contact with combustible materials
3	Powder may ignite spontaneously in the air, and can continue burning under water

3.2 RADIATION HAZARDS

No radiation hazards are known or expected at the Site.

3.3 BIOLOGICAL HAZARDS

3.3.1 Animals

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

3.3.2 Insects

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

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

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

3.4 PHYSICAL HAZARDS

3.4.1 Explosion

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

3.4.2 Heat Stress

The use of Level C protective equipment, or greater, may create heat stress. Monitoring of personnel wearing personal protective clothing should commence when the ambient temperature is 72 °F or above. Table 5 presents the suggested frequency for such monitoring. Monitoring frequency should increase as ambient temperature increases or as slow recovery rates are observed. Refer to the Table 6 below to assist in assessing when the risk for heat related illness is likely. To use this table, the ambient temperature and relative humidity must be obtained (a regional weather report should suffice). Heat stress monitoring should be performed by the SSC, who shall be able to recognize symptoms related to heat stress.

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

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

  - Headache, nausea, weakness, hot dry skin, fever, rapid strong pulse, rapid deep respirations, loss of consciousness, convulsions, coma. **This is a life threatening condition.**

Do not permit a worker to wear a semi-permeable or impermeable garment when they are showing signs or symptoms of heat-related illness. To monitor the worker, measure:

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

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

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

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

3.4.3 Cold-Related Illness

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

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

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

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

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

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

TABLE 5
SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING FOR FIT AND ACCLIMATED WORKERS[1]

Adjusted Temperature[2]	Normal Work Ensemble[3]	Impermeable Ensemble
90°F or above (32.2°C) or above	After each 45 min. of work	After each 15 min. of work
87.5°F (30.8°-32.2°C)	After each 60 min. of work	After each 30 min. of work
82.5°-87.5°F (28.1°-30.8°C)	After each 90 min. of work	After each 60 min. of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 min. of work	After each 90 min. of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 min. of work	After each 120 min. of work

1 For work levels of 250 kilocalories/hour.

2 Calculate the adjusted air temperature (ta adj) by using this equation: ta adj ^{O}F = ta ^{O}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.)

3 A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

TABLE 6 - HEAT INDEX

ENVIRONMENTAL TEMPERATURE (Fahrenheit)

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

*Combined Index of Heat and Humidity...what it "feels like" to the body
Source: National Oceanic and Atmospheric Administration

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

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

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

3.4.4 Noise

Work activities during the proposed construction activities may be conducted at locations with high noise levels from the operation of equipment. Hearing protection (e.g., ear plugs, headphones) will be used as necessary.

3.4.5 Lifting

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

3.4.6 Falling Hazards

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

3.4.7 Working near Heavy Machinery

Care should be exercised when working near heavy machinery such as an excavator. Workers should always stay in view of the equipment operator; give equipment wide berth. Clear communications signals, including hand signals, should be established prior to commencement of work and the equipment should have a back-up alarm.

3.4.8 Hand and Power Tools

Hand and/or power tools may be used during the course of the work. The use of hand and power tools can present a variety of hazards, including physical harm from being struck by flying objects, being cut or struck by the tool, fire, and electrocution. Ground Fault Circuit Interrupters (GFCI) are required for all portable tools.

3.4.9 Slips, Trips, and Fall Hazards

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

3.4.10 Utilities (Electrocution and Fire Hazards)

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

3.5 TASK HAZARD ANALYSIS

3.5.1 Excavation and Soil Sampling

Excavation and soil sampling activities are inherently dangerous. Special attention should be given to establishing the location of any underground utilities prior to excavating.

Chemical exposure may occur as these activities progress across the Site, where workers may be exposed to contaminants in the excavated soils, encountered groundwater, or products used on-site including gasoline, diesel, and motor oil. Also, sampling of both in-situ and stockpiled soils presents similar potential exposure hazard. Activities will be conducted initially in Level D but may be upgraded to Modified Level D. Although not anticipated, there will be a Level C and B contingency should pockets of contaminants be brought to the surface and breathing zone air becomes contaminated.

If evidence of historic or unknown contamination is encountered during remediation activities or other contaminated materials, such as oily materials, high PID readings, etc., the SSC will make a determination of the appropriate level of personnel protection.

3.5.2 Dewatering Activities and Groundwater Sampling

The following hazards are associated with dewatering activities and sampling of contaminated groundwater:

- Splash hazards (eye hazard);
- Contaminated groundwater (chemical exposure hazard); and
- Potential exposure to pump components (electrical and mechanical hazard).

Activities will be conducted initially in Level D but may be upgraded to Modified Level D.

SECTION 4 PERSONNEL PROTECTION AND MONITORING

4.1 OSHA TRAINING

All on-site personnel who will be actively involved in intrusive activities (e.g., soil handling, excavation, sampling, and dewatering) and encounter petroleum or chlorinated solvent contaminated waste or hazardous waste must have completed hazardous waste operations-related training, as required by OSHA Regulations 29 CFR 1910.120. Personnel who completed this training more than 12 months prior to the start of the project must have completed an 8-hour refresher course within the past 12 months. Documentation of OSHA training for project personnel must be provided to Langan prior to starting work.

4.2 SITE-SPECIFIC TRAINING

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

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

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

4.3 MONITORING REQUIREMENTS

Based on the existing Site data, it is not expected that significant levels of organic vapors will be encountered during the Site work. However, worker air monitoring will be conducted for VOCs as described below. If levels above the background air monitoring results are encountered in the worker breathing zone, the AMP as described in Section 7.4 will be implemented.

Fugitive dust generation that could affect Site workers, Site occupants, or the public is not expected because the majority of work will be conducted in moist soil. Soil that is not moist will be wetted as appropriate to minimize dust emissions. Particulate concentrations will be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment will be equipped with an audible or visual alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

VOCs will be monitored with a PID at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis during intrusive activities (e.g., soil handling, excavation, and sampling). Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work will be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment will be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment will be capable of calculating 15-minute running average concentrations. If air monitoring measurements above background are encountered, ventilation of the work area will be implemented as described below to verify levels do not exceed acceptable limits as specified in Table 2 and Section 4.4.

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

If air monitoring during operations indicates the presence of VOCs, the action levels, permissible exposure, engineering controls, and PPE specified in this HASP will be implemented. Air monitoring results will be recorded in the field book during investigation activities and made available for the NYCOER, NYSDEC, and NYSDOH review, as requested.

4.4 SUMMARY OF ACTION LEVELS AND RESTRICTIONS

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

Conditions for Level D:
All areas:

- PID readings < 25 ppm and benzene < 1 ppm,
- No visible fugitive dust emissions from Site activities,
- Oxygen readings >19.5% to 21.5%.

Conditions for Level C:
All areas:

- PID readings > 25 ppm (sustained for 15 minutes in the breathing zone) to 200 ppm and benzene < 5ppm,
- Any visible fugitive dust emissions from Site activities that disturb contaminated soil.
- Oxygen readings > 19.5% to 21.5%.

Conditions for Level B (or retreat):
All areas:

- PID readings > 500 ppm or benzene > 25 ppm,
- Visible fugitive dust emissions from Site activities cloud the surrounding air,
- Oxygen readings < 19.5%.

4.4.1 Level D and Modified Level D

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

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

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

4.4.2 Level C

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

- Full-face or half-mask APR or PAPR, depending on presence and abundance of airborne toxic constituents of concern;
- Combination HEPA filter/organic vapor cartridges;
- Tyvek coveralls (must be worn if particulate hazard present);
- PE-coated Tyvek coveralls (if liquid contamination present);
- Steel-toe safety boots;
- Nitrile outer gloves and PVC or nitrile inner gloves (must be worn during all sampling activities); and
- Hard hat (must be worn during all Site activities).

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

4.4.3 Level B (Retreat)

If the concentration of volatile organics which can be detected with a PID equals or exceeds the specified action levels, or oxygen levels decrease below 19.5%, all field personnel associated with the project will immediately retreat to a location up-wind of the source of contamination. At this point the SSC must consult with the Langan HSO to discuss appropriate actions.

4.4.4 OSHA Requirements for PPE

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

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

ANSI American National Standards Institute

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

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

- Oxygen deficiency;
- Immediately Dangerous to Life and Health (IDLH) concentrations;
- High relative humidity; and
- If contaminant levels exceed designated use concentrations.

SECTION 5 WORK ZONES AND DECONTAMINATION

5.1 SITE WORK ZONES

To reduce the spread of hazardous materials by workers from the contaminated areas to the clean areas, work zones will be delineated at the Site. The flow of personnel between the zones should be controlled. The establishment of the work zones will help ensure that personnel are properly protected against the hazards present where they are working, and ensure that work activities and contamination are confined to the appropriate areas. The work zones described below will be implemented for localized hot spots (i.e., potentially contaminated areas discovered during excavation activities) and may be modified in the field depending on field conditions. Remaining on-site soils are primarily expected to be typical of historic urban fill, and mass excavation of the Site is expected; therefore the establishment of work zones (hot, warm, and cold) for the mass excavation is not deemed necessary.

5.1.1 Hot Zone

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

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

5.1.2 Warm Zone

Should PID action levels be exceeded or indications of contamination (by sight or odor) be encountered, a warm zone will be established and utilized during the field activities. This zone will be established between the hot zone and the cold zone (discussed below), and will include the personnel and equipment necessary for decontamination of equipment and personnel exiting the hot zone. Personnel and equipment in the hot zone must pass through this zone before entering the cold zone. This zone should always be located upwind of the hot zone.

5.1.3 Cold Zone

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

5.2 DECONTAMINATION

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

5.2.1 Decontamination of Personnel

Decontamination of personnel will be necessary if Level C or Level B protection is used, which is not anticipated based on current knowledge of the Site history. Decontamination will not be necessary if only Level D protection is used. However, disposable gloves used during sampling activities should be removed and bagged; personnel should be encouraged to remove clothing and shower as soon as is practicable at the end of the day. All clothing should be machine-washed. All personnel will wash hands and face prior to eating and before and after using the restroom.

5.2.2 Decontamination of Field Equipment

Decontamination of field equipment will be necessary for all equipment in contact with contaminated materials. Decontamination activities shall be performed in a designated area lined with PE sheeting designed to collect the decontamination rinsate or over a contaminated portion of the site (i.e., cleaning an excavator bucket over a section of Site soil that will be part of future removal). Equipment to be decontaminated includes, but is not limited to, excavators, pumping equipment, hand tools, trucks, loaders and bull dozers.

5.3 REMEDIAL ACTIVITY-DERIVED WASTE

All PPE related remedial activity-derived waste materials (e.g., PPE, decontamination waste) will be placed in labeled containers and appropriately disposed. Contaminated soil will be kept moist, properly characterized and disposed off-site. Stockpiling of contaminated materials will only occur temporarily and if adequate space exists.

SECTION 6 SAMPLE SHIPMENT

6.1 NON-HAZARDOUS SAMPLES

Samples collected at the Site will be classified as environmental samples.

6.1.1 Environmental Samples

In general, non-hazardous environmental soil or groundwater samples that are collected are not expected to contain high levels of hazardous materials, and are submitted for environmental testing.

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

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

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

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

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

6.2 HAZARDOUS SAMPLES

Should hazardous materials be encountered or sampled at the Site, the following procedures will be implemented. Personnel who must complete a Hazardous Goods Airway Bill must first be DOT trained and certified every two years. Drummed waste samples, tank samples, sludge samples, and grossly contaminated soil samples will be shipped as DOT Hazardous Materials. The designation "Flammable Liquid" or "Flammable Solid" will be used. The samples will be transported as follows:

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

Quantity" or "Ltd. Qty."; "Laboratory Samples"; "Net Weight ___" or "Net Volume ___" (of hazardous contents) should be indicated on shipping papers and on outside of shipping container.

- "This Side Up" or "This End Up" should also be on container.
- Sign shipper certification.

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

6.3 SHIPPING PAPERS

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

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

Other materials may include the following:

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

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

SECTION 7 ACCIDENT PREVENTION AND CONTINGENCY PLAN

7.1 ACCIDENT PREVENTION

7.1.1 Site-Specific Training

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

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

7.1.2 Vehicles and Heavy Equipment

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

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

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

7.2 SPILL CONTROL PLAN

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

7.3 CONTINGENCY PLAN

7.3.1 Emergency Procedures

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

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

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

7.3.2 Chemical Exposure

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

- Another team member (buddy) should remove the individual from the immediate area of contamination. The buddy should communicate to FTL (via voice and hand signals) of the chemical exposure. The FTL should contact the appropriate emergency response agency.
- Precautions should be taken to avoid exposure of other individuals to the chemical.
- If the chemical is on the individual's clothing, the chemical should be neutralized or removed if it is safe to do so.
- If the chemical has contacted the skin, the skin should be washed with copious amounts of water.
- In case of eye contact, an emergency eye wash should be used. Eyes should be washed for at least 15 minutes.

- All chemical exposure incidents must be reported in writing to the HSO. The SSC or FTL is responsible for completing the accident report.

7.3.3 Personal Injury

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

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

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

7.3.4 Evacuation Procedures

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

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

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

7.4 AIR MONITORING PROGRAM

VOCs will be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis during invasive work. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work will be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment will be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment will be capable of calculating 15-minute running average concentrations. Monitoring will be performed to verify the adequacy of respiratory protection and to document worker exposure. All monitoring instruments shall be operated by qualified personnel only and will be calibrated daily prior to use, or more often as necessary. The monitoring will be conducted with a PID, Rae Instruments with 10.6 eV lamp. Calibration records shall be documented, and included in the health and safety logbook or instrument calibration logbook. All instruments shall be calibrated before and after each daily use in accordance with the manufacturers' procedures.

Particulate concentrations will be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment will be equipped with an audible or visual alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

All 15-minute readings must be recorded and be available for OER personnel to review. Instantaneous readings, if any, used for decision purposes will also be recorded.

7.4.1 Vapor Emission Response Plan

VOCs

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities will resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate

emissions, and monitoring continued. After these steps, work activities will resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities will be shutdown.

Particulates

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work will continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m3 above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m3 above the upwind level, work will be stopped and a re-evaluation of activities initiated. Work will resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m3 of the upwind level and in preventing visible dust migration.

When work shut-down occurs, downwind air monitoring as directed by the HSO will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission section.

7.4.2 Major Vapor Emission

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

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

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

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

7.4.3 Major Vapor Emission Response Plan

Upon activation, the following activities will be undertaken:

1. The local police authorities will immediately be contacted by the Site HSO and advised of the situation;
2. Frequent air monitoring will be conducted at 30-minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the Site HSO; and
3. All Emergency contacts will go into effect as appropriate.

Fugitive dust generation that could affect Site workers, Site occupants, or the public is not expected because the majority of work will be conducted in moist soil. Soil that is not moist will be wetted as appropriate to minimize visible dust emissions. Particulate monitoring will be conducted at the perimeter of the Site if sustained visible emissions are observed migrating off-site. At this time, particulate monitoring is not included in this AMP.

