# 572 & 568-570 BROOME STREET

**MANHATTAN, NEW YORK**

# Remedial Action Work Plan

**NYC VCP Number: 15CVCP096M**
**NYC E Project Number: 15EH-A176M**

**Prepared for:**

Kiska Group, Ltd.
190 North 10th Street – Suite 309, Brooklyn, New York
akyuz@kskllc.com

**Prepared by:**

Hydro Tech Environmental, Corp
15 Ocean Avenue, 2nd Floor
Brooklyn, New York 11225
Phone: (718)-636-0800

**MARCH 2015**

# REMEDIAL ACTION WORK PLAN
# TABLE OF CONTENTS

TABLE OF CONTENTS ..... II
FIGURES ..... IV
APPENDICES ..... V
LIST OF ACRONYMS ..... VI
CERTIFICATION ..... 1
EXECUTIVE SUMMARY ..... 2
REMEDIAL ACTION WORK PLAN ..... 13
1.0 SITE BACKGROUND ..... 13
1.1 SITE LOCATION AND CURRENT USAGE ..... 13
1.2 PROPOSED REDEVELOPMENT PLAN ..... 13
1.3 DESCRIPTION OF SURROUNDING PROPERTY ..... 14
1.4 REMEDIAL INVESTIGATION ..... 14
2.0 REMEDIAL ACTION OBJECTIVES ..... 18
3.0 REMEDIAL ALTERNATIVES ANALYSIS ..... 19
3.1 THRESHOLD CRITERIA ..... 21
3.2. BALANCING CRITERIA ..... 22
4.0 REMEDIAL ACTION ..... 28
4.1 SUMMARY OF PREFERRED REMEDIAL ACTION ..... 28
4.2 SOIL CLEANUP OBJECTIVES AND SOIL/FILL MANAGEMENT ..... 30
4.3 ENGINEERING CONTROLS ..... 34
4.4 INSTITUTIONAL CONTROLS ..... 35
4.5 SITE MANAGEMENT PLAN ..... 37
4.6 QUALITATIVE HUMAN HEALTH EXPOSURE ASSESSMENT ..... 37
5.0 REMEDIAL ACTION MANAGEMENT ..... 42
5.1 PROJECT ORGANIZATION AND OVERSIGHT ..... 42
5.2 SITE SECURITY ..... 42
5.3 WORK HOURS ..... 42
5.4 CONSTRUCTION HEALTH AND SAFETY PLAN ..... 42

5.5 COMMUNITY AIR MONITORING PLAN ..... 43
5.6 AGENCY APPROVALS ..... 45
5.7 SITE PREPARATION ..... 46
5.8 TRAFFIC CONTROL ..... 49
5.9 DEMOBILIZATION ..... 50
5.10 REPORTING AND RECORD KEEPING ..... 50
5.11 COMPLAINT MANAGEMENT ..... 51
5.12 DEVIATIONS FROM THE REMEDIAL ACTION WORK PLAN ..... 51
6.0 REMEDIAL ACTION REPORT ..... 52
7.0 SCHEDULE ..... 54

# FIGURES

Figure 1: Site Location Map
Figure 2: Site Boundary Map
Figure 3: Proposed Redevelopment Plan
Figure 4: Land-Use Map
Figure 5: Locations of Planned Site Excavation

# APPENDICES

Appendix 1: Citizen Participation Plan

Appendix 2: Sustainability Statement

Appendix 3: Soil/Materials Management Plan

Appendix 4: Construction Health and Safety Plan

# LIST OF ACRONYMS

| Acronym | Definition |
|---|---|
| AOC | Area of Concern |
| AS/SVE | Air Sparging/Soil Vapor Extraction |
| BOA | Brownfield Opportunity Area |
| CAMP | Community Air Monitoring Plan |
| C/D | Construction/Demolition |
| COC | Certificate of Completion |
| CQAP | Construction Quality Assurance Plan |
| CSOP | Contractors Site Operation Plan |
| DCR | Declaration of Covenants and Restrictions |
| ECs/ICs | Engineering and Institutional Controls |
| HASP | Health and Safety Plan |
| IRM | Interim Remedial Measure |
| VCA | Voluntary Cleanup Agreement |
| MNA | Monitored Natural Attenuation |
| NOC | Notice of Completion |
| NYC VCP | New York City Voluntary Cleanup Program |
| NYC DEP | New York City Department of Environmental Protection |
| NYC DOHMH | New York State Department of Health and Mental Hygiene |
| NYCRR | New York Codes Rules and Regulations |
| NYC OER | New York City Office of Environmental Remediation |
| NYS DEC | New York State Department of Environmental Conservation |
| NYS DEC DER | New York State Department of Environmental Conservation Division of Environmental Remediation |
| NYS DOH | New York State Department of Health |
| NYS DOT | New York State Department of Transportation |
| ORC | Oxygen-Release Compound |
| OSHA | United States Occupational Health and Safety Administration |
| PE | Professional Engineer |

| | |
|---|---|
| PID | Photo Ionization Detector |
| QEP | Qualified Environmental Professional |
| QHHEA | Qualitative Human Health Exposure Assessment |
| RAOs | Remedial Action Objectives |
| RAR | Remedial Action Report |
| RAWP | Remedial Action Work Plan or Plan |
| RCA | Recycled Concrete Aggregate |
| RD | Remedial Design |
| RI | Remedial Investigation |
| RMZ | Residual Management Zone |
| SCOs | Soil Cleanup Objectives |
| SCG | Standards, Criteria and Guidance |
| SMP | Site Management Plan |
| SPDES | State Pollutant Discharge Elimination System |
| SVOC | Semi-Volatile Organic Compound |
| USGS | United States Geological Survey |
| UST | Underground Storage Tank |
| VOC | Volatile Organic Compound |

# CERTIFICATION

I, Shaik Saad, am a Professional Engineer licensed in the State of New York. I have primary direct responsibility for implementation of the remedial action for the 572 & 568-570 Broome Street Site Site number.

I, Mark E. Robbins am a Qualified Environmental Professional as defined in §43-140. I have primary direct responsibility for implementation of the remedial action for the 572 & 568-570 Broome Street Site 15CVCP096M.

I certify that this Remedial Action Work Plan (RAWP) has a plan for handling, transport and disposal of soil, fill, fluids and other materials removed from the property in accordance with applicable City, State and Federal laws and regulations. Importation of all soil, fill and other material from off-Site will be in accordance with all applicable City, State and Federal laws and requirements. This RAWP has provisions to control nuisances during the remediation and all invasive work, including dust and odor suppression.

SHAIK SAAD

Name

071078

NYS PE License Number

Signature

3/24/15

Date

STATE OF NEW YORK
SHAIK A. SAAD
071078
LICENSED PROFESSIONAL ENGINEER

Mark E. Robbins

QEP Name

QEP Signature

3/24/15

Date

# EXECUTIVE SUMMARY

Kiska Group, LLC has applied to enroll in the New York City Voluntary Brownfield Cleanup Program (NYC VCP) to investigate and remediate a 5,703-square foot site located at 572 & 568-570 Broome Street in Manhattan, New York. A remedial investigation (RI) was performed to compile and evaluate data and information necessary to develop this Remedial Action Work Plan (RAWP). The remedial action described in this document provides for the protection of public health and the environment consistent with the intended property use, complies with applicable environmental standards, criteria and guidance and conforms with applicable laws and regulations.

**Site Location and Current Usage**

The Site is located at 572 & 568-570 Broome Street in the Hudson Square section of Manhattan, New York and is identified as Block 578 and Lot 77 & 75 on the New York City Tax Map. Figure 1 shows the Site location. The Site is 5,703-square feet and is bounded by two 3-story residential buildings and a multi-story commercial building to the north, Freedom Plaza North Park and the Holland Tunnel entrance ramp to the south, a multi-story commercial building to the east and a 3-story residential building to the west. A map of the site boundary is shown in Figure 2. Currently, the Site is occupied by a vacant 3-story residential building with a basement and a backyard on Lot 77 and a vacant church building with a basement on Lot 75.

**Summary of Proposed Redevelopment Plan**

The proposed future use of the Site will consist of a multi-story residential building with a full basement that will be 12 feet below grade. The residential building on Lot 77 will require an additional 8 feet of excavation to reach a depth of 12 feet and the backyard on Lot 77 will be fully excavated to a depth of 12 feet below grade. The church on Lot 75 will require an additional 4 feet of excavation to reach a depth of 12 feet below grade. Elevator pits will require an additional 5 feet of excavation in the central portion of the Site (total depth 17 feet). A backyard area approximately 2,010 square feet will span the northern portion of the site. The basement will consist of a 5,097 square foot area that will be utilized for mechanical equipment,

recreational use, storage and staff offices. The first floor will consist of a 935.7 square foot area of commercial space and a 1,856.31 square foot area for residential use. Floors 2 through 18 will be residential units and the penthouse will be utilized for mechanical equipment. A total of 59,628 square feet will be utilized for residential use. Layout of the proposed site development is presented in Figure 3. The current zoning designation is M1-6/ Special Hudson Square district. The proposed use is consistent with existing zoning for the property.