Appendix A
Air Monitoring Equipment Calibration and Maintenance

All monitoring instruments must be calibrated and maintained periodically. Calibration and on-site maintenance records will be kept in the field log book. The operator must understand the limitations and possible sources of errors for each instrument. It is important that the operator checks that the instrument responds properly to the substances it was designed to monitor. Portable air quality monitoring equipment that measures total ionizables present such as the RaeSystems MiniRae 2000 (or equivalent) photoionization detector (PID) must be calibrated at least once each day. Combustible gas/oxygen meters (explosimeter) such as the MSA Model 360 monitor must be calibrated at least once a week. The specific instructions for calibration and maintenance provided for each instrument should be followed.

Appendix B

Forms for Health and Safety Related Activity

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

You Have a Right to a Safe and Healthful Workplace.

IT'S THE LAW!

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

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

1-800-321-OSHA

www.osha.gov

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

Langan **ACCIDENT REPORT FORM**

(Page 1 of 2)

Project Name:____

Injured or Ill Employee

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

Employer

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

The Accident or Exposure to Occupational Illness

10. Place of accident or exposure ____
    (No. and Street) (City or Town) (State and Zip)
11. Was place of accident or exposure on employer's premises? ______(Yes/No)
12. What was the employee doing when injured?__________________________________
    ____
    (Be specific - was employee using tools or equipment or handling material?)
    ____
13. How did the accident occur? ____
    (Describe fully the events that resulted in the injury or occupational illness. Tell what happened and how. Name objects and substances involved. Give details on all factors that led to accident. Use separate sheet if needed)
    ____
    ____
14. Time of accident ________________
15. Date of injury or initial diagnosis of occupational illness _____________

(Page 2 of 2)

16. WITNESS TO ACCIDENT

(Name)	(Affiliation)	(Phone No.)
(Name)	(Affiliation)	(Phone No.)
(Name)	(Affiliation)	(Phone No.)

Occupational Injury or Occupational Illness

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

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

19. Did the accident result in employee fatality? ________ (Yes or No)
20. Number of lost workdays ____/restricted workdays _____ resulting from injury or illness?

Other

21. Did you see a physician for treatment? ________ (Yes or No) ________ (Date)
22. Name and address of physician ________________________________

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

23. If hospitalized, name and address of hospital ________________________

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

Date of report ____________________ Prepared by ________________________

Official position ____________________________

Langan

PLAN ACCEPTANCE FORM

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

____________________________ ______________________________

(Project Title) (Project Number)

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

Name (print)	**Signature**	**Date**

1. **For Langan employees <u>only.</u>**
2. **Place in project Health and Safety File as soon as possible.**

Langan

SITE-SPECIFIC HEALTH AND SAFETY TRAINING FORM

I hereby confirm that Site-specific health and safety training has been conducted by the Site Health and Safety Officer that included:

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

For the following project:

__________________________ ____________________________

(Project Title) (Project Number)

Name (print)	Signature	Date

1. **For <u>all</u> Langan and subcontract employees on-site.**

2. **Place in project Health and Safety File as soon as possible.**

Appendix C
Material Safety Data Sheets

- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- Chrysene
- Dibenzo(a,h)anthracene
- Arsenic
- Barium
- Beryllium
- Cadmium
- Chromium
- Copper
- Iron
- Lead
- Magnesium
- Mercury
- Nickel
- Selenium
- Zinc
- Tetrachloroethene
- Trichloroethene
- Vinyl Chloride
- Cis-1,2-dichloroethene

Safety data for 1,2-benzanthracene

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: 1,2-benz(a)anthracene, benzanthrene, benzo(a)anthracene, benzo (b)phenanthrene, 2,3-benzophenanthrene, naphthanthracene, tetraphene
Use:
Molecular formula: $C_{18}H_{12}$
CAS No: 56-55-3
EINECS No: 200-280-6

Physical data

Appearance: solid
Melting point: 158 C
Boiling point: 438 C
Vapour density:
Vapour pressure:
Density (g cm^{-3}):
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility:

Stability

Stable. Combustible. Incompatible with strong oxidizing agents.

Toxicology

IARC group 2A carcinogen. Mutagen.

Toxicity data

(The meaning of any toxicological abbreviations which appear in this section is given here.)

IVN-RAT LD50 > 200 mg kg^{-1}

Risk phrases

(The meaning of any risk phrases which appear in this section is given here.)
R45 R50 R53.

Environmental information

Very toxic to aquatic organisms. May cause long-term damage in the environment.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
UN No 2811. Packing group I. Hazard class 6.1. EmS No: 6.1-04.

Personal protection

Restricted material. This material must not be used by untrained workers. A full risk assessment must be prepared before use. Use safety glasses, gloves and containment suitable for a carcinogen.

Safety phrases

(The meaning of any safety phrases which appear in this section is given here.)
S45 S53 S60 S61.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Safety data for benzo(a)pyrene

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: 1,2-benzopyrene, 6,7-benzopyrene, benzo[a]pyrene, B(a)P, BP, 3,4-benzopyrene, benzo[d,e,f]chrysene, 3,4-benzpyrene, benzpyrene, 3,4-benzylpyrene, 3,4-benz[a]pyrene, 3,4-BP, 3,4-benzopyrene
Molecular formula: $C_{20}H_{12}$
CAS No: 50-32-8
EINECS No: 200-028-5
EU Index No: 601-032-00-3

Physical data

Appearance: yellow crystals or powder [found in cigarette smoke, coal tar, fuel exhaust gas and in many other sources]
Melting point: 176 C
Boiling point: 495 C
Vapour density: 8.7 (air = 1)
Vapour pressure:
Density (g cm^{-3}): 1.351
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility: slight

Stability

Stable. Incompatible with strong oxidizing agents.

Toxicology

POISON. This material is an experimental carcinogen, mutagen, tumorigen, neoplastigen and teratogen. It is a probable carcinogen in humans and a known human mutagen. IARC Group 2A carcinogen. It is believed to cause bladder, skin and lung cancer. Exposure to it may damage the developing foetus. May cause reproductive damage. May be transferred to nursing infants through mother's milk. Skin, respiratory and eye irritant. May cause changes to the colour and properties of skin. Exposure to sunlight can increase the skin damage caused by this chemical.

Toxicity data

(The meaning of any abbreviations which appear in this section is given here.)

SCU-RAT LD50 50 mg kg^{-1}

IPR-MUS LDLO 500 mg kg^{-1}

IRN-FRG LDLO 11 mg kg^{-1}

Risk phrases

(The meaning of any risk phrases which appear in this section is given here.)
R45 R46 R50 R53 R60 R61.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
Un No 2811. Packing group III. Hazard class 6.1.

Environmental information

Very toxic in the environment - may cause long-term damage.

Personal protection

Restricted material. Only to be used by trained workers. Prepare a full risk assessment before starting work. Safety glasses, gloves, good ventilation. Handle as a carcinogen. Do not dry sweep spills because of the risk of increasing the amount of airborne material.

Safety phrases

(The meaning of any safety phrases which appear in this section is given here.)

S45 S53 S60 S61.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

This information was last updated on December 20, 2004. We have tried to make it as accurate and useful as possible, but can take no responsibility for its use, misuse, or accuracy. We have not verified this information, and cannot guarantee that it is up-to-date.

Note also that the information on the PTCL Safety web site, where this page was hosted, has been copied onto many other sites, often without permission. If you have any doubts about the veracity of the information that you are viewing, or have any queries, please check the URL that your web browser displays for this page. If the URL **begins** "http://msds.chem.ox.ac.uk/" the page is maintained by the Safety Officer in Physical Chemistry at Oxford University. If not, this page is a copy made by some other person and we have no responsibility for it.

Safety data for benzo[b]fluoranthene

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: 3,4-benzofluoranthene, benz[e]acenaphthanthrylene, 3,4-benz[e]acenaphthanthrylane, 2,3-benzofluoranthene, benzofluoranthrene, benzo[e]fluoranthene
Use:
Molecular formula: $C_{20}H_{12}$
CAS No: 205-99-2
EINECS No: 205-911-9
EC Index No: 601-024-00-4

Physical data

Appearance: off-white to tan powder
Melting point: 163 - 165 C
Boiling point:
Vapour density:
Vapour pressure:
Density (g cm^{-3}):
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility:

Stability

Stable. Incompatible with strong oxidizing agents.

Toxicology

Toxic. Probable human carcinogen. May act as an irritant.

Toxicity data

(The meaning of any toxicological abbreviations which appear in this section is given here.)

Risk phrases

(The meaning of any risk phrases which appear in this section is given here.)
R45 R50 R53.

Environmental information

Very harmful to aquatic organisms - may cause long-term damage to the environment.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)

Personal protection

Safety glasses, good ventilation, disposable gloves. Treat as a possible carcinogen.

Safety phrases

(The meaning of any safety phrases which appear in this section is given here.)
S45 S53 S60 S61.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

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New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **BENZO(k)FLUORANTHENE**

CAS Number: 207-08-9
DOT Number: None

RTK Substance number: 2969
Date: October 2002

HAZARD SUMMARY

* **Benzo(k)Fluoranthene** can affect you when breathed in and may be absorbed through the skin.
* **Benzo(k)Fluoranthene** should be handled as a CARCINOGEN--WITH EXTREME CAUTION.
* Contact can irritate the skin and eyes.

IDENTIFICATION

Benzo(k)Fluoranthene is a pale yellow, needle-like solid. It is primarily found in smoke from tobacco and polluted air.

REASON FOR CITATION

* **Benzo(k)Fluoranthene** is on the Hazardous Substance List because it is cited by NTP, IARC, HHAG and EPA.
* This chemical is on the Special Health Hazard Substance List because it is a **CARCINOGEN**.
* Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

* Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.1020.
* If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

No occupational exposure limits have been established for **Benzo(k)Fluoranthene**. This does not mean that this substance is not harmful. Safe work practices should always be followed.

* **Benzo(k)Fluoranthene** may be a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
* It should be recognized that **Benzo(k)Fluoranthene** can be absorbed through your skin, thereby increasing your exposure.

WAYS OF REDUCING EXPOSURE

* Enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
* Wear protective work clothing.
* Wash thoroughly immediately after exposure to **Benzo(k)Fluoranthene** and at the end of the workshift.
* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Benzo(k)Fluoranthene** to potentially exposed workers.

This Fact Sheet is a summary source of information of all potential and most severe 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 **Benzo(k)Fluoranthene**:

* Contact can irritate the skin and eyes.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Benzo(k)Fluoranthene** and can last for months or years:

Cancer Hazard

* **Benzo(k)Fluoranthene** may be a CARCINOGEN in humans since it has been shown to cause skin cancer in animals.
* Many scientists believe there is no safe level of exposure to a carcinogen. Such substances 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 and Senior Services, **Benzo(k)Fluoranthene** has not been tested for its ability to affect reproduction.

Other Long-Term Effects

* **Benzo(k)Fluoranthene** has not been adequately tested for other chronic (long-term) health effects.

MEDICAL

Medical Testing

There is no special test for this chemical. However, if illness occurs or overexposure is suspected, medical attention is recommended.

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 OSHA 1910.1020.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following control is recommended:

* Where possible, automatically transfer **Benzo(k)Fluoranthene** from drums or other storage containers to process containers.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by **Benzo(k)Fluoranthene** should change into clean clothing promptly.
* Do not take contaminated work clothes home. Family members could be exposed.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Benzo(k)Fluoranthene**.
* Eye wash fountains should be provided in the immediate work area for emergency use.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with **Benzo(k)Fluoranthene**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Benzo(k)Fluoranthene**, whether or not known skin contact has occurred.
* Do not eat, smoke, or drink where **Benzo(k)Fluoranthene** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, smoking, or using the toilet.
* Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 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.

Clothing

* Avoid skin contact with **Benzo(k)Fluoranthene.** Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

* Eye protection is included in the recommended respiratory protection.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

* At any exposure level, use a MSHA/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.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?
A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?
A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?
A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?
A: Conditions which increase risk of exposure include dust releasing operations (grinding, mixing, blasting, dumping, etc.), other physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?
A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

Q: Don't all chemicals cause cancer?
A: No. Most chemicals tested by scientists are not cancer-causing.

Q: Should I be concerned if a chemical causes cancer in animals?
A: Yes. Most scientists agree that a chemical that causes cancer in animals should be treated as a suspected human carcinogen unless proven otherwise.

Q: But don't they test animals using much higher levels of a chemical than people usually are exposed to?
A: Yes. That's so effects can be seen more clearly using fewer animals. But high doses alone don't cause cancer unless it's a cancer agent. In fact, a chemical that causes cancer in animals at high doses could cause cancer in humans exposed to low doses.

The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863
(609) 984-7407 (fax)

Web address: http://www.state.nj.us/health/eoh/odisweb/

Industrial Hygiene Information
Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

Medical Evaluation
If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

Public Presentations
Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

Right to Know Information Resources
The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know Survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is assigned by the Chemical Abstracts Service to identify a specific chemical.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or 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.

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.

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

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.

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

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 Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEL is the Permissible Exposure Limit which is enforceable by the Occupational Safety and Health Administration.

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.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

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.

>>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<

Common Name: **BENZO(k)FLUORANTHENE**
DOT Number: **None**
NAERG Code: **No Citation**
CAS Number: **207-08-9**

Hazard rating	NJDHSS	NFPA
FLAMMABILITY	Not Found	Not Rated
REACTIVITY	Not Found	Not Rated
CARCINOGEN POISONOUS GASES ARE PRODUCED IN FIRE		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

FIRE HAZARDS

- * Use dry chemical, CO_2, water spray, or foam extinguishers.
- * POISONOUS GASES ARE PRODUCED IN FIRE.
- * If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

SPILLS AND EMERGENCIES

If **Benzo(k)Fluoranthene** is spilled, take the following steps:

- * Evacuate persons not wearing protective equipment from area of spill until clean-up is complete.
- * Remove all ignition sources.
- * Collect powdered material in the most convenient and safe manner and deposit in sealed containers.
- * Ventilate and wash area after clean-up is complete.
- * It may be necessary to contain and dispose of **Benzo(k)Fluoranthene** 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.
- * If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: 1-877-WARN-DEP

HANDLING AND STORAGE

- * Prior to working with **Benzo(k)Fluoranthene** you should be trained on its proper handling and storage.
- * **Benzo(k)Fluoranthene** is not compatible with OZONE; OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); NITROGEN; and SULFUR OXIDES.
- * Store in tightly closed containers in a cool, well-ventilated area.

FIRST AID

For POISON INFORMATION call 1-800-222-1222

Eye Contact

- * Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

Skin Contact

- * Remove contaminated clothing. Wash contaminated skin with soap and water.

Breathing

- * Remove the person from exposure.

PHYSICAL DATA

Vapor Pressure: 0 mm Hg at 68°F (20°C)
Water Solubility: Insoluble

OTHER COMMONLY USED NAMES

Chemical Name:
Benzo(k)Fluoranthene
Other Names:
8,9-Benzofluoranthene; B(k)F

Not intended to be copied and sold for commercial purposes.

NEW JERSEY DEPARTMENT OF HEALTH AND
SENIOR SERVICES
Right to Know Program
PO Box 368, Trenton, NJ 08625-0368
(609) 984-2202

Safety data for dibenz(a,h)anthracene

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: 1,2:5,6-benzanthracene, 1,2:5,6-dibenzanthracene, dibenzo(a,h) anthracene, DBA, 1,2,5,6-DBA
Use: a common pollutant in smoke and used oils
Molecular formula: $C_{22}H_{14}$
CAS No: 53-70-3
EINECS No: 200-181-8
Annex I Index. No: 601-041-00-2

Physical data

Appearance: white to light yellow crystalline solid
Melting point: 266 - 267 C
Boiling point: 524 C
Vapour density:
Vapour pressure:
Density (g cm^{-3}): 1.28
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility:

Stability

Stable. Combustible. Incompatible with strong oxidizing agents.

Toxicology

Harmful if swallowed or inhaled. Experimental carcinogen, tumorigen and neoplastigen. IARC probable human carcinogen.

Toxicity data

(The meaning of any toxicological abbreviations which appear in this section is given here.)

IVN-MUS LDLO 10 mg kg^{-1}

Risk phrases

(The meaning of any risk phrases which appear in this section is given here.)
R45 R50 R53.

Environmental information

Harmful in the environment - may cause long-term damage.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
Non-hazardous for air, sea and road freight.

Personal protection

Safety glasses, gloves, good ventilation. Handle as a possible carcinogen.

Safety phrases

(The meaning of any safety phrases which appear in this section is given here.)
S45 S53 S60 S61.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Safety data for chrysene

Glossary of terms on this data sheet.

General

Synonyms: 1,2-benzophenanthrene, benzo(a)phenanthrene, 1,2-benzphenanthrene, coal tar pitch, benz(a)phenanthrene, 1,2,5,6-dibenzonaphthalene
Molecular formula: $C_{18}H_{12}$
CAS No: 218-01-9
EC No: 205-923-4

Physical data

Appearance: crystalline powder
Melting point: 253 C
Boiling point: 448 C
Vapour density:
Vapour pressure:
Density (g cm^{-3}): 1.27
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility: insoluble

Stability

Stable. Combustible. Incompatible with strong oxidizing agents.

Toxicology

Toxic. Confirmed animal carcinogen, possible human carcinogen. Harmful if swallowed, inhaled or absorbed through the skin.

Toxicity data

(The meaning of any abbreviations which appear in this section is given here.)

IPR-MUS LD50 >320 mg kg^{-1}

Risk phrases

(The meaning of any risk phrases which appear in this section is given here.)

R20 R21 R22 R45 R46.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)

UN No 2811. Packing group I. Hazard class 6.1. CDG UK Transport category 1. EMS No 6.1-04.

Personal protection

Safety glasses, good ventilation, gloves. Handle as a carcinogen. A COSHH assessment is required.

Safety phrases

(The meaning of any safety phrases which appear in this section is given here.)

S3 S7 S9 S36 S37 S39 S45.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Right to Know
Hazardous Substance Fact Sheet

Common Name: **ARSENIC**

Synonyms: Gray Arsenic; Arsen
Chemical Name: Arsenic
Date: June 1998 Revision: April 2008

CAS Number: 7440-38-2
RTK Substance Number: 0152
DOT Number: UN 1558

Description and Use

Arsenic is a silver-gray or white metallic, odorless, brittle solid. It is used as an alloying agent for heavy metals, and in solders, medicines and herbicides.

Reasons for Citation

- **Arsenic** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, IRIS 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. Seek medical attention.

Skin Contact

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Inhalation

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- 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

EMERGENCY RESPONDERS >>>> SEE PAGE 6

Hazard Summary

Hazard Rating	NJDHSS	NFPA
HEALTH	4	-
FLAMMABILITY	0	-
REACTIVITY	0	-
CARCINOGEN POISONOUS GASES ARE PRODUCED IN FIRE		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

- **Arsenic** can affect you when inhaled and may be absorbed through the skin.
- **Arsenic** is a CARCINOGEN and may cause reproductive damage. HANDLE WITH EXTREME CAUTION.
- Skin contact can cause irritation, burns, rash and loss of pigment
- Eye contact can cause irritation and burns.
- Inhaling **Arsenic** can irritate the nose and throat and can cause an ulcer or hole in the "bone" (septum) dividing the inner nose.
- Exposure to **Arsenic** can cause weakness, poor appetite, nausea, vomiting, headache, and even death.
- **Arsenic** may damage the nervous system and the liver.
- **Arsenic** is a noncombustible solid, but when in *dust* or *fine powder* form it can EXPLODE when exposed to heat, flame or hot surfaces.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **0.01 mg/m^3** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **0.002 mg/m^3**, which should not be exceeded at any time.

ACGIH: The threshold limit value (TLV) is **0.01 mg/m^3** averaged over an 8-hour workshift.

- **Arsenic** is a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

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 and Senior Services Hazardous Substance Fact Sheet, available on the RTK Program website (www.nj.gov/health/eoh/rtkweb) 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 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) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require 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 **Arsenic**:

- Skin contact can cause irritation, burns, rash and loss of pigment.
- Eye contact can cause irritation, burns and red, watery eyes.
- Inhaling **Arsenic** can irritate the nose and throat causing coughing and wheezing.
- Exposure to **Arsenic** can cause weakness, poor appetite, nausea, vomiting, headache, muscle cramps and even death.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Arsenic** and can last for months or years:

Cancer Hazard

- **Arsenic** is a CARCINOGEN in humans. It has been shown to cause skin and lung cancer.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard

- Chronic **Arsenic** exposure has been associated with spontaneous abortions and still births.
- There is limited evidence that **Arsenic** is a teratogen in animals. Until further testing has been done, it should be treated as a possible teratogen in humans.

Other Effects

- Repeated skin contact can cause thickened skin and/or patchy areas of darkening and loss of pigment. Some persons may develop white lines on the nails.
- Long-term exposure can cause an ulcer or hole in the "bone" (septum) dividing the inner nose, hoarseness and sore eyes.
- **Arsenic** may damage the nervous system causing numbness, "pins and needles," and/or weakness in the hands and feet.
- **Arsenic** may damage the liver.

Medical

Medical Testing

Before first exposure and every 12 months thereafter, OSHA requires your employer to provide (for persons exposed to greater than **0.005 mg/m^3** of *Arsenic*) a work and medical history and exam which shall include:

- Chest x-ray
- Exam of the nose, skin and nails
- Test for urine **Arsenic**. This is most accurate at the end of the workday. Eating shellfish or fish may elevate **Arsenic** levels for up to two days. At NIOSH recommended exposure levels, urine **Arsenic** should not be greater than **100 micrograms per liter** of urine.

After suspected overexposure, repeat these tests and consider exam of the nervous system and liver function tests. Also examine your skin periodically for abnormal growth. Skin cancer from **Arsenic** can be easily cured when detected early.

OSHA requires your employer to provide you and your doctor with a copy of the OSHA *Inorganic Arsenic* Standard (29 CFR 1910.1018).

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).

Mixed Exposures

- More than light alcohol consumption can cause liver damage. Drinking alcohol may increase the liver damage caused by **Arsenic**.

Conditions Made Worse By Exposure

- May scientists believe that skin changes such as thickening and pigment changes make those skin areas more likely to develop skin cancer.

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:

- Specific engineering controls are required for this chemical by OSHA. Refer to the OSHA *Inorganic Arsenic* Standard (29 CFR 1910.1018).
- 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 **Arsenic**. Wear personal protective equipment made from material which 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*, *Natural Rubber* or *Silver Shield®* for gloves and DuPont *Tyvek®*, or the equivalent, as protective materials for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear impact resistant eye protection with side shields.
- Wear a face shield with goggles when working with corrosive, high irritating or toxic substance.

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 not higher than **0.1 mg/m^3**, use a half-mask air purifying respirator equipped with high efficiency filters.
- Where the potential exists for exposure not higher than **0.5 mg/m^3**, use a full facepiece, air purifying respirator with high efficiency filters.
- Where the potential exists for exposure not higher than **5 mg/m^3**, use any powered-air purifying respirator with high efficiency filters or a half-mask supplied-air respirator operated in a positive pressure mode.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Arsenic**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Exposure to **5 mg/m^3** is immediately dangerous to life and health. If the possibility of exposure above **5 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).

- **Arsenic** is noncombustible, however, **Arsenic** *dust* or *fine powder* can explode when exposed to heat, flame or hot surfaces.
- Use dry chemical, CO_2, water spray or foam as extinguishing agents.
- POISONOUS GASES ARE PRODUCED IN FIRE, including *Arsenic Oxides*.
- 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 **Arsenic** is spilled, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Collect powdered material in the most convenient and safe manner, or use a HEPA-filter vacuum for clean-up, and deposit in sealed containers.
- Ventilate area of spill after clean-up is complete.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Arsenic** 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 **Arsenic** you should be trained on its proper handling and storage.

- A regulated, marked area should be established where **Arsenic** is handled, used or stored as required by the OSHA *Inorganic Arsenic* Standard (29 CFR 1910.1018).
- **Arsenic** reacts with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) to cause fires and explosions.
- **Arsenic** reacts with ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC) and HYDROGEN GAS to produce toxic *Arsine gas*.
- **Arsenic** is not compatible with *powdered* METALS (such as ZINC, LITHIUM, RUBIDIUM and PLATINUM); BROMINE AZIDE; LEAD MONOXIDE; and MERCURY OXIDE.
- Store in tightly closed containers in a cool, well-ventilated area away from COMBUSTIBLES and HEAT.
- DO NOT store in metal tanks.

Occupational Health Information Resources

The New Jersey Department of Health and Senior Services, 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 & Senior Services
Right to Know Program
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

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.

INFORMATION FOR EMERGENCY RESPONDERS

Common Name: **ARSENIC**

Synonyms: Gray Arsenic; Arsen
CAS No: 7440-38-2
Molecular Formula: As
RTK Substance No: 0152
Description: Silver-gray or white metallic, odorless, brittle solid

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
4 - Health **0 - Fire** **0 - Reactivity** **DOT#:** UN 1558 **ERG Guide #:** 152 **Hazard Class:** 6.1 (Poison)	**Arsenic** is noncombustible, however, *Arsenic dust* or *fine powder* can explode when exposed to heat, flame or hot surfaces. Use dry chemical, CO_2, water spray or foam as extinguishing agents. POISONOUS GASES ARE PRODUCED IN FIRE, including *Arsenic Oxides*. Use water spray to keep fire-exposed containers cool.	**Arsenic** reacts with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) to cause fires and explosions. **Arsenic** reacts with ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC) and HYDROGEN GAS to produce toxic *Arsine gas*. **Arsenic** is not compatible with *powdered* METALS (such as ZINC, LITHIUM, RUBIDIUM and PLATINUM); BROMINE AZIDE; LEAD MONOXIDE; and MERCURY OXIDE.

SPILL/LEAKS

Isolation Distance:

Spills: 25 to 50 meters (75 to 150 feet)

Fire: 800 meters (1/2 mile)

Moisten spilled material first or use a HEPA-filter vacuum for clean-up.

DO NOT wash into sewer.

Toxic to aquatic organisms.

PHYSICAL PROPERTIES

Odor Threshold:	Odorless
Flash Point:	Noncombustible solid
Vapor Pressure:	1 mm Hg at 701°F (372°C)
Specific Gravity:	5.7 (water = 1)
Water Solubility:	Insoluble
Boiling Point:	1,350°F (613°C)
Ionization Potential:	9.87 eV
Molecular Weight:	74.9

EXPOSURE LIMITS

OSHA:	0.01 mg/m^3, 8-hr TWA
NIOSH:	0.002 mg/m^3, 15-min Ceiling
ACGIH:	0.01 mg/m^3, 8-hr TWA
IDLH:	5 mg/m^3

PROTECTIVE EQUIPMENT

Gloves:	Natural Rubber, Nitrile or Silver Shield®
Coveralls:	DuPont Tyvek®
Respirator:	<0.1 mg/m^3 - Full facepiece APR with High efficiency filter <0.5 mg/m^3 -Supplied air

HEALTH EFFECTS

Eyes:	Irritation, burns, red and watery eyes
Skin:	Irritation, burns, itching, rash and loss of pigment
Inhalation:	Nose and throat irritation with coughing, wheezing and hoarseness
	Weakness, headache, nausea, vomiting, and muscle cramps
Chronic:	Cancer (skin and lung) in humans

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. Seek medical attention.

Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water.

Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer to a medical facility.

Safety data for barium

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms:
Molecular formula: Ba
CAS No: 7440-39-3
EC No:

Physical data

Appearance: yellow-white, slightly lustrous solid
Melting point: 725 C
Boiling point: 1640 C
Vapour density:
Vapour pressure: 10 mm Hg at 1049 C
Density (g cm^{-3}): 3.51
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility: reacts

Stability

Reacts vigorously or violently with acids, water, tetrachloromethane, small halogenated hydrocarbons. Should be stored under an inert material such as petroleum ether to exclude air. Flammable.

Toxicology

Poisonous if swallowed. (Note that water or acid soluble barium salts are all poisonous, but that the insoluble salts, as used in a "barium meal" are much less so.)

Toxicity data

(The meaning of any abbreviations which appear in this section is given here.)

Risk phrases

(The meaning of any risk phrases which appear in this section is given here.)
R22.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
Hazard class 4.3. Packing group II. UN No 1400.

Personal protection

Safety glasses, gloves, good ventilation. Moisture-free working environment, such as a glove-box.

Safety phrases

(The meaning of any safety phrases which appear in this section is given here.)

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

This information was last updated on February 22, 2005. We have tried to make it as accurate and useful as possible, but can take no responsibility for its use, misuse, or accuracy. We have not verified this information, and cannot guarantee that it is up-to-date.

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MATERIAL SAFETY DATA SHEET

I. PRODUCT IDENTIFICATION

Manufacturer/Supplier:
ESPI Metals
1050 Benson Way, Ashland, OR 97520
Toll Free (800) 638-2581 * Fax (541) 488-8313
E-Mail: sales@espimetals.com

Trade Name:	Beryllium
Chemical Family:	Metallic Element
Formula:	Be
CAS #:	7440-41-7

II. HAZARDOUS INGREDIENTS

Hazardous Component:	Beryllium
%:	0-100
OSHA/PEL:	.002 mg/m^3
ACGIH/TLV:	.002 mg/m^3

HMIS Ratings (Powder): **Health**: 3 **Flammability**: 1 **Reactivity**: 0
HMIS Ratings (Foil): **Health**: 2 **Flammability**: 0 **Reactivity**: 0

III. PHYSICAL DATA

Boiling Point:	2970 °C
Melting Point:	1283 °C
Specific Gravity:	1.85 g/cc
Vapor Pressure:	N/A
% Volatiles:	N/A
Solubility in H_2O:	Insoluble
Appearance and Odor:	Grey metallic, no odor

IV. FIRE AND EXPLOSION HAZARDS DATA

Flash Point: Non-combustible as a solid. Ignition occurred as a powder layer consisting of 1.0 to 5.0 micron particles between 540 °C and 700 °C. Coarser beryllium powder able to pass through a 74 micron sieve did not ignite under like testing.