**Summary of Environmental Findings**

1. Elevation of the property ranges is 15 feet.
2. One anomaly indicative of a UST was identified during the GPR survey.
3. Depth to groundwater in the vicinity of the Site is approximately 8 feet.
4. Groundwater flow is generally from east to west beneath the Site.
5. The stratigraphy of the site, from the surface down to approximately 10 feet below grade consists of fill material underlain by a mixture of brown sand with pebbles.
6. Soil/fill samples collected during the RI were compared to the 6NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (SCOs) as well as to Restricted Residential Use SCOs. Soil sampling results show 2-Butanone in one deep sample at a concentration less than its Unrestricted Use SCOs. Acetone (max. of 0.070 ppm) was detected in one deep sample at a concentration exceeding its Unrestricted Use SCO but less than its Restricted Residential Use SCO. Acetone is reported as a laboratory contaminant. No chlorinated VOCs including PCE and its degradation products were detected in any of the samples. Two Polycyclic Aromatic Hydrocarbon (PAH)-range SVOCs including Benzo(a)anthracene (max. of 1.1 ppm) and Benzo(b)fluoranthene (max. of 1.1 ppm) were detected in one shallow soil sample at concentrations exceeding their respective Unrestricted Use SCOs but under their Restricted Residential Use SCOs. Several other SVOCs were detected in two of the shallow soil samples at concentrations less than their Unrestricted Use SCOs. No PCBs or Pesticides were detected in any of the soil samples. Lead (max. of 910 ppm) was detected in one shallow soil sample at a concentration exceeding its Restricted Use SCO. Zinc (max. of 260 ppm) was also detected exceeding Unrestricted Use SCOs in

shallow soils. Overall, soil chemistry is unremarkable and does not indicate any disposal.

7. Groundwater samples collected during the RI were compared to New York State 6NYCRR Part 703.5 Class GA Groundwater Quality Standards (GQS). No VOCs, SVOCs, Pesticides or PCBs were detected in any of the groundwater samples. Several metals were identified, but only manganese (max. 3,000 µg/L) and sodium (max. 460,000 µg/L) were detected in two of the three groundwater samples at concentrations exceeding their respective GQS.

8. Soil vapor samples collected during the RI were compared to the compounds listed in Table 3.1 Air Guideline Values Derived by the NYSDOH located in the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion dated October 2006. Soil vapor results show low levels of petroleum related and associated derivatives in all four samples. All compounds were detected at concentrations less than 10 $\mu g/m^3$. The petroleum related compounds (BTEX) were detected at maximum concentrations of 19 $\mu g/m^3$. Chlorinated hydrocarbons were also detected in soil vapor samples at trace concentrations. The VOC 1,1,1-Trichloroethane (max. of 0.28 $\mu g/m^3$) was detected in one of the four samples and Tetrachloroethene (max. of 0.50 $\mu g/m^3$) was detected in two of the four samples. All VOC concentrations are below the monitoring level ranges established by NYSDOH matrix for monitoring and mitigation.

**Summary of the Remedy**

The proposed remedial action achieves protection of public health and the environment for the intended use of the property. The proposed remedial action achieves all of the remedial action objectives established for the project and addresses applicable standards, criterion, and guidance; is effective in both the short-term and long-term and reduces mobility, toxicity and volume of contaminants; is cost effective and implementable; and uses standards methods that are well established in the industry.

The proposed remedial action will consist of:

1. Preparation of a Community Protection Statement and implementation of all required NYC VCP Citizen Participation activities according to an approved Citizen Participation Plan.

2. Perform a Community Air Monitoring Program for particulates and volatile organic carbon compounds.

3. Completion of a Waste Characterization Study prior to excavation activities. Waste characterization soil samples will be collected at a frequency dictated by disposal facility. A Waste Characterization Report documenting sample procedures, location, analytical results shall be submitted to NYCOER prior to start of remedial action.

4. Selection of NYSDEC 6NYCRR Part 375 Unrestricted Use (Track 1) Soil Cleanup Objectives (SCOs).

5. Site mobilization involving Site security setup, equipment mobilization, utility mark outs and marking & staking excavation areas.

6. Excavation and removal of soil/fill exceeding SCOs. Planned development based excavation will be to a depth of approximately 12 feet for the entire Site. Approximately 1,800 tons of soil will be excavated and removed.

7. Screening of excavated soil/fill during intrusive work for indications of contamination by visual means, odor, and monitoring with a PID. Appropriate segregation of excavated media on-Site.

8. Management of excavated materials including temporarily stockpiling and segregating in accordance with defined material types and to prevent co-mingling of contaminated material and non-contaminated materials.

9. Removal of underground storage tanks and closure of petroleum spills (if evidence of a spill/leak is encountered during Site excavation in) in compliance with applicable local, State and Federal laws and regulations.

10. Transportation and off-Site disposal of all soil/fill material at permitted facilities in accordance with applicable laws and regulations for handling, transport, and disposal, and this plan. Sampling and analysis of excavated media as required by disposal

facilities. Appropriate segregation of excavated media on-Site.

11. Collection and analysis of 5 end-point samples to determine the performance of the remedy with respect to attainment of SCOs.
12. Import of materials to be used for backfill and cover in compliance with this plan and in accordance with applicable laws and regulations.
13. Implementation of storm-water pollution prevention measures in compliance with applicable laws and regulations.
14. Performance of all activities required for the remedial action, including permitting requirements and pretreatment requirements, in compliance with applicable laws and regulations.
15. Submission of a Remedial Action Report (RAR) that describes the remedial activities, certifies that the remedial requirements have been achieved, defines the Site boundaries, and describes all Engineering and Institutional Controls to be implemented at the Site, and lists any changes from this RAWP.

If Track 1 Unrestricted Use SCOs are not achieved, the following construction elements will be implemented as part of new development and will constitute Engineering and Institutional controls:

16. As part of development, installation of a vapor barrier/waterproofing membrane beneath the building slab and outside foundation sidewalls below grade.
17. As part of development, construction and maintenance of an engineered composite cover consisting of a concrete slab 42” thick to prevent human exposure to residual soil/fill remaining under the Site.
18. As part of development, construction and operation of underground ventilated garage paer codes and requirements of NYC Department of Buildings.
19. If Track 1 SCO’s are not achieved, the property will continue to be registered with an E-Designation by the NYC Buildings Department. Establishment of Engineering Controls and Institutional Controls in this RAWP and a requirement that management of these controls must be in compliance with an approved SMP. Institutional Controls will

include prohibition of the following: (1) vegetable gardening and farming; (2) use of groundwater without treatment rendering it safe for the intended use; (3) disturbance of residual contaminated material unless it is conducted in accordance with the SMP; and (4) higher level of land usage without OER-approval.

## Community Protection Statement

The Office of Environmental Remediation created the New York City Voluntary Cleanup Program (NYC VCP) to provide governmental oversight for the cleanup of contaminated property in NYC. This Remedial Action Work Plan ("cleanup plan") describes the findings of prior environmental studies that show the location of contamination at the site, and describes the plans to clean up the Site to protect public health and the environment.

This cleanup plan provides a very high level of protection for neighboring communities andalso includes many other elements that address common community concerns, such as community air monitoring, odor, dust and noise controls, hours of operation, good housekeeping and cleanliness, truck management and routing, and opportunities for community participation. The purpose of this Community Protection Statement is to explain these community protection measures in non-technical language to simplify community review.

**Remedial Investigation and Cleanup Plan.** Under the NYC VCP, a thorough cleanup study of this property (called a remedial investigation) has been performed to identify past property usage, to sample and test soils, groundwater and soil vapor, and identify contaminant sources present on the property. The cleanup plan has been designed to address all contaminant sources that have been identified during the study of this property.

**Identification of Sensitive Land Uses.** Prior to selecting a cleanup, the neighborhood was evaluated to identify sensitive land uses nearby, such as schools, day care facilities, hospitals and residential areas. The cleanup program was then tailored to address the special conditions of this community.

**Qualitative Human Health Exposure Assessment**. An important part of the cleanup planning for the Site is the performance of a study to find all of the ways that people might come in contact with contaminants at the Site now or in the future. This study is called a Qualitative Human Health Exposure Assessment (QHHEA). A QHHEA was performed for this project. This assessment has considered all known contamination at the Site and evaluated the potential for people to come in contact with this contamination. All identified public exposures will be addressed under this cleanup plan.

**Health and Safety Plan.** This cleanup plan includes a Construction Health and Safety Plan (CHASP) that is designed to protect community residents and on-Site workers. The elements of this plan are in compliance with safety requirements of the United States Occupational Safety and Health Administration (OSHA). This plan includes many protective elements including those discussed below.

**Site Safety Coordinator.** This project has a designated Site safety coordinator to implement the Health and Safety Plan. The safety coordinator maintains an emergency contact sheet and protocol for management of emergencies. The Site safety coordinator is Holly Hawkins and can be reached at 631-457-0033.

**Worker Training.** Workers participating in cleanup of contaminated material on this project are required to be trained in a 40-hour hazardous waste operators training course and to take annual refresher training. This pertains to workers performing specific tasks including removing contaminated material and installing cleanup systems in contaminated areas.

**Community Air Monitoring Plan.** Community air monitoring will be performed during this cleanup project to ensure that the community is properly protected from contaminants, dust and odors. Air samples will be tested in accordance with a detailed plan called the Community Air Monitoring Plan or CAMP. Results will be regularly reported to the NYC OER. This cleanup plan also has a plan to address any unforeseen problems that might occur during the cleanup (called a 'Contingency Plan').