Explosive limits: Not applicable to solids. As a cloud of 1.0 micron diameter powder ignition occurred at 910 °C. Beryllium powder greater than or equal to 2 microns in diameter did not ignite under like conditions. Regardless of powder size tested beryllium did not ignite as a cloud in a spark apparatus.

Extinguishing Media: As a solid, use extinguishing media appropriate to the surrounding fire. Do not use water or carbon dioxide to extinguish beryllium powder fires. As a powder, extinguish by smothering using a Class D fire extinguisher, dry sand, graphite powder, or sodium chloride.

Special Fire Fighting Procedures: If this material becomes airborne as a respirable particulate during a fire situation, pressure- demand self-contained breathing apparatus must be worn by firefighters or any other persons potentially exposed to the metal fumes.

Unusual Fire and Explosion Hazard: Do not use water to extinguish fires around operations involving molten metal due to the potential for steam explosions. In addition, water may disassociate when in contact with burning beryllium powder or chips releasing flammable hydrogen gas which could burn and result in an explosion. Ventilation duct work which has accumulated a fine coating of beryllium dust on its internal surface poses a potentially serious fire hazard. Extinguishing using Class D fire extinguisher media and shut down or isolate the affected portion of the ventilation system. Because of this potential risk, sources of ignition such as flame, spark, etc. must not be allowed to enter the ventilation duct work. Also, duct work must be made of non-combustible material.

V. HEALTH HAZARD INFORMATION

Primary Routes of Exposure: **Inhalation**: An exposure to airborne beryllium in excess of the occupational standard can occur during routine handling, material transfer, chemical processing or further processing of powdered material and when machining, melting, casting, dross handling, picking, welding, grinding, sanding, polishing, milling, crushing, or otherwise abrading the surface of solid beryllium in a manner which generates finely divided particles. Machining operations conducted under a flood of liquid coolant usually require local exhaust ventilation. The cycling through a machine of liquid lubricant/coolant containing finely divided beryllium in suspension can result in the concentration building to a point where the particulate may become airborne during use. A filter, centrifuge, or settling chamber can be installed in-line if necessary. The potential for exposures also may occur during repair or maintenance activities on contaminated equipment such as: furnace rebuilding, maintenance or repair of air cleaning equipment, structural renovation, welding, etc.

Acute Effects:

Inhalation: This product is insoluble and does not cause acute health effects.
Ingestion: This product is insoluble and does not cause acute health effects.
Skin: Skin abrasion may cause irritation.
Eye: Injury to the eyes can result from particulate irritation or mechanical injury to the cornea or conjunctiva by dust or particulate.

Chronic Effects:

Inhalation: Overexposure to airborne beryllium particulate may cause a serious lung disease, in certain sensitive individuals, called chronic beryllium disease (chronic berylliosis). Chronic beryllium disease is a condition in which the tissues of the lungs become inflamed, restricting the exchange of oxygen between the lungs and the bloodstream. Symptoms may include cough, chest pain, shortness of breath, weight loss, weakness, and fatigue. Long term effects may include loss of lung function, fibrosis, or subsequent secondary effects on the heart with eventual permanent impairment.
Ingestion: There are no known cases of illness resulting from ingestion of beryllium.
Skin: Skin abrasion may cause irritation.
Eye: Injury to the eyes can result from particulate irritation or mechanical injury to the cornea or conjunctiva by dust or particulate.
Carcinogenic references: Hazard communication regulations of the U.S. Occupational Safety & Health Administration require that
caution labels for materials listed as potential carcinogens in either the International Agency for Cancer Research Monograph Series or the National Toxicology Program Annual Report on carcinogens must contain a cancer warning. Beryllium has also been so listed based principally on animal tests and therefore this material bears a label identifying it as a potential cancer hazard.
Medical Conditions Aggravated by Exposure: Persons with impaired pulmonary function, airway diseases, or conditions such as asthma, emphysema, chronic bronchitis, etc. may incur further impairment if excessive concentrations of dust or fume are inhaled. If prior damage or disease to the neurologic (nervous), circulatory, hematologic (blood), or urinary (kidney) system has occurred, proper screening or examinations should be conducted on individuals who may be exposed to further risk where handling and use of this material may cause excessive exposure.

EMERGENCY AND FIRST AID PROCEDURES:

INHALATION: Remove to fresh air. Although no cases in which a person stopped breathing as a result of exposure are known, if breathing has stopped, perform artificial respiration and obtain medical help.
INGESTION: Swallowing metal powder or dust can be treated by having the affected person drink large quantities of water and attempting to induce vomiting if conscious. Obtain medical help.
SKIN: Remove contaminated clothing, brush material off skin, wash affected area with soap and water. If irritation persists, seek medical attention.
EYE: Flush eyes with copious amounts of clean water. If irritation persists obtain medical help. Contact lenses should not be

worn when working with metal dusts and powders because the contact lens must be removed to provide adequate treatment.

VI. REACTIVITY DATA

Stability: Stable
Conditions to Avoid: Oxidation will form on solid shapes when moist.
Incompatibility (Material to Avoid): Avoid contact with mineral acids and oxidizing agents which may generate hydrogen gas.
Hydrogen gas can be an explosion hazard.
Hazardous Decomposition Products: Melting and dross handling or powdering operations can emit airborne dusts or fumes.
Hazardous Polymerization: Will not Occur

VII. SPILL AND LEAK PROCEDURES

Steps to Be Taken in Case Material Is Released or Spilled: In solid form this material poses no health or environmental risk. If this material is in powder or dust form, establish a restricted entry zone based on the severity of the spill. Persons entering the restricted zone must wear adequate respiratory protection and protective clothing appropriate for the severity of the spill. Cleanup should be conducted with a vacuum system utilizing a high efficiency particulate air filtration system followed by wet cleaning methods. Special care must be taken when changing filters on HEPA vacuum cleaners when used to clean up potentially toxic materials. Caution should be taken to minimize airborne generation of powder or dust and avoid contamination of air and water. Depending upon the quantity of material released, fine powder or dust spills to the environment may require reporting the National Response Center at (800) 424-8802 as well as the State Emergency Response Commission and Local Emergency Planning Committee.
Waste Disposal Method: Dispose of in accordance with State, Federal and Local regulations.

VIII. SPECIAL PROTECTION INFORMATION

Respiratory Protection: When potential exposures are above the occupational limits, approved respirators must be used. Exposure to unknown concentrations of fumes or dusts requires the wearing of a pressure-demand self-contained breathing apparatus. Pressure-demand airline respirators are recommended for jobs with high potential exposures such as changing bags in a baghouse air cleaning device.
Ventilation: Whenever possible the use of local exhaust ventilation or other engineering controls is the preferred method of controlling exposure to airborne dust and fume to meet established occupational exposure limits. Powders should be stored and transported in tightly sealed containers and must only be handled under controlled ventilated conditions.
Protective Gloves: Wear gloves to prevent metal cuts and skin abrasions particularly during handling.
Eye Protection: Wear safety glasses, goggles, face shield, or welders helmet.
Other Protective Equipment: No protective equipment or clothing is required when handling solid forms. Protective overgarment or work clothing should be worn by persons who may become contaminated with dusts, fumes, or powders.
Work Practices: Vacuum or wet cleaning methods are recommended for dust removal. Be certain to de-energize electrical systems as necessary before beginning wet cleaning. Vacuum cleaners with high efficiency particulate air (HEPA) filters are the recommended type. The use of compressed air to remove dusts should be avoided as such an activity can result in unnecessary short-term elevated exposures to dusts. Contaminated work clothing and overgarment should be managed in such a manner so as to prevent secondary exposure to persons such as laundry operators and to prevent contamination to personal clothing. Never use compressed air to clean work clothing.

IX. SPECIAL PRECAUTIONS

Precautions to Be Taken in Handling and Storage: Keep storage container tightly sealed. Transfer material in closed systems or within a completely hooded containment with local exhaust ventilation. Prevent spillage. Prevent contact with clothing. Flush container clean before discarding. Store in a dry area.
Other Precautions: Particulate may enter the body through cuts, abrasions or other wounds on the surface of the skin. Wear gloves when handling this product.

Work Practices: Implement engineering and work practice controls to reduce and maintain concentration of exposure at low levels. Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating and smoking. Do not blow dust off clothing or skin with compressed air. Maintain eyewash capable of sustained flushing, safety drench shower and facilities for washing.

DOT Regulations:
Rod, Sheet, Foil:

Hazard Class:	None

Powders:

Hazard Class:	6.1
Identification Number:	UN1567
Packing Group:	II
Proper Shipping Name:	Beryllium powder
Label(s) Required:	TOXIC, FLAMMABLE SOLID
Reportable Quantity:	4.54 kg (10 lbs)
Emergency Response:	Emergency response must be provided on the shipping document

SARA Title III: Beryllium is reportable under Section 313

Toxic Substances Control Act: Beryllium (CAS # 7440-41-7) is listed on the TSCA Chemical Substance Inventory of Existing Chemical Substances.
NIOSH RTECS#: DS1750000

The above information is believed to be correct, but does not purport to be all inclusive and shall be used only as a guide. ESPI shall not be held liable for any damage resulting from handling or from contact with the above product.

Issued by: S. Dierks
Date: March 2006

Safety data for cadmium

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: cadmium metal
Molecular formula: Cd
CAS No: 7440-43-9
EC No:

Physical data

Appearance: grey-white solid
Melting point: 321 C
Boiling point: 767 C
Vapour density: 3.9
Vapour pressure:
Specific gravity: 8.64
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility: insoluble

Stability

Stable. Incompatible with strong oxidizing agents, nitrates, nitric acid, selenium, zinc. Flammable. Powdered metal may be pyrophoric.

Toxicology

Many cadmium compounds are believed to be carcinogenic and cadmium metal itself is believed to represent a cancer risk. Highly toxic if inhaled. Irritant. Typical PEL 0.05 mg/m3.

Toxicity data

(The meaning of any abbreviations which appear in this section is given here.)

ORL-RAT LD50 225 mg kg^{-1}

IPR-RAT LD50 4 mg kg^{-1}

SCU-RAT LD50 9 mg kg^{-1}

Risk phrases

(The meaning of any risk phrases which appear in this section is given here.)
R26 R36 R37 R38 R45.

Environmental information

Harmful to aquatic organisms and water treatment plants.

Transport information

Personal protection

Safety glasses, adequate ventilation, gloves. The metal should not be machined, or treated in any way which might lead to the generation of dust unless effective ventilation is provided.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

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Safety data for chromium

Glossary of terms on this data sheet.

General

Synonyms: chromium metal, chrome, alpaste RRA 030
Molecular formula: Cr
CAS No: 7440-47-3
EC No: 231-157-5

Physical data

Appearance: very hard silvery grey metal
Melting point: 1900 C
Boiling point: 2640 C
Vapour density:
Vapour pressure: 1 mm Hg at 1616 C
Specific gravity: 7.14
Flash point:
Explosion limits:
Autoignition temperature:

Stability

Stable. Incompatible with carbonates, strong bases, mineral acids, lithium, sulfur dioxide, strong acids.

Toxicology

In powdered form may act as a human carcinogen. Not expected to pose a risk to health in the massive (lump) form. Typical TLV (dust) 0.5 mg/m3.

Risk phrases

(The meaning of any risk phrases which appear in this section is given here.)
R23 R24 R25 R36 R37 R38 R45 (applies to powdered material only).

Transport information

Non-hazardous for air, sea and road freight.

Personal protection

Avoid exposure to dust.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S26 S28 S36 S37 S39 S45 S53 (applies to powdered material only).

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

This information was last updated on August 11, 2004. We have tried to make it as accurate and useful as possible, but can take no responsibility for its use, misuse, or accuracy. We have not verified this information, and cannot guarantee that it is up-to-date.

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MSDS Number: **C5170** * * * * * *Effective Date:* ***11/21/08*** * * * * * *Supercedes:* ***02/23/06***

MSDS *Material Safety Data Sheet*

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

From: **Mallinckrodt Baker, Inc.**
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS

J.T.Baker

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

COPPER METAL

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1. Product Identification

Synonyms: C.I. 77400; Arwood Copper
CAS No.: 7440-50-8
Molecular Weight: 63.546
Chemical Formula: Cu
Product Codes:
J.T. Baker: 1714, 1720, 1732, 1736
Mallinckrodt: 1733, 4649

---

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Copper	7440-50-8	90 - 100%	Yes

---

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE LIVER AND KIDNEYS. CHRONIC EXPOSURE MAY CAUSE TISSUE DAMAGE.

SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Life)
Flammability Rating: 1 - Slight
Reactivity Rating: 2 - Moderate
Contact Rating: 1 - Slight
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: Green (General Storage)

Potential Health Effects

Inhalation:
Inhalation of dusts and fumes of metallic copper causes irritation of the upper respiratory tract, congestion of nasal mucous membranes, ulceration and perforation of the nasal septum, and pharyngeal congestion. Inhalation of copper fumes may give rise to metal fume fever (high temperature, metallic taste, nausea, coughing, general weakness, muscle aches, and exhaustion).
Ingestion:
Copper ingestion causes nausea, vomiting, abdominal pain, metallic taste, and diarrhea. Ingestion of large doses may cause stomach and intestine ulceration, jaundice, and kidney and liver damage.
Skin Contact:
Causes irritation to skin. Symptoms include redness, itching, and pain. Exposure to copper dust may cause a greenish-black skin discoloration.
Eye Contact:
Small copper particles in the eyes may cause irritation, discoloration, and damage.
Chronic Exposure:
Prolonged or repeated exposure to copper can discolor skin and hair and irritate the skin; may cause mild dermatitis, runny nose, and irritation of the mucous membranes. Repeated ingestion may damage the liver and kidneys. Repeated inhalation can cause chronic respiratory disease.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or impaired liver, kidney, or pulmonary function or pre-existing Wilson's disease may be more susceptible to the effects of this material.

---

4. First Aid Measures

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

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person.

Skin Contact:

Immediately flush skin with plenty of soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

---

5. Fire Fighting Measures

Fire:

Not considered to be a fire hazard since the bulk solid does not burn, but very finely divided particles (ultra-fine powder) may burn in air.

Explosion:

Not considered to be an explosion hazard. Reactions with incompatibles may pose an explosion hazard. Liquid copper explodes on contact with water. High concentrations of finely divided copper particles in the air may present an explosion hazard.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

---

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Sweep up and containerize for reclamation or disposal. Vacuuming or wet sweeping may be used to avoid dust dispersal. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

---

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Avoid exposure to air and moisture. Isolate from incompatible substances. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

---

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
Copper Dust and Mists, as Cu:
- OSHA Permissible Exposure Limit (PEL) -
1 mg/m3 (TWA)
- ACGIH Threshold Limit Value (TLV) -
1 mg/m3 (TWA)
Copper Fume:
- OSHA Permissible Exposure Limit (PEL) -
0.1 mg/m3 (TWA)
- ACGIH Threshold Limit Value (TLV) -
0.2 mg/m3 (TWA)

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece particulate respirator (NIOSH type N100 filters) may be worn for up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids. glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

9. Physical and Chemical Properties

Appearance:
Reddish, metallic solid.

Odor:
Odorless.

Solubility:
Insoluble in water.

Density:
8.94

pH:
No information found.

% Volatiles by volume @ 21C (70F):

0
Boiling Point:
2595C (4703F)
Melting Point:
1083C (1981F)
Vapor Density (Air=1):
Not applicable.
Vapor Pressure (mm Hg):
1 @ 1628C (2962F)
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Copper becomes dull when exposed to air; on exposure to moist air it gradually converts to the carbonate. On long standing, a white, highly explosive peroxide deposit may form.
Hazardous Decomposition Products:
No information found.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Copper is incompatible with oxidizers, alkalis, acetylene, chlorine plus oxygen difluoride, phosphorus, nitric acid, potassium peroxide, 1-bromo-2-propyne, sulfur plus chlorates. Reacts violently with ammonium nitrate, bromates, iodates, chlorates, ethylene oxide, hydrozoic acid, potassium oxide, dimethyl sulfoxide plus trichloroacetic acid, hydrogen peroxide, sodium peroxide, sodium azide, sulfuric acid, hydrogen sulfide plus air, and lead azide. A potentially explosive reaction occurs with actylenic compounds. Copper ignites on contact with chlorine, fluorine (above 121C), chlorine trifluoride, and hydrazinum nitrate (above 70C). An incandescent reaction occurs with potassium dioxide.
Conditions to Avoid:
Incompatibles and prolonged exposure to air and moisture.

11. Toxicological Information

No LD50/LC50 information found relating to normal routes of occupational exposure. Investigated as a tumorigen and a reproductive effector.

--------\Cancer Lists\--

	---NTP Carcinogen---		
Ingredient	Known	Anticipated	IARC Category
Copper (7440-50-8)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste disposal facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Copper (7440-50-8)	Yes	Yes	No	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

		--Canada--		
Ingredient	Korea	DSL	NDSL	Phil.
Copper (7440-50-8)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

	-SARA 302-		------SARA 313------	
Ingredient	RQ	TPQ	List	Chemical Catg.
Copper (7440-50-8)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\----------------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Copper (7440-50-8)	5000	No	No

```
Chemical Weapons Convention:  No     TSCA 12(b):  No     CDTA:  No
SARA 311/312:  Acute: Yes      Chronic: Yes  Fire: No  Pressure: No
Reactivity: No          (Pure / Solid)
```

Australian Hazchem Code: None allocated.
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: **2** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS THE LIVER AND KIDNEYS. CHRONIC EXPOSURE MAY CAUSE TISSUE DAMAGE.
Label Precautions:
Avoid contact with eyes, skin and clothing.
Wash thoroughly after handling.
Avoid breathing dust or vapors.
Keep container closed.
Use only with adequate ventilation.
Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.
Product Use:
Laboratory Reagent.
Revision Information:
No Changes.
Disclaimer:
****

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****

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **I7500** * * * * * *Effective Date:* ***02/15/08*** * * * * * *Supercedes:* ***06/22/05***

MSDS *Material Safety Data Sheet*

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. And Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

IRON

1. Product Identification

Synonyms: Metallic Iron; Elemental Iron.
CAS No.: 7439-89-6
Molecular Weight: 55.85
Chemical Formula: Fe
Product Codes: 2234

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Iron Reduced	7439-89-6	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.

SAF-T-DATA$^{(tm)}$ Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate (Life)
Flammability Rating: 1 - Slight
Reactivity Rating: 2 - Moderate
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: Green (General Storage)

Potential Health Effects

Inhalation:
May cause irritation to the respiratory tract. Symptoms may include coughing and shortness of breath.
Ingestion:
Extremely large oral dosages may produce gastrointestinal disturbances. An overdose of iron may cause vomiting, abdominal pain, bloody diarrhea, vomiting blood, lethargy, and shock. In severe cases, toxicity may progress and develop into an increase in acidity in the blood, bluish skin discoloration, fever, liver damage, and possibly death.
Skin Contact:
No adverse effects expected.
Eye Contact:
May cause irritation, redness and pain. Eye contact may cause conjunctivitis and deposition of iron particles can leave a "rust ring" or brownish stain on the cornea.
Chronic Exposure:
Long-term inhalation exposure to iron has resulted in mottling of the lungs, a condition referred to as siderosis. This is considered a benign pneumoconiosis and does not ordinarily cause significant physiological impairment. Ingestion of greater than 50 to 100 mg of iron per day may result in pathological iron deposition in body tissues. Repeated iron ingestion can produce cardiac toxicity.
Aggravation of Pre-existing Conditions:
Persons with impaired respiratory function may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. Get medical attention for any breathing difficulty.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.
Skin Contact:
Wash exposed area with soap and water. Get medical advice if irritation develops.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get medical attention if irritation persists.

5. Fire Fighting Measures

Fire:
Moderate fire hazard in form of dust when exposed to heat or flame. Can react with water to liberate flammable hydrogen gas. Minimum ignition temperature, iron dust cloud: 430C (805F). Ultrafine iron powder (ca. 5 microns) is pyrophoric and can ignite spontaneously in air.
Explosion:
Moderate explosion hazard in the form of a dust when exposed to heat or flame.
Fire Extinguishing Media:
Use powdered graphite, powdered salt, or powdered limestone. DO NOT use water, carbon dioxide, or dry chemical.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Pick up and place in a suitable container for reclamation or disposal, using a method that does not generate dust.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Avoid dust formation and control ignition sources. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- OSHA Permissible Exposure Limit (PEL) -
Iron oxide fume: 10 mg/m3
- ACGIH Threshold Limit Value (TLV) -
Iron oxide dust and fume (Fe_2O_3) as Fe: 5 mg/m3 (TWA); inhalable particulate: A4 - Not classifiable as a human carcinogen.
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece particulate respirator (NIOSH type N100 filters) may be worn for up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids. glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear protective gloves and clean body-covering clothing.
Eye Protection:
Maintain eye wash fountain and quick-drench facilities in work area. Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible.

9. Physical and Chemical Properties

Appearance:
Gray crystalline chips.
Odor:
No information found.
Solubility:
Insoluble, can react with water.
Specific Gravity:
7.86 @ 20C (68F)
pH:
No information found.
% Volatiles by volume @ 21C (70F):
0
Boiling Point:

2750C (4982F)
Melting Point:
1535C (2795F)
Vapor Density (Air=1):
Not applicable.
Vapor Pressure (mm Hg):
1 @ 1787C (3249F)
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable in dry air but readily oxidizes in moist air forming rust. Ultrafine (ca. 5 microns) powder forms are very unstable and can ignite spontaneously in air.
Hazardous Decomposition Products:
May produce toxic iron oxide fumes when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong oxidizers, water (including humid atmospheres), acids, hydrogen peroxide, nitrogen dioxide. Solid or powdered iron ignites or explodes on contact with acetaldehyde, ammonium peroxodisulfate, chloroformamidinium, chloric acid, ammonium nitrate, halogens, dinitrogen tetraoxide, nitryl fluoride, polystyrene, sodium acetylide, potassium dichromate, peroxyformic acid, and nitryl fluoride. Hot iron wire burns in chlorine gas. Chlorine trifluoride reacts with iron with incandescence.
Conditions to Avoid:
Heat, flame, ignition sources, dusting and incompatibles.

11. Toxicological Information

Oral rat LD50: 30 gm/kg; investigated as a tumorigen.

--------\Cancer Lists\--

	---NTP Carcinogen---		
Ingredient	Known	Anticipated	IARC Category
Iron Reduced (7439-89-6)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Iron Reduced (7439-89-6)	Yes	Yes	No	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

		--Canada--		
Ingredient	Korea	DSL	NDSL	Phil.
Iron Reduced (7439-89-6)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

	-SARA 302-		------SARA 313------	
Ingredient	RQ	TPQ	List	Chemical Catg.
Iron Reduced (7439-89-6)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Iron Reduced (7439-89-6)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Solid)

Australian Hazchem Code: None allocated.
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **1** Reactivity: **1**
Label Hazard Warning:
CAUTION! MAY BE HARMFUL IF SWALLOWED OR INHALED. MAY CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT.
Label Precautions:
Avoid contact with eyes, skin and clothing.
Wash thoroughly after handling.
Avoid breathing dust.
Keep container closed.
Use with adequate ventilation.
Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. Get medical attention for any breathing difficulty. In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation develops or persists.
Product Use:
Laboratory Reagent.
Revision Information:
No Changes.
Disclaimer:
****
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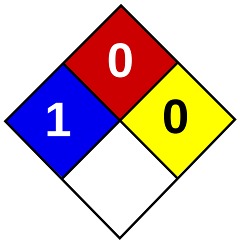
Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

ScienceLab.com
Chemicals & Laboratory Equipment



Health	1
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Lead MSDS

Section 1: Chemical Product and Company Identification

Product Name: Lead

Catalog Codes: SLL1291, SLL1669, SLL1081, SLL1459, SLL1834

CAS#: 7439-92-1

RTECS: OF7525000

TSCA: TSCA 8(b) inventory: Lead

CI#: Not available.

Synonym: Lead Metal, granular; Lead Metal, foil; Lead Metal, sheet; Lead Metal, shot

Chemical Name: Lead

Chemical Formula: Pb

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Lead	7439-92-1	100

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

Section 3: Hazards Identification

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

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (permeator). CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, kidneys, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

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

Serious Inhalation: Not available.

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

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

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

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

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

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

Special Remarks on Fire Hazards: When heated to decomposition it emits highly toxic fumes of lead.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

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

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

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable

protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

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

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 0.05 (mg/m3) from ACGIH (TLV) [United States] TWA: 0.05 (mg/m3) from OSHA (PEL) [United States] TWA: 0.03 (mg/m3) from NIOSH [United States] TWA: 0.05 (mg/m3) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

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

Odor: Not available.

Taste: Not available.

Molecular Weight: 207.21 g/mole

Color: Bluish-white. Silvery. Gray

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

Boiling Point: 1740°C (3164°F)

Melting Point: 327.43°C (621.4°F)

Critical Temperature: Not available.

Specific Gravity: 11.3 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, excess heat

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Can react vigorously with oxidizing materials. Incompatible with sodium carbide, chlorine trifluoride, trioxane + hydrogen peroxide, ammonium nitrate, sodium azide, disodium acetylide, sodium acetylide, hot concentrated nitric acid, hot concentrated hydrochloric acid, hot concentrated sulfuric acid, zirconium.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation. Ingestion.

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

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. May cause damage to the following organs: blood, kidneys, central nervous system (CNS).

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

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:
Acute Potential: Skin: Lead metal granules or dust: May cause skin irritation by mechanical action. Lead metal foil, shot or sheets: Not likely to cause skin irritation Eyes: Lead metal granules or dust: Can irritate eyes by mechanical action. Lead metal foil, shot or sheets: No hazard. Will not cause eye irritation. Inhalation: In an industrial setting, exposure to lead mainly occurs from inhalation of dust or fumes. Lead dust or fumes: Can irritate the upper respiratory tract (nose, throat) as well as the bronchi and lungsby mechanical action. Lead dust can be absorbed through the respiratory system. However, inhaled lead does not accumulate in the lungs. All of an inhaled dose is eventually abssorbed or transferred to the gastrointestinal tract. Inhalation effects of exposure to fumes or dust of inorganic lead may not develop quickly. Symptoms may include metallic taste, chest pain, decreased physical fitness, fatigue, sleep disturbance, headache, irritability, reduces memory, mood and personality changes, aching bones and muscles, constipation, abdominal pains, decreasing appetite. Inhalation of large amounts may lead to ataxia, deliriuim, convulsions/seizures, coma, and death. Lead metal foil, shot, or sheets: Not an inhalation hazard unless metal is heated. If metal is heated, fumes will be released. Inhalation of these fumes may cause "fume metal fever", which is characterized by flu-like symptoms. Symptoms may include metallic taste, fever, nausea, vomiting, chills, cough, weakness, chest pain, generalized muscle pain/aches, and increased white blood cell count. Ingestion: Lead metal granules or dust: The symptoms of lead poisoning include abdominal pain or cramps (lead cholic), spasms, nausea, vomiting, headache, muscle weakness, hallucinations, distorted perceptions, "lead line" on the gums, metallic taste, loss of appetite, insomnia, dizziness and other symptoms similar to that of inhalation. Acute poisoning may result in high lead levels in the blood and urine, shock, coma and death in extreme cases. Lead metal foil, shot or sheets: Not an ingestion hazard for usual industrial handling.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

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

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

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

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

Section 14: Transport Information

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

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (female) which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (male) which would require a warning under the statute: Lead California prop. 65 (no significant risk level): Lead: 0.0005 mg/day (value) California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Lead Connecticut hazardous material survey.: Lead Illinois toxic substances disclosure to employee act: Lead Illinois chemical safety act: Lead New York release reporting list: Lead Rhode Island RTK hazardous substances: Lead Pennsylvania RTK: Lead

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

Other Classifications:

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

DSCL (EEC):
R20/22- Harmful by inhalation and if swallowed. R33- Danger of cumulative effects. R61- May cause harm to the unborn child. R62- Possible risk of impaired fertility. S36/37- Wear suitable protective clothing and gloves. S44- If you feel unwell, seek medical advice (show the label when possible). S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

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

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:21 PM

Last Updated: 11/01/2010 12:00 PM

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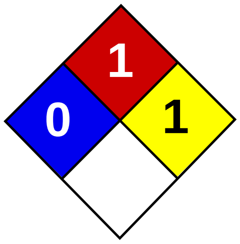

Health	1
Fire	3
Reactivity	2
Personal Protection	E

Material Safety Data Sheet

Magnesium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Magnesium

Catalog Codes: SLM4408, SLM2263, SLM3637

CAS#: 7439-95-4

RTECS: OM2100000

TSCA: TSCA 8(b) inventory: Magnesium

CI#: Not applicable.

Synonym: Magnesium ribbons, turnings or sticks

Chemical Name: Magnesium

Chemical Formula: Mg

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Magnesium	7439-95-4	100

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

Section 3: Hazards Identification

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

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

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

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

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances:
Highly flammable in presence of open flames and sparks, of heat. Flammable in presence of acids, of moisture. Non-flammable in presence of shocks.