**Odor, Dust and Noise Control.** This cleanup plan includes actions for odor and dust control. These actions are designed to prevent off-Site odor and dust nuisances and includes steps to be taken if nuisances are detected. Generally, dust is managed by application of physical covers and by water sprays. Odors are controlled by limiting the area of open excavations, physical covers, spray foams and by a series of other actions (called operational measures). The project is also required to comply with NYC noise control standards. If you observe problems in these areas, please contact the onsite Project Manager Holly Hawkins (631-457-0033) or NYC Office of Environmental Remediation Project Manager Rebecca Bub (212-341-2073).

**Quality Assurance.** This cleanup plan requires that evidence be provided to illustrate that all cleanup work required under the plan has been completed properly. This evidence will be

summarized in the final report, called the Remedial Action Report. This report will be submitted to the NYC Office of Environmental Remediation and will be thoroughly reviewed.

**Storm-Water Management.** To limit the potential for soil erosion and discharge, this cleanup plan has provisions for storm-water management. The main elements of the storm water management include physical barriers such as tarp covers and erosion fencing, and a program for frequent inspection.

**Hours of Operation.** The hours for operation of cleanup will comply with the NYC Department of Buildings construction code requirements or according to specific variances issued by that agency. For this cleanup project, the hours of operation are 7:00am to 4:00pm, Monday through Friday.

**Signage.** While the cleanup is in progress, a placard will be prominently posted at the main entrance of the property with a laminated project Fact Sheet that states that the project is in the NYC Voluntary Cleanup Program, provides project contact names and numbers, and locations of project documents can be viewed.

**Complaint Management.** The contractor performing this cleanup is required to address all complaints. If you have any complaints, you can call the facility Project Manager Holly Hawkins at 631-457-0033, the NYC Office of Environmental Remediation Project Manager Rebecca Bubb at (212-341-2073), or call 311 and mention the Site is in the NYC Voluntary Cleanup Program.

**Utility Mark-outs.** To promote safety during excavation in this cleanup, the contractor is required to first identify all utilities and must perform all excavation and construction work in compliance with NYC Department of Buildings regulations.

**Soil and Liquid Disposal.** All soil and liquid material removed from the Site as part of the cleanup will be transported and disposed of in accordance with all applicable City, State and Federal regulations and required permits will be obtained.

**Soil Chemical Testing and Screening.** All excavations will be supervised by a trained and properly qualified environmental professional. In addition to extensive sampling and chemical testing of soils on the Site, excavated soil will be screened continuously using hand-held

instruments, by sight, and by smell to ensure proper material handling and management, and community protection.

**Stockpile Management.** Soil stockpiles will be kept covered with tarps to prevent dust, odors and erosion. Stockpiles will be frequently inspected. Damaged tarp covers will be promptly replaced. Stockpiles will be protected with silt fences. Hay bales will be used, as needed to protect storm water catch basins and other discharge points.

**Trucks and Covers.** Loaded trucks leaving the Site will be covered in compliance with applicable laws and regulations to prevent dust and odor. Trucks will be properly recorded in logs and records and placarded in compliance with applicable City, State and Federal laws, including those of the New York State Department of Transportation. If loads contain wet material that can leak, truck liners will be used. All transport of materials will be performed by licensed truckers and in compliance with all laws and regulations.

**Imported Material.** All fill materials proposed to be brought onto the Site will comply with rules outlined in this cleanup plan and will be inspected and approved by a qualified worker located on-Site. Waste materials will not be brought onto the Site. Trucks entering the Site with imported clean materials will be covered in compliance with applicable laws and regulations.

**Equipment Decontamination.** All equipment used for cleanup work will be inspected and washed, if needed, before it leaves the Site. Trucks will be cleaned at a truck inspection station on the property before leaving the Site.

**Housekeeping.** Locations where trucks enter or leave the Site will be inspected every day and cleaned regularly to ensure that they are free of dirt and other materials from the Site.

**Truck Routing.** Truck routes have been selected to: (a) limit transport through residential areas and past sensitive nearby properties; (b) maximize use of city-mapped truck routes; (c) limit total distance to major highways; (d) promote safety in entry to highways; (e) promote overall safety in trucking; and (f) minimize off-Site line-ups (queuing) of trucks entering the property. Operators of loaded trucks leaving the Site will be instructed not to stop or idle in the local neighborhood.

**Final Report.** The results of all cleanup work will be fully documented in a final report (called a Remedial Action Report) that will be available for you to review in the public document repositories located at New York Public Library – Hudson Park Library located at 66 Leroy Street, New York, New York 10014.

**Long-Term Site Management.** If long-term protection is needed after the cleanup is complete, the property owner will be required to comply with an ongoing Site Management Plan that calls for continued inspection of protective controls, such as Site covers. The Site Management Plan is evaluated and approved by the NYC Office of Environmental Remediation. Requirements that the property owner must comply with are established through a city environmental designation. A certification of continued protectiveness of the cleanup will be required from time to time to show that the approved cleanup is still effective.

# REMEDIAL ACTION WORK PLAN

## 1.0 SITE BACKGROUND

Kiska Group, Ltd. has applied to enroll in the New York City Voluntary Cleanup Program (NYC VCP) to investigate and remediate a property located at 572 & 568-570 Broome Street in the Hudson Square section of Manhattan, New York (the "Site"). A Remedial Investigation (RI) was performed to compile and evaluate data and information necessary to develop this Remedial Action Work Plan (RAWP) in a manner that will render the Site protective of public health and the environment consistent with the contemplated end use. This RAWP establishes remedial action objectives, provides a remedial alternatives analysis that includes consideration of a permanent cleanup, and provides a description of the selected remedial action. The remedial action described in this document provides for the protection of public health and the environment, complies with applicable environmental standards, criteria and guidance and applicable laws and regulations.

### 1.1 SITE LOCATION AND CURRENT USAGE

The Site is located at 572 & 568-570 Broome Street in the Hudson Square section of Manhattan, New York and is identified as Block 578 and Lot 77 & 75 on the New York City Tax Map. Figure 1 shows the Site location. The Site is 5,703-square feet and is bounded by two 3-story residential buildings and a multi-story commercial building to the north, Freedom Plaza North Park and the Holland Tunnel entrance ramp to the south, a multi-story commercial building to the east and a 3-story residential building to the west. A map of the site boundary is shown in Figure 2. Currently, the Site is occupied by a vacant 3-story residential building with a basement and a backyard on Lot 77 and a vacant church building with a basement on Lot 75.

### 1.2 PROPOSED REDEVELOPMENT PLAN

The proposed future use of the Site will consist of a multi-story residential building with a full basement that will be 12 feet below grade. The residential building on Lot 77 will require an additional 8 feet of excavation to reach a depth of 12 feet and the backyard on Lot 77 will be fully excavated to a depth of 12 feet below grade. The church on Lot 75 will require an

additional 4 feet of excavation to reach a depth of 12 feet below grade. Elevator pits will require an additional 5 feet of excavation in the central portion of the Site (total depth 17 feet). A backyard area approximately 2,010 square feet will span the northern portion of the site. The basement will consist of a 5,097 square foot area that will be utilized for mechanical equipment, recreational use, storage and staff offices. The first floor will consist of a 935.7 square foot area of commercial space and a 1,856.31 square foot area for residential use. Floors 2 through 18 will be residential units and the penthouse will be utilized for mechanical equipment. A total of 59,628 square feet will be utilized for residential use. Layout of the proposed site development is presented in Figure 3. The current zoning designation is M1-6/ Special Hudson Square district. The proposed use is consistent with existing zoning for the property.

## 1.3 DESCRIPTION OF SURROUNDING PROPERTY

This site is located in a special Hudson Square district/ manufacturing district. The neighborhood is characterized by multi-story industrial and mixed use multi-story commercial/residential buildings. The adjoining properties also consist of multi-story industrial and mixed-use multi-story commercial/residential buildings. Properties located within a ¼-mile radius of the Site are zoned M1-6/ HSQ (mixed use industrial/ commercial/ residential district characterized by multi-story industrial buildings with residential and retail development) and C6-2A/ TMU (mixed use commercial/ residential/ with light industrial use district characterized by multi-story mixed use commercial/ residential/ industrial buildings). Within a 500-foot radius of the Site, there are two sensitive receptors: Chelsea Vocational High School and Unity High School. Figure 4 shows the surrounding land usage.

## 1.4 REMEDIAL INVESTIGATION

A remedial investigation was performed and the results are documented in a companion document called "*Remedial Investigation Report, 572 & 568-570 Broome Street*", dated January, 2015 (RIR).

### Summary of Past Uses of Site and Areas of Concern

Based upon the review of the Fire Insurance Maps and Regulatory Agency documents from the Phase I Environmental Site Assessment (ESA) Reports prepared by Hydro Tech

Environmental Corp. in April 2014 a Site history was established. Lot 77 was developed as a 3-story residential building prior to 1984. A 4-story residential building was then constructed between 1922 and 1950. The current 3-story building with a basement was constructed between 1985 and 1987.

Lot 75 was developed as two (2) 2-story residential buildings. Two (2) lots were merged between 1905 and 1913 and the current 1-story church with a basement was constructed.

The AOCs identified for this site include:

- The presence of a Potential Vapor Encroachment Condition;
- The presence of a NYC Little "E" Designation for Hazmat and Air Quality;
- The presence of suspect lead based paint;
- The presence of a suspect sump;
- The presence of aboveground storage tanks;

**Summary of the Work Performed under the Remedial Investigation**

1. Conducted a Site inspection to identify AOCs and physical obstructions (i.e. structures, buildings, etc.);
2. Performed a Ground-Penetrating Radar (GPR) survey across the Site;
3. Installed five (5) soil borings across the entire project Site, and collected ten (10) soil samples for chemical analysis from the soil borings to evaluate soil quality;
4. Installed three (3) groundwater monitoring wells throughout the Site to establish groundwater flow and collected three (3) groundwater samples for chemical analysis to evaluate groundwater quality;
5. Installed one (1) soil vapor probe and three (3) sub-slab vapor probes around the Site perimeter and collected four (4) samples for chemical analysis.

**Summary of Environmental Findings**

1. Elevation of the property ranges is 15 feet.
2. One anomaly indicative of a UST was identified during the GPR survey.
3. Depth to groundwater in the vicinity of the Site is approximately 8 feet.
4. Groundwater flow is generally from east to west beneath the Site.
5. The stratigraphy of the site, from the surface down to approximately 10 feet below grade consists of fill material underlain by a mixture of brown sand with pebbles.
6. Soil/fill samples collected during the RI were compared to the 6NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (SCOs) as well as to Restricted Residential Use SCOs. Soil sampling results show 2-Butanone in one deep sample at a concentration less than its Unrestricted Use SCOs. Acetone (max. of 0.070 ppm) was detected in one deep sample at a concentration exceeding its Unrestricted Use SCO but less than its Restricted Residential Use SCO. Acetone is reported as a laboratory contaminant. No chlorinated VOCs including PCE and its degradation products were detected in any of the samples. Two Polycyclic Aromatic Hydrocarbon (PAH)-range SVOCs including Benzo(a)anthracene (max. of 1.1 ppm) and Benzo(b)fluoranthene (max. of 1.1 ppm) were detected in one shallow soil sample at concentrations exceeding their respective Unrestricted Use SCOs but under their Restricted Residential Use SCOs. Several other SVOCs were detected in two of the shallow soil samples at concentrations less than their Unrestricted Use SCOs. No PCBs or Pesticides were detected in any of the soil samples. Lead (max. of 910 ppm) was detected in one shallow soil sample at a concentration exceeding its Restricted Use SCO. Zinc (max. of 260 ppm) was also detected exceeding Unrestricted Use SCOs in shallow soils. Overall, soil chemistry is unremarkable and does not indicate any disposal.
7. Groundwater samples collected during the RI were compared to New York State 6NYCRR Part 703.5 Class GA Groundwater Quality Standards (GQS). No VOCs, SVOCs, Pesticides or PCBs were detected in any of the groundwater samples. Several metals were identified, but only manganese (max. 3,000 µg/L) and sodium (max. 460,000

µg/L) were detected in two of the three groundwater samples at concentrations exceeding their respective GQS.

8. Soil vapor samples collected during the RI were compared to the compounds listed in Table 3.1 Air Guideline Values Derived by the NYSDOH located in the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion dated October 2006. Soil vapor results show low levels of petroleum related and associated derivatives in all four samples. All compounds were detected at concentrations less than 10 $\mu g/m^3$. The petroleum related compounds (BTEX) were detected at maximum concentrations of 19 $\mu g/m^3$. Chlorinated hydrocarbons were also detected in soil vapor samples at trace concentrations. The VOC 1,1,1-Trichloroethane (max. of 0.28 $\mu g/m^3$) was detected in one of the four samples and Tetrachloroethene (max. of 0.50 $\mu g/m^3$) was detected in two of the four samples. All VOC concentrations are below the monitoring level ranges established by NYSDOH matrix for monitoring and mitigation.

For more detailed results, consult the RIR. Based on an evaluation of the data and information from the RIR and this RAWP, disposal of significant amounts of hazardous waste is not suspected at this site.

# 2.0 REMEDIAL ACTION OBJECTIVES

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

**Groundwater**

- Prevent direct exposure to contaminated groundwater.
- Prevent exposure to contaminants volatilizing from groundwater.

**Soil**

- Prevent direct contact with contaminated soil.
- Prevent exposure to contaminants volatilizing from contaminated soil.
- Prevent migration of contaminants that would result in groundwater or surface water contamination.

**Soil Vapor**

- Prevent exposure to contaminants in soil vapor.
- Prevent migration of soil vapor into dwelling and other occupied structures.

# 3.0 REMEDIAL ALTERNATIVES ANALYSIS

The goal of the remedy selection process is to select a remedy that is protective of human health and the environment taking into consideration the current, intended and reasonably anticipated future use of the property. The remedy selection process begins by establishing remedial action objectives (RAOs) for media in which chemical constituents were found in exceedance of applicable standards, criteria and guidance values (SCGs). A remedy is then developed based on the following ten criteria:

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

The following is a detailed description of the alternatives analysis and remedy selection to address impacted media at the Site. As required, a minimum of two remedial alternatives (including a Track 1 scenario) are evaluated, as follows:

Alternative 1 involves:

- Selection of NYSDEC 6NYCRR Part 375 Unrestricted Use (Track 1) Soil Cleanup Objectives (SCOs).
- Removal of all soil/fill exceeding Track 1 Unrestricted Use SCOs throughout the Site and confirmation that Track 1 Unrestricted Use SCOs has been achieved with post-excavation endpoint sampling. If soil/fill containing analytes at concentrations above Unrestricted Use SCOs is still present at the base of the excavation (12 feet) after removal of all soil required for construction of the new building's cellar level is complete, additional excavation will be performed to ensure complete removal of soil that does not meet Track 1 Unrestricted Use SCOs;

- No Engineering or Institutional Controls are required for a Track 1 cleanup, but a vapor barrier/waterproofing membrane would be installed beneath the building foundations and behind foundation sidewalls as part of new construction to prevent any potential future exposures from soil vapor.
- As part of the new development, placement of a final cover over the entire site.

- Alternative 2 involves
  - Establishment of Site Specific (Track 4) Soil Cleanup Objectives (SCOs).
  - Removal of all soil/fill exceeding Track 4 Site-Specific SCOs and confirmation that Track 4 has been achieved with post-excavation endpoint sampling. Excavation for development purposes would take place to a depth of approximately 12 across the property. If soil/fill containing analytes at concentrations above Track 4 SCOs is still present at the base of the excavation after removal of all soil required for construction of the new building is complete, additional excavation will be performed to ensure complete removal of soil that does not meet Track 4 SCOs.
  - Installation of a 20-milvapor barrier/waterproofing membrane beneath the cellar slab and along foundation sidewalls of cellar to prevent any potential future exposures from soil vapor.
  - Placement of a final cover over the entire site to eliminate exposure to remaining soil/fill.
  - Establishment of use restrictions including prohibitions on the use of groundwater from the site and prohibitions on sensitive site uses, such as farming or vegetable gardening, to eliminate future exposure pathways.
  - Establishment of an approved Site Management Plan to ensure long-term management of these engineering and institutional controls including the performance of periodic inspections and certification that the controls are performing as they were intended; and
  - Continued registration as an E-designation property to memorialize the remedial action and the Engineering and Institutional Controls required by this RAWP.

## 3.1 THRESHOLD CRITERIA

### Protection of Public Health and the Environment

This criterion is an evaluation of the remedy's ability to protect public health and the environment, and an assessment of how risks posed through each existing or potential pathway of exposure are eliminated, reduced or controlled through removal, treatment, and implementation of Engineering Controls or Institutional Controls. Protection of public health and the environment must be achieved for all approved remedial actions.

**Alternative 1** would be protective of human health and the environment by removing the historic fill at the Site, thus eliminating potential for direct contact with contaminated soil/ fill once construction is complete and eliminating the risk of contamination leaching into groundwater. Potential migration of soil vapors into the new building would be prevented by installing a vapor barrier as part of new construction and by operating a cellar level ventilated garage.

**Alternative 2** would achieve comparable protections of human health and the environment by excavating the historic soil/fill at the Site and by ensuring that the remaining soil/fill on-Site would meet the site-specific Track 4 SCOs and would include institutional and engineering controls, including a composite cover system. The composite cover system would prevent direct contact with any remaining on-Site soil/fill. Implementing institutional controls including a Site Management Plan and continued "E" designation of property would ensure that the composite cover system remains intact and protective. Establishment of Track 4 Site-Specific SCOs would minimize the risk of contamination leaching into groundwater.

For both Alternatives, potential exposure to contaminated soils or groundwater during construction would be minimized by implementing a Construction Health and Safety Plan, an approved Soil and Materials Management Plan and Community Air Monitoring Plan (CAMP) would minimize potential exposure to contaminated soils during construction. Potential contact with contaminated groundwater is not anticipated during construction/ the remedial action and the deed notice would prohibit groundwater use for potable supply. Potential future migration of off-Site soil vapors into the new building would be prevented by installing a vapor barrier system

below the new building's basement slab and continuing the vapor barrier around foundation walls as part of new construction.

## 3.2. BALANCING CRITERIA

### Compliance with Standards, Criteria and Guidance (SCGs)

This evaluation criterion assesses the ability of the alternative to achieve applicable standards, criteria and guidance.

**Alternative 1** would achieve compliance with the remedial goals, chemical-specific SCGs and RAOs for soil through removal to Track 1 Unrestricted Use SCOs. Focused attention on means and methods employed during the remedial action would ensure that handling and management of contaminated material would be in compliance with applicable SCGs.