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

Fire Fighting Media and Instructions:
Flammable solid. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:
Magnesium turnings, chips or granules, ribbons, are flammable. They can be easily ignited. They may reignite after fire is extinguished. Produces flammable gases on contact with water and acid. May ignite on contact with water or moist air. Magnesium fires do not flare up violently unless moisture is present.

Special Remarks on Explosion Hazards: Reacts with acids and water to form hydrogen gas 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

Material Safety Data Sheet

Mercury, 99.999%

ACC# 96252

Section 1 - Chemical Product and Company Identification

MSDS Name: Mercury, 99.999%
Catalog Numbers: AC193480000, AC193480500
Synonyms: Colloidal mercury; Hydrargyrum; Metallic mercury; Quick silver; Liquid silver
Company Identification:

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

-

CAS#	Chemical Name	Percent	EINECS/ELINCS
7439-97-6	Mercury	99.999	231-106-7

-

Section 3 - Hazards Identification

-

EMERGENCY OVERVIEW

- Appearance: silver liquid.

Danger! Corrosive. Harmful if inhaled. May be absorbed through intact skin. Causes eye and skin irritation and possible burns. May cause severe respiratory tract irritation with possible burns. May cause severe digestive tract irritation with possible burns. May cause liver and kidney damage. May cause central nervous system effects. This substance has caused adverse reproductive and fetal effects in animals. Inhalation of fumes may cause metal-fume fever. Possible sensitizer.
Target Organs: Blood, kidneys, central nervous system, liver, brain.

Potential Health Effects

Eye: Exposure to mercury or mercury compounds can cause discoloration on the front surface of the lens, which does not interfere with vision. Causes eye irritation and possible burns. Contact with mercury or mercury compounds can cause ulceration of the conjunctiva and cornea.
Skin: May be absorbed through the skin in harmful amounts. May cause skin sensitization, an allergic reaction, which becomes evident upon re-exposure to this material. Causes skin

irritation and possible burns. May cause skin rash (in milder cases), and cold and clammy skin with cyanosis or pale color.
Ingestion: May cause severe and permanent damage to the digestive tract. May cause perforation of the digestive tract. May cause effects similar to those for inhalation exposure. May cause systemic effects.
Inhalation: Causes chemical burns to the respiratory tract. Inhalation of fumes may cause metal fume fever, which is characterized by flu-like symptoms with metallic taste, fever, chills, cough, weakness, chest pain, muscle pain and increased white blood cell count. May cause central nervous system effects including vertigo, anxiety, depression, muscle incoordination, and emotional instability. Aspiration may lead to pulmonary edema. May cause systemic effects. May cause respiratory sensitization.
Chronic: May cause liver and kidney damage. May cause reproductive and fetal effects. Effects may be delayed. Chronic exposure to mercury may cause permanent central nervous system damage, fatigue, weight loss, tremors, personality changes. Chronic ingestion may cause accumulation of mercury in body tissues. Prolonged or repeated exposure may cause inflammation of the mouth and gums, excessive salivation, and loosening of the teeth.

Section 4 - First Aid Measures

-

Eyes: Get medical aid immediately. Do NOT allow victim to rub eyes or keep eyes closed. Extensive irrigation with water is required (at least 30 minutes).
Skin: Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Destroy contaminated shoes.
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. Wash mouth out with water.
Inhalation: Get medical aid immediately. Remove from exposure and move to fresh air immediately. If breathing is difficult, give oxygen. Do NOT use mouth-to-mouth resuscitation. If breathing has ceased apply artificial respiration using oxygen and a suitable mechanical device such as a bag and a mask.
Notes to Physician: The concentration of mercury in whole blood is a reasonable measure of the body-burden of mercury and thus is used for monitoring purposes. Treat symptomatically and supportively. Persons with kidney disease, chronic respiratory disease, liver disease, or skin disease may be at increased risk from exposure to this substance.
Antidote: The use of d-Penicillamine as a chelating agent should be determined by qualified medical personnel. The use of Dimercaprol or BAL (British Anti-Lewisite) as a chelating agent should be determined by qualified medical personnel.

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. Water runoff can cause environmental damage. Dike and collect water used to fight fire. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or

combustion.
Extinguishing Media: Substance is nonflammable; use agent most appropriate to extinguish surrounding fire. Use water spray, dry chemical, carbon dioxide, or appropriate foam.
Flash Point: Not applicable.
Autoignition Temperature: Not applicable.
Explosion Limits, Lower: Not available.
Upper: Not available.
NFPA Rating: (estimated) Health: 3; Flammability: 0; Instability: 0

Section 6 - Accidental Release Measures

▪

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Provide ventilation.

Section 7 - Handling and Storage

▪

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Minimize dust generation and accumulation. Keep container tightly closed. Do not get on skin or in eyes. Do not ingest or inhale. Use only in a chemical fume hood. Discard contaminated shoes. Do not breathe vapor.
Storage: Keep container closed when not in use. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. Keep away from metals. Store protected from azides.

Section 8 - Exposure Controls, Personal Protection

▪

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use only under a chemical fume hood.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Mercury	0.025 mg/m3 TWA; Skin - potential significant contribution to overall exposure by the cutaneous r oute	0.05 mg/m3 TWA (vapor) 10 mg/m3 IDLH	0.1 mg/m3 Ceiling

▪

OSHA Vacated PELs: Mercury: 0.05 mg/m3 TWA (vapor)
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: Liquid
Appearance: silver
Odor: odorless
pH: Not available.
Vapor Pressure: 0.002 mm Hg @ 25C
Vapor Density: 7.0
Evaporation Rate: Not available.
Viscosity: 15.5 mP @ 25 deg C
Boiling Point: 356.72 deg C
Freezing/Melting Point:-38.87 deg C
Decomposition Temperature: Not available.
Solubility: Insoluble.
Specific Gravity/Density:13.59 (water=1)
Molecular Formula: Hg
Molecular Weight:200.59

Section 10 - Stability and Reactivity

▪

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: High temperatures, incompatible materials.
Incompatibilities with Other Materials: Metals, aluminum, ammonia, chlorates, copper, copper alloys, ethylene oxide, halogens, iron, nitrates, sulfur, sulfuric acid, oxygen, acetylene, lithium, rubidium, sodium carbide, lead, nitromethane, peroxyformic acid, calcium, chlorine dioxide, metal oxides, azides, 3-bromopropyne, alkynes + silver perchlorate, methylsilane + oxygen, tetracarbonylnickel + oxygen, boron diiodophosphide.
Hazardous Decomposition Products: Mercury/mercury oxides.
Hazardous Polymerization: Will not occur.

Section 11 - Toxicological Information

▪

RTECS#:
CAS# 7439-97-6: OV4550000
LD50/LC50:
Not available.

Carcinogenicity:
CAS# 7439-97-6: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: Intraperitoneal, rat: TDLo = 400 mg/kg/14D-I (Tumorigenic - equivocal tumorigenic agent by RTECS criteria - tumors at site of application).
Teratogenicity: Inhalation, rat: TCLo = 1 mg/m3/24H (female 1-20 day(s) after conception) Effects on Embryo or Fetus - fetotoxicity (except death, e.g., stunted fetus).
Reproductive Effects: Inhalation, rat: TCLo = 890 ng/m3/24H (male 16 week(s) pre-mating) Paternal Effects - spermatogenesis (incl. genetic material, sperm morphology, motility, and count).; Inhalation, rat: TCLo = 7440 ng/m3/24H (male 16 week(s) pre-mating) Fertility - post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants).
Mutagenicity: Cytogenetic Analysis: Unreported, man = 150 ug/m3.
Neurotoxicity: The brain is the critical organ in humans for chronic vapor exposure; in severe cases, spontaneous degeneration of the brain cortex can occur as a late sequela to past exposure.
Other Studies:

Section 12 - Ecological Information

▪

Ecotoxicity: Fish: Rainbow trout: LC50 = 0.16-0.90 mg/L; 96 Hr; UnspecifiedFish: Bluegill/Sunfish: LC50 = 0.16-0.90 mg/L; 96 Hr; UnspecifiedFish: Channel catfish: LC50 = 0.35 mg/L; 96 Hr; UnspecifiedWater flea Daphnia: EC50 = 0.01 mg/L; 48 Hr; Unspecified In aquatic systems, mercury appears to bind to dissolved matter or fine particulates, while the transport of mercury bound to dust particles in the atmosphere or bed sediment particles in rivers and lakes is generally less substantial. The conversion, in aquatic environments, of inorganic mercury cmpd to methyl mercury implies that recycling of mercury from sediment to water to air and back could be a rapid process.
Environmental: Mercury bioaccumulates and concentrates in food chain (concentration may be as much as 10,000 times that of water). Bioconcentration factors of 63,000 for freshwater fish and 10,000 for salt water fish have been found. Much of the mercury deposited on land, appears to revaporize within a day or two, at least in areas substantially heated by sunlight.
Physical: All forms of mercury (Hg) (metal, vapor, inorganic, or organic) are converted to methyl mercury. Inorganic forms are converted by microbial action in the atmosphere to methyl mercury.
Other: No information available.

Section 13 - Disposal Considerations

▪

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 7439-97-6: waste number U151.

Section 14 - Transport Information

▪

	US DOT	Canada TDG
Shipping Name:	DOT regulated - small quantity provisions apply (see 49CFR173.4)	MERCURY
Hazard Class:		8
UN Number:		UN2809
Packing Group:		III

▪

Section 15 - Regulatory Information

▪

US FEDERAL

TSCA
CAS# 7439-97-6 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
CAS# 7439-97-6: Section 5
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 7439-97-6: 1 lb final RQ; 0.454 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 7439-97-6: immediate, delayed.
Section 313
This material contains Mercury (CAS# 7439-97-6, 99.999%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:

CAS# 7439-97-6 (listed as Mercury compounds) is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 7439-97-6 is listed as a Priority Pollutant under the Clean Water Act. CAS# 7439-97-6 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 7439-97-6 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

WARNING: This product contains Mercury, a chemical known to the state of California to cause developmental reproductive toxicity.

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

T

Risk Phrases:

R 23 Toxic by inhalation.

R 33 Danger of cumulative effects.

Safety Phrases:

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 7 Keep container tightly closed.

WGK (Water Danger/Protection)

CAS# 7439-97-6: 3

Canada - DSL/NDSL

CAS# 7439-97-6 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2A, E.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

CAS# 7439-97-6 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

▪

MSDS Creation Date: 6/15/1999

Revision #5 Date: 3/16/2007

The information above is believed to be accurate and represents the best information currently available to us. However,

Safety data for Nickel

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: alcan 756, carbonyl nickel powder, C.I. 77775, EL12, fibrex, fibrex P, NI 270, nickel 2170, nickel sponge, nickel catalyst, NI 0901-s, NI 4303T, NP2, Raney alloy, Raney nickel
Molecular formula: Ni
CAS No: 7440-02-0
EC No: 231-111-4
EC Index No: 028-002-00-7

Physical data

Appearance: silver white, hard, malleable metal chunks or grey powder
Melting point: 1453 C
Boiling point: 2732 C
Vapour density:
Vapour pressure:
Specific gravity: 8.9
Flash point:
Explosion limits:
Autoignition temperature:

Stability

Stable in massive form. Powder is pyrophoric - can ignite spontaneously. May react violently with titanium, ammonium nitrate, potassium perchlorate, hydrazoic acid. Incompatible with acids, oxidizing agents, sulfur.

Toxicology

Carcinogen. Toxic by all routes of entry. May cause sensitization by skin contact. Typical TLV 0.05 mg/m3

Toxicity data

(The meaning of any toxicological abbreviations which appear in this section is given here.)
IPR-RAT LD50 250 mg kg^{-1}

Risk phrases

(The meaning of any risk phrases which appear in this section is given here.)
R10 R17 R36 R37 R38 R40 R42 R43.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
UN No 3089. Packing group II. Hazard class 4.1.

Personal protection

Good ventilation. Wear gloves and safety glasses when handling the powder.

Safety phrases

(The meaning of any safety phrases which appear in this section is given here.)
S16 S22 S26 S36.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

NEW JERSEY
DEPARTMENT
of
HEALTH
and
SENIOR SERVICES

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **SELENIUM**

CAS Number: 7782-49-2
DOT Number: UN 2658

RTK Substance number: 1648
Date: January 1987 Revision: September 2002

HAZARD SUMMARY

- **Selenium** can affect you when breathed in.
- Contact can irritate and burn the skin and eyes. High or repeated exposure can cause a skin rash (dermatitis).
- Breathing **Selenium** can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.
- **Selenium** can cause nausea, vomiting, diarrhea, abdominal pain, and headache.
- Repeated exposure can cause a garlic odor on the breath, metallic taste, irritability, fatigue, increased dental cavities, loss of nails and hair, and mood change (depression).

IDENTIFICATION

Selenium is a black, gray or red odorless solid. It is used in the manufacture of electrodes and as a pigment for ruby glass, paints and dyes.

REASON FOR CITATION

- **Selenium** is on the Hazardous Substance List because it is regulated by OSHA and cited by ACGIH, DOT, NIOSH, DEP, HHAG and EPA.
- Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

- Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.1020.
- If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

OSHA:	The legal airborne permissible exposure limit (PEL) is **0.2 mg/m^3** averaged over an 8-hour workshift.
NIOSH:	The recommended airborne exposure limit is **0.2 mg/m^3** averaged over a 10-hour workshift.
ACGIH:	The recommended airborne exposure limit is **0.2 mg/m^3** averaged over an 8-hour workshift.

WAYS OF REDUCING EXPOSURE

- Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
- Wear protective work clothing.
- Wash thoroughly immediately after exposure to **Selenium** and at the end of the workshift.
- Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Selenium** to potentially exposed workers.

This Fact Sheet is a summary source of information of all potential and most severe 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 **Selenium**:

- Contact can irritate and burn the skin and eyes.
- Breathing **Selenium** can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.
- **Selenium** can cause nausea, vomiting, diarrhea, abdominal pain, and headache.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Selenium** and can last for months or years:

Cancer Hazard

- According to the information presently available to the New Jersey Department of Health and Senior Services, **Selenium** has not been tested for its ability to cause cancer in animals.

Reproductive Hazard

- There is limited evidence that **Selenium** may decrease fertility in females.

Other Long-Term Effects

- High or repeated exposure can cause a skin rash (dermatitis).
- Repeated exposure can cause a garlic odor on the breath, metallic taste, irritability, fatigue, increased dental cavities, loss of nails and hair, and mood change (depression).

MEDICAL

Medical Testing

Before beginning employment and at regular times after that, for those with frequent or potentially high exposures, the following is recommended:

- Urine test for **Selenium** (normal is less than **100 micrograms per liter** of urine).

If symptoms develop or overexposure is suspected, the following are recommended:

- Lung function tests.