**Alternative 2** would achieve compliance with the remedial goals, chemical-specific SCGs and RAOs for soil through removal of soil to meet Track 4 Site-Specific SCOs. Compliance with SCGs for soil vapor would also be achieved by installing a basic vapor barrier/waterproofing membrane below the new building's basement slab and continuing the vapor barrier around foundation walls. A site management plan would ensure that these controls remained protective for the long term.

Health and safety measures contained in the CHASP and Community Air Monitoring Plan (CAMP) that comply with the applicable SCGs shall be implemented during Site redevelopment under this RAWP. For both Alternatives, focused attention on means and methods employed during the remedial action would ensure that handling and management of contaminated material would be in compliance with applicable SCGs. These measures will protect on-site workers and the surrounding community from exposure to Site-related contaminants.

### Short-term effectiveness and impacts

This evaluation criterion assesses the effects of the alternative during the construction and implementation phase until remedial action objectives are met. Under this criterion, alternatives are evaluated with respect to their effects on public health and the environment during implementation of the remedial action, including protection of the community, environmental

impacts, time until remedial response objectives are achieved, and protection of workers during remedial actions.

Both Alternative 1 and Alternative 2 have similar short-term effectiveness during their respective implementations, as each requires excavation of historic fill material. Both alternatives would result in short-term dust generation impacts associated with excavation, handling, load out of materials, and truck traffic.

An additional short-term adverse impact and risks to the community associated with both remedial alternatives is increased truck traffic. Truck traffic will be routed on the most direct course using major thoroughfares where possible and flaggers will be used to protect pedestrians at Site entrances and exits.

Both alternatives would both employ appropriate measures to prevent short-term impacts, including a Community Air Monitoring Plan (CAMP) and a Soil/Materials Management Plan (SMMP), during all on-site soil disturbance activities and would effectively prevent the release of significant contaminants into the environment. Both alternatives provide short-term effectiveness in protecting the surrounding community by decreasing the risk of contact with on-site contaminants. Construction workers operating under appropriate management procedures and a Construction Health and Safety Plan (CHASP) will be protected from on-site contaminants (personal protective equipment would be worn consistent with the documented risks within the respective work zones).

**Long-term effectiveness and permanence**

This evaluation criterion addresses the results of a remedial action in terms of its permanence and quantity/nature of waste or residual contamination remaining at the Site after response objectives have been met, such as permanence of the remedial alternative, magnitude of remaining contamination, adequacy of controls including the adequacy and suitability of ECs/ICs that may be used to manage contaminant residuals that remain at the Site and assessment of containment systems and ICs that are designed to eliminate exposures to contaminants, and long-term reliability of Engineering Controls.

Alternative 1 would achieve long-term effectiveness and permanence related to on-Site contamination by permanently removing all impacted soil/ fill material and insulating the sub-

grade portion of the building with a waterproofing barrier system. The waterproofing barrier system is also considered to be a permanent control for off-site soil vapor management. Removal of on-Site contaminant sources will prevent future groundwater contamination.

Alternative 2 would provide long-term effectiveness by removing most on-site contamination and attaining Track 4 Site-Specific SCOs, establishing Engineering Controls including a composite cover system across the Site, establishing Institutional Controls to ensure long-term management including use restrictions, a Site Management Plan, and continued registration as an E-designated property to memorialize these controls for the long term. The SMP would ensure long-term effectiveness of all ECs and ICs by requiring periodic inspection and certification that these controls and use restrictions continue to be in place and are functioning as they were intended assuring that protections designed into the remedy will provide continued high level of protection in perpetuity.

Both alternatives would result in removal of soil contamination exceeding the SCOs providing the highest level, most effective and permanent remedy over the long-term with respect to a remedy for contaminated soil, which will eliminate any migration to groundwater. Potential sources of soil vapor and groundwater contamination will also be eliminated as part of the remedy.

**Reduction of toxicity, mobility, or volume of contaminated material**

This evaluation criterion assesses the remedial alternative's use of remedial technologies that permanently and significantly reduce toxicity, mobility, or volume of contaminants as their principal element. The following is the hierarchy of source removal and control measures that are to be used to remediate a Site, ranked from most preferable to least preferable: removal and/or treatment, containment, elimination of exposure and treatment of source at the point of exposure. It is preferred to use treatment or removal to eliminate contaminants at a Site, reduce the total mass of toxic contaminants, cause irreversible reduction in contaminants mobility, or reduce of total volume of contaminated media.

**Alternative 1** would permanently eliminate the toxicity, mobility, and volume of contaminants from on-site soil by meeting Track 1 Unrestricted Use SCOs.

**Alternative 2** would permanently reduce the toxicity, mobility, and volume of contaminants due to substantial soil removal for development purposes, and any remaining soil/fill would meet Track 4 Site-Specific SCOs.

The removal of soil to an average depth of approximately 12 feet for the new development in both scenarios would probably result in relatively minor differences between these two alternatives.

**Implementability**

This evaluation criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation, including technical feasibility of construction and operation, reliability of the selected technology, ease of undertaking remedial action, monitoring considerations, administrative feasibility (e.g. obtaining permits for remedial activities), and availability of services and materials.

Both cleanup alternatives are feasible and implementable. The techniques, materials and equipment to implement both remedial Alternatives 1 and 2 are readily available and have been proven effective in remediating the contaminants associated with the Site. They use standard materials and services that are well established technology. The reliability of each remedy is also high. There are no special difficulties associated with any of the activities proposed.

**Cost effectiveness**

This evaluation criterion addresses the cost of alternatives, including capital costs (such as construction costs, equipment costs, and disposal costs, engineering expenses) and site management costs (costs incurred after remedial construction is complete) necessary to ensure the continued effectiveness of a remedial action.

Since fill layer at the Site extends to 10 feet below grade and entire property will be excavated to depths of 12 feet for development purposes. The costs associated with both Alternative 1 and Alternative 2 will likely be the comparable. However, the long-term costs are higher for Alternative 2 than Alternative 1 based on implementation of a Site Management Plan and continued “E” designation of property as part of Alternative 2.

The remedial plan creates an approach that combines the remedial action with the

redevelopment of the Site, including the construction of the building foundation and subgrade structures. The remedial plan is also cost effective in that it will take into consideration the selection of the closest and most appropriate disposal facilities to reduce transportation and disposal costs during the excavation of historic fill and other soils during the redevelopment of the Site.

**Community Acceptance**

This evaluation criterion addresses community opinion and support for the remedial action. Observations here will be supplemented by public comment received on the RAWP.

Both remedial actions provide for protection of public health and the environment and minimize potential contaminant exposures and would result in favorable environmental outcomes for the community. This RAWP will be subject to and undergo public review under the NYC VCP and will provide the opportunity for detailed public input on the remedial alternatives and the selected remedial action. This public comment will be considered by OER prior to approval of this plan. The Citizen Participation Plan is provided in **Appendix 1.**

**Land use**

This evaluation criterion addresses the proposed use of the property. This evaluation has considered reasonably anticipated future uses of the Site and takes into account: current use and historical and/or recent development patterns; applicable zoning laws and maps; NYS Department of State's Brownfield Opportunity Areas (BOA) pursuant to section 970-r of the general municipal law; applicable land use plans; proximity to real property currently used for residential use, and to commercial, industrial, agricultural, and/or recreational areas; environmental justice impacts, Federal or State land use designations; population growth patterns and projections; accessibility to existing infrastructure; proximity of the site to important cultural resources and natural resources, potential vulnerability of groundwater to contamination that might emanate from the site, proximity to flood plains, geography and geology; and current Institutional Controls applicable to the site.

The proposed redevelopment of the Site is compatible with its current M1-6/Special Hudson Square District, special multi-story industrial and mixed-use multi-story commercial/residential buildings. Following remediation, the Site will meet either Track 1 Unrestricted Use or Track 4

Site-Specific SCOs, both of which are appropriate for its planned residential/commercial use. Improvements in the current environmental condition of the property achieved by both alternatives are also consistent with the City's goals for cleanup of contaminated land, making them safer and bringing such properties into productive reuse. Both alternatives are equally protective of natural resources and cultural resources.

**Sustainability of the Remedial Action**

This criterion evaluates the overall sustainability of the remedial action alternatives and the degree to which sustainable means are employed to implement the remedial action including those that take into consideration NYC's sustainability goals defined in *PlaNYC: A Greener, Greater New York*. Sustainability goals may include: maximizing the recycling and reuse of non-virgin materials; reducing the consumption of virgin and non-renewable resources; minimizing energy consumption and greenhouse gas emissions; improving energy efficiency; and promotion of the use of native vegetation and enhancing biodiversity during landscaping associated with Site development.

Both Alternative 1 and Alternative 2 would potentially result in similar energy usage based on the potentially equal volume of material transported off-Site. Both remedial alternatives are comparable with respect to the opportunity to achieve sustainable remedial action. A sustainability statement is provided in **Appendix 2**.

# 4.0 REMEDIAL ACTION

## 4.1 SUMMARY OF PREFERRED REMEDIAL ACTION

The preferred remedial action alternative is Alternative 1, the Track 1 Alternative. The preferred remedial action alternative achieves protection of public health and the environment for the intended use of the property. The preferred remedial action alternative will achieve all of the remedial action objectives established for the project and addresses applicable SCGs. The preferred remedial action alternative is effective in both the short-term and long-term and reduces mobility, toxicity and volume of contaminants. The preferred remedial action alternative is cost effective and implementable and uses standards methods that are well established in the industry.

The proposed remedial action will consist of:

1. Preparation of a Community Protection Statement and implementation of all required NYC VCP Citizen Participation activities according to an approved Citizen Participation Plan.

2. Perform a Community Air Monitoring Program for particulates and volatile organic carbon compounds.

3. Completion of a Waste Characterization Study prior to excavation activities. Waste characterization soil samples will be collected at a frequency dictated by disposal facility. A Waste Characterization Report documenting sample procedures, location, analytical results shall be submitted to NYCOER prior to start of remedial action.

4. Selection of NYSDEC 6NYCRR Part 375 Unrestricted Use (Track 1) Soil Cleanup Objectives (SCOs).

5. Site mobilization involving Site security setup, equipment mobilization, utility mark outs and marking & staking excavation areas.

6. Excavation and removal of soil/fill exceeding SCOs. Planned development based excavation will be to a depth of approximately 12 feet for the entire Site. Approximately 1,800 tons of soil will be excavated and removed.

7. Screening of excavated soil/fill during intrusive work for indications of contamination by visual means, odor, and monitoring with a PID. Appropriate segregation of excavated media on-Site.
8. Management of excavated materials including temporarily stockpiling and segregating in accordance with defined material types and to prevent co-mingling of contaminated material and non-contaminated materials.
9. Removal of underground storage tanks and closure of petroleum spills (if evidence of a spill/leak is encountered during Site excavation in) in compliance with applicable local, State and Federal laws and regulations.
10. Transportation and off-Site disposal of all soil/fill material at permitted facilities in accordance with applicable laws and regulations for handling, transport, and disposal, and this plan. Sampling and analysis of excavated media as required by disposal facilities. Appropriate segregation of excavated media on-Site.
11. Collection and analysis of 5 end-point samples to determine the performance of the remedy with respect to attainment of SCOs.
12. Import of materials to be used for backfill and cover in compliance with this plan and in accordance with applicable laws and regulations.
13. Implementation of storm-water pollution prevention measures in compliance with applicable laws and regulations.
14. Performance of all activities required for the remedial action, including permitting requirements and pretreatment requirements, in compliance with applicable laws and regulations.
15. Submission of a Remedial Action Report (RAR) that describes the remedial activities, certifies that the remedial requirements have been achieved, defines the Site boundaries, and describes all Engineering and Institutional Controls to be implemented at the Site, and lists any changes from this RAWP.

If Track 1 Unrestricted Use SCOs are not achieved, the following construction elements will be implemented as part of new development and will constitute Engineering and Institutional controls:

16. As part of development, installation of a vapor barrier/waterproofing membrane beneath the building slab and outside foundation sidewalls below grade.

17. As part of development, construction and maintenance of an engineered composite cover consisting of a concrete slab 42” thick to prevent human exposure to residual soil/fill remaining under the Site.

18. As part of development, construction and operation of underground ventilated garage paer codes and requirements of NYC Department of Buildings.

If Track 1 SCO’s are not achieved, the property will continue to be registered with an E-Designation by the NYC Buildings Department. Establishment of Engineering Controls and Institutional Controls in this RAWP and a requirement that management of these controls must be in compliance with an approved SMP. Institutional Controls will include prohibition of the following: (1) vegetable gardening and farming; (2) use of groundwater without treatment rendering it safe for the intended use; (3) disturbance of residual contaminated material unless it is conducted in accordance with the SMP; and (4) higher level of land usage without OER-approval.

## 4.2 SOIL CLEANUP OBJECTIVES AND SOIL/FILL MANAGEMENT

Unrestricted Use Track 1 Soil Cleanup Objectives (SCOs) are proposed for this project. The SCOs for this Site are listed in Table 1. If 6 NYCRR Part 375, Table 6.8(a) Track 1 is not achieved, the 6 NYCRR Part 375, Table 6.8(b) Track 2 (Restricted Residential) SCOs will be used as amended by the following Site-Specific Track 4 SCOs:

| **Contaminant** | **Track 1 SCOs** |
|---|---|
| Total SVOCs | 250 ppm |
| Lead | 1,000 ppm |

Soil and materials management on-Site and off-Site, including excavation, handling and disposal, will be conducted in accordance with the Soil/Materials Management Plan in Appendix 3. The location of planned excavations is shown in Figure 5.

Discrete contaminant sources (such as hotspots) identified during the remedial action will be identified by GPS or surveyed. This information will be provided in the Remedial Action Report.

**Estimated Soil/Fill Removal Quantities**

The total quantity of soil/fill to be excavated and disposed off-Site is 1,800 tons.

The proposed disposal locations for Site-derived impacted materials are listed below. Additional disposal locations established at a later date will be reported promptly to the OER Project Manager.

Disposal facilities will be reported to OER when they are identified and prior to the start of remedial action.

**End-Point Sampling**

Removal actions for development purposes under this plan will be performed in conjunction with confirmation soil sampling. End-point samples will be collected from the base of the excavation at locations to be determined by OER. For comparison to Track 1 SCOs, analytes will include VOCs, SVOC, pesticides, PCBs and metals according to analytical methods described below. For comparison to Track 4 SCOs, analytes will only include trigger compounds and elements established on the Track 4 SCO list.

Hot-spot removal actions, whether established under this RAWP or identified during the remedial program, will be performed in conjunction with post remedial end-point samples to ensure that hot-spots are fully removed. Analytes for end-point sampling will be those parameters that are driving the hot-spot removal action and will be approved by OER. Frequency for hot-spot end-point sample collection is as follows:

1. For excavations less than 20 feet in total perimeter, at least one bottom sample and one sidewall sample biased in the direction of surface runoff.

2. For excavations 20 to 300 feet in perimeter:

- For surface removals, one sample from the top of each sidewall for every 30 linear feet of sidewall and one sample from the excavation bottom for every 900 square feet of bottom area.
- For subsurface removals, one sample from each sidewall for every 30 linear feet of sidewall and one sample from the excavation bottom for every 900 square feet of bottom area.

3. For sampling of volatile organics, bottom samples should be taken within 24 hours of excavation, and should be taken from the zero to six-inch interval at the excavation floor. Samples taken after 24 hours should be taken at six to twelve inches.

4. For contaminated soil removal, post remediation soil samples for laboratory analysis should be taken immediately after contaminated soil removal. If the excavation is enlarged horizontally, additional soil samples will be taken pursuant to bullets 1-3 above.

Post-remediation end-point sample locations and depth will be biased towards the areas and depths of highest contamination identified during previous sampling episodes unless field indicators such as field instrument measurements or visual contamination identified during the remedial action indicate that other locations and depths may be more heavily contaminated. In all cases, post-remediation samples should be biased toward locations and depths of the highest expected contamination.

New York State ELAP certified labs will be used for all confirmation and end-point sample analyses. Labs performing confirmation and end-point sample analyses will be reported in the RAR. The RAR will provide a tabular and map summary of all confirmation and end-point sample results and will include all data including non-detects and applicable standards and/or guidance values. End-point samples will be Confirmation samples will be analyzed for compounds and elements as described above utilizing the following methodology:

Soil analytical methods will include:

- Volatile organic compounds by EPA Method 8260;
- Semi-volatile organic compounds by EPA Method 8270;
- Target Analyte List metals; and

- Pesticides/PCBs by EPA Method 8081/8082.

If either LNAPL and/or DNAPL are detected, appropriate samples will be collected for characterization and "finger print analysis" and required regulatory reporting (i.e. spills hotline) will be performed.

**Quality Assurance/Quality Control**

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

Field QA/QC will include the following procedures:

- Calibration of field equipment, including PID, on a daily basis;
- Use of dedicated and/or disposable field sampling equipment;
- Proper sample handling and preservation;
- Proper sample chain of custody documentation; and
- Completion of report logs.

The above procedures will be executed as follows:

- Disposable sampling equipment will be used to minimize cross-contamination between samples;
- For each of the parameters analyzed, a sufficient sample volume will be collected to adhere to the specific analytical protocol, and provide sufficient sample for reanalysis if necessary;
- Because plasticizers and other organic compounds inherent in plastic containers may contaminate samples requiring organic analysis, samples will be collected in glass containers;

- Appropriate sample preservation techniques, including cold temperature storage at 4º C, will be utilized to ensure that the analytical parameters concentrations do not change between the time of sample collection and analysis; and
- Samples will be analyzed prior to the expiration of the respective holding time for each analytical parameter to ensure the integrity of the analytical results.

**Import and Reuse of Soils**

Import of soils onto the property and reuse of soils already onsite will be performed in conformance with the Soil/Materials Management Plan in Appendix 3. The estimated quantity of soil to be imported into the Site for backfill and cover soil is 0 tons. The estimated quantity of onsite soil/fill expected to be reused/relocated on Site is 0 tons.

## 4.3 ENGINEERING CONTROLS

The excavation required for the proposed site development will achieve Track 1 SCOs. No engineering controls are required to address residual contamination at the site. However, the following elements will be incorporated into the foundation design, as part of development; composite cover system, ventilated garage and soil vapor barrier. If Track 1 is not achieved, these three elements will constitute Engineering Controls that will be employed in the remedial action to address residual contamination remaining at the site.