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 OSHA 1910.1020.

Mixed Exposures

- Because smoking can cause heart disease, as well as lung cancer, emphysema, and other respiratory problems, it may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following control is recommended:

- Where possible, automatically transfer **Selenium** from drums or other storage containers to process containers.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

- Workers whose clothing has been contaminated by **Selenium** should change into clean clothing promptly.
- Do not take contaminated work clothes home. Family members could be exposed.
- Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Selenium**.
- Eye wash fountains should be provided in the immediate work area for emergency use.
- If there is the possibility of skin exposure, emergency shower facilities should be provided.
- On skin contact with **Selenium**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Selenium**, whether or not known skin contact has occurred.

- Do not eat, smoke, or drink where **Selenium** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, smoking, or using the toilet.
- Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 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.

Clothing

- Avoid skin contact with **Selenium.** Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear impact resistant eye protection with side shields or goggles.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.
- Contact lenses should not be worn when working with this substance.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

- NIOSH has established new testing and certification requirements for negative pressure, air purifying, particulate filter and filtering facepiece respirators. The filter classifications of dust/mist/fume, paint spray or pesticide prefilters, and filters for radon daughters, have been replaced with the N, R, and P series. Each series has three levels of filtering efficiency: 95%, 99%, and 99.9%. Check with your safety equipment supplier or your respirator manufacturer to determine which respirator is appropriate for your facility.
- If while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Selenium,** or if while wearing particulate filters abnormal resistance to breathing is experienced, or eye irritation occurs while wearing a full facepiece respirator, leave the area immediately. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Be sure to consider all potential exposures in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential for high exposure exists, 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 **1 mg/m^3** is immediately dangerous to life and health. If the possibility of exposure above **1 mg/m^3** exists, use a MSHA/NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?

A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?

A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?

A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?

A: Conditions which increase risk of exposure include <u>dust releasing operations</u> (grinding, mixing, blasting, dumping, etc.), <u>other physical and mechanical processes</u> (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and <u>"confined space" exposures</u> (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?

A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

Q: Can men as well as women be affected by chemicals that cause reproductive system damage?

A: Yes. Some chemicals reduce potency or fertility in both men and women. Some damage sperm and eggs, possibly leading to birth defects.

Q: Who is at the greatest risk from reproductive hazards?

A: Pregnant women are at greatest risk from chemicals that harm the developing fetus. However, chemicals may affect the ability to have children, so both men and women of childbearing age are at high risk.

The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863
(609) 984-7407 (fax)

Web address: http://www.state.nj.us/health/eoh/odisweb/

Industrial Hygiene Information

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

Medical Evaluation

If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

Public Presentations

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

Right to Know Information Resources

The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know Survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is assigned by the Chemical Abstracts Service to identify a specific chemical.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or 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.

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.

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

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.

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

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 Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEL is the Permissible Exposure Limit which is enforceable by the Occupational Safety and Health Administration.

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.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

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.

>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<

Common Name: **SELENIUM**
DOT Number: **UN 2658**
NAERG Code: **152**
CAS Number: **7782-49-2**

Hazard rating	NJDHSS	NFPA
FLAMMABILITY	Not Found	Not Rated
REACTIVITY	Not Found	Not Rated
DOES NOT BURN POISONOUS GASES ARE PRODUCED IN FIRE CONTAINERS MAY EXPLODE IN FIRE		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

FIRE HAZARDS

- Extinguish fire using an agent suitable for type of surrounding fire. **Selenium** itself DOES NOT BURN.
- POISONOUS GASES ARE PRODUCED IN FIRE, including **Selenium** *fumes.*
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to keep fire-exposed containers cool.
- If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

SPILLS AND EMERGENCIES

If **Selenium** is spilled, take the following steps:

- Evacuate persons not wearing protective equipment from area of spill until clean-up is complete.
- Collect powdered material in the most convenient and safe manner and deposit in sealed containers.
- Ventilate and wash area after clean-up is complete.
- It may be necessary to contain and dispose of **Selenium** 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.
- If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: 1-877-WARN-DEP

HANDLING AND STORAGE

- Prior to working with **Selenium** you should be trained on its proper handling and storage.
- **Selenium** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); CHROMIUM TRIOXIDE; and CADMIUM.
- Store in tightly closed containers in a cool, well-ventilated area away from WATER.

FIRST AID

For POISON INFORMATION call 1-800-222-1222

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

Skin Contact

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Breathing

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

PHYSICAL DATA

Vapor Pressure: 0.001 mm Hg at 68°F (20°C)
Water Solubility: Insoluble

OTHER COMMONLY USED NAMES

Chemical Name:

Selenium

Other Names:

Gray Selenium; Selenium Homopolymer

Not intended to be copied and sold for commercial purposes.

NEW JERSEY DEPARTMENT OF HEALTH AND
SENIOR SERVICES
Right to Know Program
PO Box 368, Trenton, NJ 08625-0368
(609) 984-2202

NEW JERSEY
DEPARTMENT
of
HEALTH
and
SENIOR SERVICES

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **ZINC**

CAS Number: 7440-66-6
DOT Number: UN 1436
DOT Hazard Class: 4.3 (Water Reactive/ Dangerous When Wet)

RTK Substance number: 2021
Date: February 1989 Revision: October 2005

HAZARD SUMMARY

- **Zinc** can affect you when breathed in.
- **Zinc** *fragments* or *dust particles* can irritate and scratch the eyes.
- Exposure to **Zinc** can cause *"metal fume fever."* This is a flu-like illness with symptoms of metallic taste in the mouth, headache, fever and chills, aches, chest tightness and cough. The symptoms may be delayed for several hours after exposure and usually last for a day or two.
- **Zinc** *fume* may be released when welding galvanized metal.
- **Zinc** *dust* and *powder* are FLAMMABLE and DANGEROUS FIRE HAZARD.

IDENTIFICATION

Solid **Zinc** is a soft white metal with a bluish tinge. It is used as a coating on iron and steel, and in making brass metal alloys. **Zinc** *powder* is grayish in color and is used in making paint and dyestuffs.

REASON FOR CITATION

- **Zinc** is on the Hazardous Substance List because it is cited by DOT, DEP and EPA.
- This chemical is on the Special Health Hazard Substance List because the *dust* and *powder* are **FLAMMABLE**.
- Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

- Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.1020.
- If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

No occupational exposure limits have been established for **Zinc**. This does not mean that this substance is not harmful. Safe work practices should always be followed.

- **Zinc** may form metal fumes which present different hazards than the substance itself.

WAYS OF REDUCING EXPOSURE

- Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
- Wear protective work clothing.
- Wash thoroughly at the end of the workshift.
- Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Zinc** to potentially exposed workers.

This Fact Sheet is a summary source of information of all potential and most severe 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.

Metal, metal compounds and alloys are often used in "hot" operations in the workplace. These may include, but are not limited to, welding, brazing, soldering, plating, cutting, and metallizing. At the high temperatures reached in these operations, metals often form metal fumes which have different health effects and exposure standards than the original metal or metal compound and require specialized controls. Your workplace can be evaluated for the presence of particular fumes which may be generated. Consult the appropriate New Jersey Department of Health and Senior Services Hazardous Substance Fact Sheets.

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Zinc**:

* **Zinc** *fragments* or *dust particles* can irritate and scratch the eyes.
* Exposure to **Zinc** can cause *"metal fume fever."* This is a flu-like illness with symptoms of metallic taste in the mouth, headache, fever and chills, aches, chest tightness and cough. The symptoms may be delayed for several hours after exposure and usually last for a day or two.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Zinc** and can last for months or years:

Cancer Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **Zinc** has not been tested for its ability to cause cancer in animals.

Reproductive Hazard

* **Zinc** appears to affect the male reproductive system (including sperm count). Further testing is required to assess its potential to cause reproductive harm.

Other Long-Term Effects

* **Zinc** has not been tested for other chronic (long-term) health effects.

MEDICAL

Medical Testing

There is no special test for this chemical. However, if illness occurs or overexposure is suspected, medical attention is recommended.

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 OSHA 1910.1020.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following controls are recommended:

* Where possible, automatically transfer **Zinc** *powder* from drums or other storage containers to process containers.
* Before entering a confined space where **Zinc** *dust* or *powder* may be present, check to make sure that an explosive concentration does not exist.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by **Zinc** *dust* or *powder* should change into clean clothing promptly.
* Do not take contaminated work clothes home. Family members could be exposed.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Zinc** *dust* or *powder*.
* Eye wash fountains should be provided in the immediate work area for emergency use.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* Wash any areas of the body that may have contacted **Zinc** *dust* or *powder* at the end of each workday, whether or not known skin contact has occurred.
* For **Zinc** *dust* or *powder* use a vacuum to reduce dust during clean-up.
* Do not eat, smoke, or drink where **Zinc** *dust* or *powder* is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, smoking, or using the toilet.
* Maintain all surfaces as free as possible from accumulations of **Zinc** *dust* or *powder*.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 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.

Clothing

* Avoid skin contact with **Zinc** *dust* and *powder*. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

* Wear eye protection with side shields or goggles.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

* For processes where **Zinc** is heated, refer to the respiratory protection recommendations on the *NJDHSS HAZARDOUS SUBSTANCE FACT SHEET ON ZINC OXIDE.*
* NIOSH has established new testing and certification requirements for negative pressure, air purifying, particulate filter and filtering facepiece respirators. The filter classifications of dust/mist/fume, paint spray or pesticide prefilters, and filters for radon daughters, have been replaced with the N, R, and P series. Each series has three levels of filtering efficiency: 95%, 99%, and 99.9%. Check with your safety equipment supplier or your respirator manufacturer to determine which respirator is appropriate for your facility.
* If while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Zinc**, or if while wearing particulate filters abnormal resistance to breathing is experienced, or eye irritation occurs while wearing a full facepiece respirator, leave the area immediately. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
* Be sure to consider all potential exposures in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
* Where the potential for high exposure exists, use a MSHA/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.

HANDLING AND STORAGE

* Prior to working with **Zinc** you should be trained on its proper handling and storage.
* **Zinc** *dust* and *powder* react with WATER and MOIST AIR to produce *flammable Hydrogen gas* and HEAT. The HEAT may ignite the *Hydrogen gas.*
* **Zinc** *dust* and *powder* in contact with STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC) and STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE) may cause fires and explosions.
* **Zinc** *dust* and *powder* must be stored to avoid contact with SULFUR; METALS (such as POTASSIUM, and SODIUM, MAGNESIUM); AMMONIUM NITRATE; CARBON DISULFIDE; OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); METAL SALTS; HALOGENS; AMINES; CHLORINATED HYDROCARBONS; and METAL OXIDES since violent reactions occur.
* Store in tightly closed containers in a cool, well-ventilated area away from COMBUSTIBLES.
* Sources of ignition, such as smoking and open flames, are prohibited where **Zinc** *dust* or *powder* is used, handled, or stored.
* Metal containers involving the transfer of **Zinc** *dust* or *powder* should be grounded and bonded.
* Use only non-sparking tools and equipment, especially when opening and closing containers of **Zinc** *dust* or *powder*.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?

A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?

A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?

A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?

A: Conditions which increase risk of exposure include dust releasing operations (grinding, mixing, blasting, dumping, etc.), other physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?

A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

Q: Can men as well as women be affected by chemicals that cause reproductive system damage?

A: Yes. Some chemicals reduce potency or fertility in both men and women. Some damage sperm and eggs, possibly leading to birth defects.

Q: Who is at the greatest risk from reproductive hazards?

A: Pregnant women are at greatest risk from chemicals that harm the developing fetus. However, chemicals may affect the ability to have children, so both men and women of childbearing age are at high risk.

The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863
(609) 984-7407 (fax)

Web address: http://www.state.nj.us/health/eoh/odisweb/

Industrial Hygiene Information

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

Medical Evaluation

If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

Public Presentations

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

Right to Know Information Resources

The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know Survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is assigned by the Chemical Abstracts Service to identify a specific chemical.

CFR is the Code of Federal Regulations, which consists of 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 irreversible damage to human tissue or 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.

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 that classifies chemicals according to their cancer-causing potential.

IRIS is the Integrated Risk Information System database of the federal EPA.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

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.

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

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 Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEL is the Permissible Exposure Limit which is enforceable by the Occupational Safety and Health Administration.

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.

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

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.

>>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<<

Common Name: **ZINC**
DOT Number: **UN 1436**
DOT Hazard Class: **4.3 (Water Reactive/Dangerous When Wet)**
NAERG Code: **136**
CAS Number: **7440-66-6**

Hazard rating	NJDHSS	NFPA
FLAMMABILITY	3	-
REACTIVITY	1	-
FLAMMABLE DUST AND POWDER DO NOT USE WATER, FOAM, HALON OR CO_2 POISONOUS GASES ARE PRODUCED IN FIRE		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

FIRE HAZARDS

- **Zinc** *dust* and *powder* are FLAMMABLE and may form EXPLOSIVE MIXTURES WITH AIR.
- Use sand, lime, soda ash or dry chemicals appropriate for extinguishing metal fires.
- DO NOT USE WATER, FOAM, HALON or CO_2 extinguishing agents.
- POISONOUS GASES ARE PRODUCED IN FIRE including *Zinc Oxide fumes*.
- If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

SPILLS AND EMERGENCIES

If **Zinc** *powder* is spilled, take the following steps:

- Evacuate persons not wearing protective equipment from area of spill until clean-up is complete.
- Remove all ignition sources.
- Cover spill with dry sand or vermiculite.
- Collect powdered material in the most convenient and safe manner and deposit in sealed containers.
- DO NOT USE WATER OR WET METHOD.
- Ventilate area of spill.
- It may be necessary to contain and dispose of **Zinc** 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.
- If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: 1-877-WARN-DEP

HANDLING AND STORAGE (See page 3)

FIRST AID

For POISON INFORMATION call 1-800-222-1222

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

Skin Contact

- Remove contaminated clothing. Wash contaminated skin with soap and water.

Breathing

- Remove the person from exposure.
- Transfer promptly to a medical facility.

PHYSICAL DATA

Water Solubility: Reactive

OTHER COMMONLY USED NAMES

Chemical Name:

Zinc

Other Names:

Blue Powder; Granular Zinc; Emanay Zinc Dust

Not intended to be copied and sold for commercial purposes.

NEW JERSEY DEPARTMENT OF HEALTH AND
SENIOR SERVICES
Right to Know Program
PO Box 368, Trenton, NJ 08625-0368
(609) 984-2202

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **TETRACHLOROETHYLENE**

CAS Number: 127-18-4
DOT Number: UN 1897

RTK Substance number: 1810
Date: April 1996 Revision: March 2002

HAZARD SUMMARY

- **Tetrachloroethylene** can affect you when breathed in and by passing through your skin.
- **Tetrachloroethylene** should be handled as a CARCINOGEN--WITH EXTREME CAUTION.
- **Tetrachloroethylene** can cause reproductive damage. Handle with extreme caution.
- Contact can cause skin irritation, burns and drying and cracking of the skin.
- Exposure to **Tetrachloroethylene** can irritate the eyes, nose, mouth and throat.
- High exposure can cause headache, dizziness, lightheadedness, nausea, vomiting and even passing out.
- Breathing **Tetrachloroethylene** can irritate the lungs causing coughing and/or shortness of breath. Higher exposures can cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.
- **Tetrachloroethylene** may damage the liver and kidneys and affect the nervous system.