**Composite Cover System**

Exposure to residual soil/fill will be prevented by an engineered, composite cover system to be built on the Site. This composite cover system is comprised of a 42 inch thick concrete slab in the cellar throughout the Site.

The composite cover system is a permanent engineering control for the Site. The system will be inspected and reported at specified intervals as required by this RAWP and the SMP. A Soil Management Plan will be included in the Site Management Plan and will outline the procedures to be followed in the event that the composite cover system and underlying residual soil/fill is disturbed after the remedial action is complete. Maintenance of this composite cover system will be described in the Site Management Plan in the RAR.

**Vapor Barrier**

Migration of soil vapor will be mitigated with a combination of building slab and vapor barrier.

A vapor barrier will be installed beneath the building slab and behind the foundation walls. The vapor barrier will be installed according to manufacturer instructions and all seams, penetrations and repairs will be sealed. Once the vapor barrier has been selected and the installation details have been finalized, the specifications will be provided to the OER.

The composite cover system will be a permanent engineering control to address residual soils. The composite cover system will serve as a permanent engineering control for the Site. The system will be inspected and reported at specified intervals as required by this RAWP and the Site Management Plan. A Soil and Materials Management Plan (SMMP) will be included in the Site Management Plan and will outline the procedures to be followed in the event that the composite cover system and underlying residual soil/fill is disturbed after the remedial action is complete. Maintenance of this composite cover system will be described in the Site Management Plan in the RAR.

The project's Professional Engineer licensed by the State of New York will have primary direct responsibility for overseeing the implementation of the vapor barrier. The Remedial Action Report will include photographs (maximum of two photos per page) of the installation process, PE/RA certified letter (on company letterhead) from primary contractor responsible for installation oversight and field inspections, and a copy of the manufacturers certificate of warranty.

**Ventilated Garage**

A cellar level ventilated garage will be constructed and operated per codes and requirements of Building's Department.

## 4.4 INSTITUTIONAL CONTROLS

Institutional Controls (IC) have been incorporated in this remedial action to manage residual soil/fill and other media and render the Site protective of public health and the environment. Institutional Controls are listed below. Long-term employment of EC/ICs will be implemented

under a site-specific Site Management Plan (SMP) that will be included in the RAR. The property will continue to be registered with an E-Designation by the NYC Buildings Department.

Institutional Controls for this remedial action are:

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

## 4.5 SITE MANAGEMENT PLAN

Site Management is not required for Track 1 remedial actions. However, if Track 1 SCOs are not achieved, Site Management will be the last phase of remediation and begins with the approval of the Remedial Action Report and issuance of the Notice of Completion (NOC) for the Remedial Action. The Site Management Plan (SMP) describes appropriate methods and procedures to ensure implementation of all ECs and ICs that are required by this RAWP. The Site Management Plan is submitted as part of the RAR but will be written in a manner that allows its use as an independent document. Site Management continues until terminated in writing by OER. The property owner is responsible to ensure that all Site Management responsibilities defined in the Site Management Plan are implemented.

The SMP will provide a detailed description of the procedures required to manage residual soil/fill left in place following completion of the remedial action in accordance with the Voluntary Cleanup Agreement with OER. This includes a plan for: (1) implementation of EC's and ICs; (2) implementation of monitoring programs; (3) operation and maintenance of EC's; (4) inspection and certification of EC's; and (5) reporting.

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

## 4.6 QUALITATIVE HUMAN HEALTH EXPOSURE ASSESSMENT

The objective of the qualitative exposure assessment is to identify potential receptors and pathways for human exposure to the contaminants of concern (COC) that are present at, or migrating from, the Site. The identification of exposure pathways describes the route that the COC takes to travel from the source to the receptor. An identified pathway indicates that the potential for exposure exists; it does not imply that exposures actually occur.

Investigations reported in the Remedial Investigation Report (RIR) are sufficient to complete a Qualitative Human Health Exposure Assessment (QHHEA). As part of the VCP process, a QHHEA was performed to determine whether the Site poses an existing or future health hazard to the Site's exposed or potentially exposed population. The sampling data from the RI were

evaluated to determine whether there is any health risk by characterizing the exposure setting, identifying exposure pathways, and evaluating contaminant fate and transport. This QHHEA was prepared in accordance with Appendix 3B and Section 3.3 (b) 8 of the NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation.

**Known and Potential Sources**

Historic fill material is present at the Site from grade to depths as great as 10 feet below grade. Based on the results of the Remedial Investigation Report, the contaminants of concern found are:Soil:

- VOCs including Acetone exceed its respective Unrestricted Use SCO.
- Several SVOCs were identified, but none exceeded their respective Unrestricted Use SCOs.
- Metals including Lead exceed its respective Restricted Residential SCO.

Groundwater:

- Metals including Manganese and Sodium exceed their respective GQS.

Soil Vapor:

- Chlorinated VOCs including 1,1,1-Trichloroethane and Tetrachloroethylene below the DOH monitoring guidlines.

**Nature, Extent, Fate and Transport of Contaminants**

SVOCs are present in the soil in the northern portion of the Site. Metals are present in the soil throughout the site. Metals were also identified in the groundwater at the Site at concentrations exceeding the GQS. Chlorinated VOCs were not identified in the soil vapor samples.

**Potential Routes of Exposure**

The five elements of an exposure pathway are: (1) a contaminant source; (2) contaminant release and transport mechanisms; (3) a point of exposure; (4) a route of exposure; and (5) a receptor population. An exposure pathway is considered complete when all five elements of an

exposure pathway are documented. A potential exposure pathway exists when any one or more of the five elements comprising an exposure pathway cannot be documented. An exposure pathway may be eliminated from further evaluation when any one of the five elements comprising an exposure pathway has not existed in the past, does not exist in the present, and will never exist in the future. Three potential primary routes exist by which chemicals can enter the body:

- Ingestion of water, fill, or soil;
- Inhalation of vapors and particulates; and
- Dermal contact with water, fill, soil, or building materials.

**Existence of Human Health Exposure**

*Current Conditions*: There is potential for soil vapors to accumulate beneath the existing building slab at the Site. Groundwater is marginally contaminated but is not exposed at the Site, and because the Site is served by the public water supply and groundwater use for potable supply is prohibited, groundwater is not used at the Site and there is no potential for exposure. There is no potential for direct exposure and ingestion of water, soil and fill currently at the site due to the existing asphalt cover.

*Construction/ Remediation Activities*: Once redevelopment activities begin, construction workers will come into direct contact with surface and subsurface soils and groundwater, as a result of on-Site construction and excavation activities. On-Site construction workers potentially could ingest, inhale or have dermal contact with any exposed impacted soil, and fill. Similarly, off-Site receptors could be exposed to dust and vapors from on-Site activities. During construction, on-Site and off-Site exposures to contaminated dust from on-Site will be addressed through the Soil/Materials Management Plan, dust controls, and through the implementation of the Community Air-Monitoring Program and a Construction Health and Safety Plan.

*Proposed Future Conditions*: Under future remediated conditions, most or all soils in excess of Track 1 SCOs will be removed and the site will meet, at minimum, Track 4 SCOs. The site will be fully capped, limiting potential direct exposure to soil and groundwater remaining in place, and engineering controls including a vapor barrier system and composite cover will

prevent potential for inhalation via soil vapor intrusion. The site is served by a public water supply and groundwater is not used at the site. There are no plausible off-site pathways for ingestion, inhalation, or dermal exposure to contaminants derived from the site.

**Receptor Populations**

*On-Site Receptors*: Onsite receptors are limited to trespassers and site representatives and visitors granted access to the property. During construction, onsite receptors will include construction workers, site representatives and visitors. After construction, onsite receptors will include child and adult residents and occupants of the site, employees and commercial customers.

*Off-Site Receptors*: Potential off-site receptors within a 0.25-mile radius of the Site include: adult and child residents, and commercial and construction workers, pedestrians, trespassers, and cyclists, based on the following:

1. Commercial Businesses – existing and future
2. Residential Buildings – existing and future
3. Building Construction/Renovation – existing and future
4. Pedestrians, Trespassers, Cyclists– existing and future
5. Schools– existing and future

**Overall Human Health Exposure Assessment**

There are complete exposure pathways for the current site condition. There is a potential complete exposure pathway that requires mitigation during implementation of the remedy. There is no complete exposure pathway under future conditions after the site is developed. This assessment takes into consideration the reasonably anticipated use of the site, which includes a residential structure, site-wide impervious surface cover cap, a ventilated garage and a subsurface vapor barrier system for the building. Potential post-construction use of groundwater is not considered an option because groundwater in this area of New York City is not used as a potable water source. There are no surface waters in close proximity to the Site that could be impacted or threatened.

During remedial construction, on-Site and off-Site exposures to contaminated dust from historic fill material will be addressed through dust controls, and through the implementation of the Community Air Monitoring Program, the Soil/Materials Management Plan, and a Construction Health and Safety Plan. After the remedial action is complete, there will be no remaining exposure pathways to on-Site soil/fill, as all soil above Unrestricted Use SCOs will have been removed and a vapor barrier system will have been installed as part of development.

# 5.0 REMEDIAL ACTION MANAGEMENT

## 5.1 PROJECT ORGANIZATION AND OVERSIGHT

Principal personnel who will participate in the remedial action include Holly Hawkins (Project Manager) and Rachel Ataman (Senior Vice President). The Professional Engineer (PE) for this project is Shaik Saad and the Qualified Environmental Professional (QEP) for this project is Mark E. Robbins.