IDENTIFICATION

Tetrachloroethylene is a clear liquid with a sweet *Chloroform*-like odor. It is used in dry cleaning and metal degreasing.

REASON FOR CITATION

- **Tetrachloroethylene** is on the Hazardous Substance List because it is regulated by OSHA and cited by ACGIH, DOT, NIOSH, NTP, DEP, IARC, HHAG, NFPA and EPA.
- This chemical is on the Special Health Hazard Substance List because it is a **CARCINOGEN**.
- Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

- Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.1020.
- If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.
- **ODOR THRESHOLD = 47 ppm.**
- The range of accepted odor threshold values is quite broad. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

WORKPLACE EXPOSURE LIMITS

OSHA:	The legal airborne permissible exposure limit (PEL) is **100 ppm** averaged over an 8-hour workshift, **200 ppm** not to be exceeded during any 15 minute work period, and **300 ppm** for 5 minutes during any 3 hours.
NIOSH:	Recommends that exposure to occupational carcinogens be limited to the lowest feasible concentration.
ACGIH:	The recommended airborne exposure limit is **25 ppm** averaged over an 8-hour workshift and **100 ppm** as a STEL (short-term exposure limit).

- **Tetrachloroethylene** may be a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

WAYS OF REDUCING EXPOSURE

- Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
- Wear protective work clothing.
- Wash thoroughly immediately after exposure to **Tetrachloroethylene** and at the end of the workshift.

- Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Tetrachloroethylene** to potentially exposed workers.

This Fact Sheet is a summary source of information of <u>all potential</u> and most severe 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 **Tetrachloroethylene**:

- Contact can cause skin irritation and burns.
- Exposure to **Tetrachloroethylene** can irritate the eyes, nose, mouth and throat.
- High exposure can cause headache, dizziness, lightheadedness, nausea, vomiting and even passing out.
- Breathing **Tetrachloroethylene** can irritate the lungs causing coughing and/or shortness of breath. Higher exposures can cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Tetrachloroethylene** and can last for months or years:

Cancer Hazard

- **Tetrachloroethylene** may be a CARCINOGEN in humans since it has been shown to cause liver cancer in animals.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard

- **Tetrachloroethylene** may damage the developing fetus.

Other Long-Term Effects

- **Tetrachloroethylene** may damage the liver and kidneys and affect the nervous system.
- Long-term exposure can cause drying and cracking of the skin.

MEDICAL

Medical Testing

For those with frequent or potentially high exposure (half the PEL or greater, or significant skin contact), the following are recommended before beginning work and at regular times after that:

- Liver and kidney function tests.
- Exam of the nervous system.

If symptoms develop or overexposure is suspected, the following is recommended:

- Consider chest x-ray after acute overexposure.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are <u>not</u> a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.1020.

Mixed Exposures

- Because more than light alcohol consumption can cause liver damage, drinking alcohol can increase the liver damage caused by **Tetrachloroethylene.**
- Because smoking can cause heart disease, as well as lung cancer, emphysema, and other respiratory problems, it may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following control is recommended:

- Where possible, automatically pump liquid **Tetrachloroethylene** from drums or other storage containers to process containers.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

- Workers whose clothing has been contaminated by **Tetrachloroethylene** should change into clean clothing promptly.

- * Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Tetrachloroethylene.**
- * Eye wash fountains should be provided in the immediate work area for emergency use.
- * If there is the possibility of skin exposure, emergency shower facilities should be provided.
- * On skin contact with **Tetrachloroethylene**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Tetrachloroethylene**, whether or not known skin contact has occurred.
- * Do not eat, smoke, or drink where **Tetrachloroethylene** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, applying cosmetics, smoking, or using the toilet.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 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.

Clothing

- * Avoid skin contact with **Tetrachloroethylene**. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
- * All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.
- * ACGIH recommends *Nitrile Rubber, Polyvinyl Alcohol* and *Viton* as protective materials.

Eye Protection

- * Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- * Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.
- * Contact lenses should not be worn when working with this substance.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

- * Where the potential exists for exposure over **25 ppm**, 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 **150 ppm** is immediately dangerous to life and health. If the possibility of exposure above **150 ppm** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?

A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?

A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?

A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?

A: Conditions which increase risk of exposure include physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?

A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

Q: Don't all chemicals cause cancer?

A: No. Most chemicals tested by scientists are not cancer-causing.

Q: Should I be concerned if a chemical causes cancer in animals?

A: Yes. Most scientists agree that a chemical that causes cancer in animals should be treated as a suspected human carcinogen unless proven otherwise.

Q: But don't they test animals using much higher levels of a chemical than people usually are exposed to?

A: Yes. That's so effects can be seen more clearly using fewer animals. But high doses alone don't cause cancer unless it's a cancer agent. In fact, a chemical that causes cancer in animals at high doses could cause cancer in humans exposed to low doses.

Q: Can men as well as women be affected by chemicals that cause reproductive system damage?

A: Yes. Some chemicals reduce potency or fertility in both men and women. Some damage sperm and eggs, possibly leading to birth defects.

Q: Who is at the greatest risk from reproductive hazards?

A: Pregnant women are at greatest risk from chemicals that harm the developing fetus. However, chemicals may affect the ability to have children, so both men and women of childbearing age are at high risk.

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EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

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.

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

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.

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NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

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 Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEL is the Permissible Exposure Limit which is enforceable by the Occupational Safety and Health Administration.

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.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

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.

>>>>>>>>>>>>>>>>>>>EMERGENCY INFORMATION<<<<<<<<<<<<<<<<<

Common Name: **TETRACHLOROETHYLENE**
DOT Number: **UN 1897**
NAERG Code: **160**
CAS Number: **127-18-4**

Hazard rating	NJDHSS	NFPA
FLAMMABILITY	-	0
REACTIVITY	-	0
CARCINOGEN POISONOUS GASES ARE PRODUCED IN FIRE CONTAINERS MAY EXPLODE IN FIRE		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

FIRE HAZARDS

- Extinguish fire using an agent suitable for type of surrounding fire. **Tetrachloroethylene** itself does not burn.
- POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen Chloride* and *Phosgene*.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to keep fire-exposed containers cool.
- If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

SPILLS AND EMERGENCIES

If **Tetrachloroethylene** is spilled or leaked, take the following steps:

- Evacuate persons not wearing protective equipment from area of spill or leak until clean-up is complete.
- Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.
- Ventilate and wash area after clean-up is complete.
- It may be necessary to contain and dispose of **Tetrachloroethylene** 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.
- If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: 1-877-WARN-DEP

HANDLING AND STORAGE

- Prior to working with **Tetrachloroethylene** you should be trained on its proper handling and storage.
- **Tetrachloroethylene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); CHEMICALLY ACTIVE METALS (such as POTASSIUM, SODIUM, MAGNESIUM and ZINC); STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); LITHIUM; BERYLLIUM; and BARIUM.
- Store in tightly closed containers in a cool, well-ventilated area away from HEAT.

FIRST AID

For POISON INFORMATION call 1-800-222-1222

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids. Seek medical attention.

Skin Contact

- Quickly remove contaminated clothing. Immediately wash area with large amounts of soap and water. Seek medical attention.

Breathing

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.
- Medical observation is recommended for 24 to 48 hours after breathing overexposure, as pulmonary edema may be delayed.

PHYSICAL DATA

Vapor Pressure: 14 mm Hg at 68°F (20°C)
Water Solubility: Insoluble

OTHER COMMONLY USED NAMES

Chemical Name:

Ethene, Tetrachloro-

Other Names:

Perchloroethylene; PERC; Ethylene Tetrachloride

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NEW JERSEY DEPARTMENT OF HEALTH AND SENIOR SERVICES
Right to Know Program
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Safety data for trichloroethylene

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: 1-chloro,2,2-dichloroethylene, 1,1-dichloro-2-chloroethylene, ethinyl trichloride, ethylene trichloride, algylen, blacosolv, cecolene, dukeron, threthylen, tri, triad, triasol, trike, trimar, triol, vestrol, vitran, numerous further trade and non-systematic names
Molecular formula: C_2HCl_3
CAS No: 79-01-6
EC No: 201-167-4

Physical data

Appearance: colourless liquid
Melting point: -85 C
Boiling point: 87 C
Vapour density: 4.5
Vapour pressure: 61 mm Hg at 20C
Specific gravity: 1.46
Flash point: none
Explosion limits: 8 - 10.5%
Autoignition temperature:
Water solubility: negligible

Stability

Stable. Incompatible with oxidizing agents, aluminium, magnesium, strong bases, reducing agents. Light-sensitive. Reacts violently with many metals, ozone, potassium nitrate, potassium hydroxide, sodium hydroxide.

Toxicology

Carcinogen. Mutagen. Toxic. Possible teratogen. Human mutagenic data. May cause systemic effects if swallowed or inhaled. May be addictive. Harmful if swallowed, inhaled or absorbed through skin. Narcotic. Severe irritant. May cause dermatitis. Typical STEL 150 ppm. Typical LTEL 100 ppm. Carcinogen category 3.

Toxicity data

(The meaning of any abbreviations which appear in this section is given here.)

ORL-RAT LD50 7193 mg kg^{-1}

IHL-HMN TCLO 6900 mg m^{-3} 10min

IHL-MAN LCLO 2900 ppm

IPR-DOG LD50 1900 mg kg^{-1}

IVN-MUS LD50 34 mg kg^{-1}

ORL-HMN LDLO 7000 mg kg^{-1}

Risk phrases

(The meaning of any risk phrases which appear in this section is given here.)
R20 R21 R22 R40 R52 R53.

Personal protection

Safety glasses, gloves and good ventilation.

Safety phrases

(The meaning of any safety phrases which appear in this section is given here.)
S23 S36 S37 S61.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

This information was last updated on September 5, 2005. We have tried to make it as accurate and useful as possible, but can take no responsibility for its use, misuse, or accuracy. We have not verified this information, and cannot guarantee that it is up-to-date.

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Safety data for vinyl chloride

Glossary of terms on this data sheet.

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General

Synonyms: vinyl chloride monomer, monochloroethylene, ethylene monochloride, monochloroethene, VC, VCM, chloroethene, chloroethylene
Molecular formula: C_2H_3Cl
CAS No: 75-01-4
EINECS No: 200-831-0
Annex I Index No: 602-023-00-7

Physical data

Appearance: colourless gas
Melting point: -153.7 C
Boiling point: -13.9 C
Vapour density: 2.2 (air = 1)
Vapour pressure: 2580 mm Hg at 20 C
Density (g cm^{-3}): 0.9106
Flash point: -61 C (closed cup)
Explosion limits:
Autoignition temperature:
Water solubility: 0.11 g 100 cm^{-3} at 25 C
Critical temperature: 156.5 C

Stability

Stable, but may be light sensitive. May undergo autopolymerization. Incompatible with strong oxidizing agents, chemically active metals, copper.

Highly flammable. Severe explosion risk at concentrations of around 3%. It is reported that "large fires of this material are practically inextinguishable".

Toxicology

This material is a known human carcinogen. Harmful if inhaled or absorbed through the skin. May be a reproductive hazard. Typical TWA 1 ppm.

Toxicity data

(The meaning of any abbreviations which appear in this section is given here.)
IHL-MAN TCLO 500 ppm/4y-i
ORL-RAT LD50 500 mg kg^{-1}

Risk phrases

(The meaning of any risk phrases which appear in this section is given here.)
R13 R20 R21 R22 R45.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
UN No 1086. Major hazard class 2. Subsidiary hazard class 3. Not permitted as cargo on passenger planes.

Personal protection

Safety glasses, good ventilation. Handle as a carcinogen.

Safety phrases

(The meaning of any safety phrases which appear in this section is given here.)
S9 S16 S44 S53.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Safety data for cis-1,2-dichloroethylene

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: (Z)-1,2-dichloroethene, cis-1,2-dichloroethene
Molecular formula: $C_2H_2Cl_2$
CAS No: 156-59-2
EC No: 205-859-7

Physical data

Appearance: colourless liquid
Melting point: -80 C
Boiling point: 60 C
Vapour density:
Vapour pressure: 200 mm Hg at 25 C
Specific gravity: 1.284
Flash point: 4 C
Explosion limits: 9.7 - 12.8 %
Autoignition temperature: 460 C
Water solubility: slight

Stability

Stable, but may decompose slowly on exposure to light, air or moisture. Incompatible with bases, oxidizing agents, sodium, sodium hydroxide, potassium hydroxide, copper, copper alloys, most metals. Highly flammable.

Toxicology

Harmful if swallowed, inhaled, or absorbed through skin. Irritant. Narcotic. Suspected carcinogen.

Toxicity data

(The meaning of any abbreviations which appear in this section is given here.)
IHL-MUS LCLO 65000 mg/m3/2h
IHL-CAT LCLO 20000 mg/m3/6h

Risk phrases

(The meaning of any risk phrases which appear in this section is given here.)
R11 R20 R21 R22 R36 R37 R39.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
Hazard class 3.0. Packing group II. UN No 1150.

Personal protection

Safety glasses, good ventilation.

Safety phrases

(The meaning of any safety phrases which appear in this section is given here.)
S16 S26.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Appendix D
Standard Safe Work Practices

1) Eating, drinking, chewing tobacco, smoking, and carrying matches or lighters is prohibited in a contaminated or potentially contaminated area or where the possibility for the transfer of contamination exists.
2) Avoid contact with potentially contaminated substances. Do not walk through puddles, pools, mud, etc. Avoid, whenever possible, kneeling on the ground, leaning, or sitting on equipment or ground. Do not place monitoring equipment on potentially contaminated surfaces (i.e., ground, etc.).
3) All field crew members should make use of their senses to alert them to potentially dangerous situations in which they should not become involved; i.e., presence of strong and irritating or nauseating odors.
4) Prevent, to the extent possible, spills. In the event that a spillage occurs, contain liquid if possible.
5) Field crew members shall be familiar with the physical characteristics of investigations, including:

    - Wind direction;
    - Accessibility to associates, equipment, vehicles;
    - Communication;
    - Hot zone (areas of known or suspected contamination);
    - Site access; and
    - Nearest water sources.

6) All wastes generated during activities on-site should be disposed of as directed by the project manager or his on-site representative.
7) Protective equipment as specified in the section on personnel protection will be utilized by workers during the initial Site reconnaissance, and other activities.
8) Employees shall follow procedures to avoid at-risk behaviors that could result in an incident.