## 5.2 SITE SECURITY

Site access will be controlled by barriers that will be installed around work areas as needed to delineate and restrict access to the work area. For work areas of limited size, barrier tape will be sufficient to delineate and restrict access. For larger worker areas, temporary fencing will be provided.

## 5.3 WORK HOURS

The hours for operation of remedial construction will be from 7:00am to 5:00pm. These hours conform to the New York City Department of Buildings construction code requirements.

## 5.4 CONSTRUCTION HEALTH AND SAFETY PLAN

The Health and Safety Plan is included in Appendix 4. The Site Safety Coordinator will be Holly Hawkins. Remedial work performed under this RAWP will be in full compliance with applicable health and safety laws and regulations, including Site and OSHA worker safety requirements and HAZWOPER requirements. Confined space entry, if any, will comply with OSHA requirements and industry standards and will address potential risks. The parties performing the remedial construction work will ensure that performance of work is in compliance with the HASP and applicable laws and regulations. The HASP pertains to remedial and invasive work performed at the Site until the issuance of the Notice of Completion.

All field personnel involved in remedial activities will participate in training required under 29 CFR 1910.120, including 40-hour hazardous waste operator training and annual 8-hour

refresher training. Site Safety Officer will be responsible for maintaining workers training records.

Personnel entering any exclusion zone will be trained in the provisions of the HASP and be required to sign an HASP acknowledgment. Site-specific training will be provided to field personnel. Additional safety training may be added depending on the tasks performed. Emergency telephone numbers will be posted at the site location before any remedial work begins. A safety meeting will be conducted before each shift begins. Topics to be discussed include task hazards and protective measures (physical, chemical, environmental); emergency procedures; PPE levels and other relevant safety topics. Meetings will be documented in a log book or specific form.

An emergency contact sheet with names and phone numbers is included in the HASP. That document will define the specific project contacts for use in case of emergency.

## 5.5 COMMUNITY AIR MONITORING PLAN

Real-time air monitoring for volatile organic compounds (VOCs) and particulate levels at the perimeter of the exclusion zone or work area will be performed. Continuous monitoring will be performed for all ground intrusive activities and during the handling of contaminated or potentially contaminated media. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pit excavation or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be performed during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. Periodic monitoring during sample collection, for instance, will consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. Depending upon the proximity of potentially exposed individuals, continuous monitoring may be performed during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence. Exceedances of action levels observed during performance

of the Community Air Monitoring Plan (CAMP) will be reported to the OER Project Manager and included in the Daily Report.

**VOC Monitoring, Response Levels, and Actions**

Volatile organic compounds (VOCs) will be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis during invasive work. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work will be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment will be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment will be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

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

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

**Particulate Monitoring, Response Levels, and Actions**

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

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/$m^3$) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work will continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/$m^3$ above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/$m^3$ above the upwind level, work will be stopped and a re-evaluation of activities initiated. Work will resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/$m^3$ of the upwind level and in preventing visible dust migration.

All readings will be recorded and be available for OER personnel to review.

## 5.6 AGENCY APPROVALS

All permits or government approvals required for remedial construction have been or will be obtained prior to the start of remedial construction. Approval of this RAWP by OER does not constitute satisfaction of these requirements and will not be a substitute for any required permit.

## 5.7 SITE PREPARATION

### Pre-Construction Meeting

OER will be invited to attend the pre-construction meeting at the Site with all parties involved in the remedial process prior to the start of remedial construction activities.

### Mobilization

Mobilization will be conducted as necessary for each phase of work at the Site. Mobilization includes field personnel orientation, equipment mobilization (including securing all sampling equipment needed for the field investigation), marking/staking sampling locations and utility mark-outs. Each field team member will attend an orientation meeting to become familiar with the general operation of the Site, health and safety requirements, and field procedures.

### Utility Marker Layouts, Easement Layouts

The presence of utilities and easements on the Site will be fully investigated prior to the performance of invasive work such as excavation or drilling under this plan by using, at a minimum, the One-Call System (811). Underground utilities may pose an electrocution, explosion, or other hazard during excavation or drilling activities. All invasive activities will be performed incompliance with applicable laws and regulations to assure safety. Utility companies and other responsible authorities will be contacted to locate and mark the locations, and a copy of the Markout Ticket will be retained by the contractor prior to the start of drilling, excavation or other invasive subsurface operations. Overhead utilities may also be present within the anticipated work zones. Electrical hazards associated with drilling in the vicinity of overhead utilities will be prevented by maintaining a safe distance between overhead power lines and drill rig masts.

Proper safety and protective measures pertaining to utilities and easements, and compliance with all laws and regulations will be employed during invasive and other work contemplated under this RAWP. The integrity and safety of on-Site and off-Site structures will be maintained during all invasive, excavation or other remedial activity performed under the RAWP.

## Equipment and Material Staging

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

## Stabilized Construction Entrance

Steps will be taken to ensure that trucks departing the site will not track soil, fill or debris off-Site. Such actions may include use of cleaned asphalt or concrete roads or use of stone or other aggregate-based egress paths between the truck inspection station and the property exit. Measures will be taken to ensure that adjacent roadways will be kept clean of project related soils, fill and debris.

## Truck Inspection Station

An outbound-truck inspection station will be set up close to the Site exit. Before exiting the NYC VCP Site, trucks will be required to stop at the truck inspection station and will be examined for evidence of contaminated soil on the undercarriage, body, and wheels. Soil and debris will be removed. Brooms, shovels and potable water will be utilized for the removal of soil from vehicles and equipment, as necessary.

## Extreme Storm Preparedness and Response Contingency Plan

Damage from flooding or storm surge can include dislocation of soil and stockpiled materials, dislocation of site structures and construction materials and equipment, and dislocation of support of excavation structures. Damage from wind during an extreme storm event can create unsafe or unstable structures, damage safety structures and cause downed power lines creating dangerous site conditions and loss of power. In the event of emergency conditions caused by an extreme storm event, the enrollee will undertake the following steps for site preparedness prior to the event and response after the event.

### Storm Preparedness

Preparations in advance of an extreme storm event will include the following: containerized hazardous materials and fuels will be removed from the property; lose materials will be secured to prevent dislocation and blowing by wind or water; heavy equipment such as excavators and

generators will be removed from holes, trenches and depressions on the property to high ground or removed from the property; an inventory of the property with photographs will be performed to establish conditions for the site and equipment prior to the event; stockpile covers for soil and fill will be secured by adding weights such as sandbags for added security and worn or ripped stockpile covers will be replaced with competent covers; stockpiled hazardous wastes will be removed from the property;  storm water management systems will be inspected and fortified, including, as necessary: clean and reposition silt fences, hay bales; clean storm sewer filters and traps; and secure and protect pumps and hosing.

**Storm Response**

At the conclusion of an extreme storm event, as soon as it is safe to access the property, a complete inspection of the property will be performed. A site inspection report will be submitted to OER at the completion of site inspection and after the site security is assessed. Site conditions will be compared to the inventory of site conditions and material performed prior to the storm event and significant differences will be noted. Damage from storm conditions that result in acute public safety threats, such as downed power lines or imminent collapse of buildings, structures or equipment will be reported to public safety authorities via appropriate means such as calling 911. Petroleum spills will be reported to NYS DEC within 2 hours of identification and consistent with State regulations. Emergency and spill conditions will also be reported to OER. Public safety structures, such as construction security fences will be repaired promptly to eliminate public safety threats. Debris will be collected and removed. Dewatering will be performed in compliance with existing laws and regulations and consistent with emergency notifications, if any, from proper authorities. Eroded areas of soil including unsafe slopes will be stabilized and fortified. Dislocated materials will by collected and appropriately managed. Support of excavation structure will be inspected and fortified as necessary. Impacted stockpiles will be contained and damaged stockpile covers will be replaced. Storm-water control systems and structures will be inspected and maintained as necessary. If soil or fill materials are discharged off site to adjacent properties, property owners and OER will be notified and corrective measure plan designed to remove and clean dislocated material will be submitted to OER and implemented following approval by OER and granting of site access by the property owner. Impacted offsite areas may require characterization based on site conditions, at the discretion of OER. If onsite petroleum spills are identified, a qualified environmental

professional will determine the nature and extent of the spill and report to NYS DEC's spill hotline at DEC 800-457-7362. If the source of the spill is ongoing and can be identified, it should be stopped it this can be done safely. Potential hazards will be addressed immediately, consistent with guidance issued by NYS DEC.

**Storm Response Reporting**

A site inspection report will be submitted to OER at the completion of site inspection. An inspection report established by OER is available on OER's website (www.nyc.gov/oer) and will be used for this purpose. Site conditions will be compared to the inventory of site conditions and material performed prior to the storm event and significant differences will be noted. The site inspection report will be sent to the OER project manager and will include the site name, address, tax block and lot, site primary and alternate contact name and phone number. Damage and soil release assessment will include: whether the project had stockpiles; whether stockpiles were damaged; photographs of damage and notice of plan for repair; report of whether soil from the site was dislocated and whether any of the soil left the site; estimates of the volume of soil that left the site, nature of impact, and photographs; description of erosion damage; description of equipment damage; description of damage to the remedial program or the construction program, such as damage to the support of excavation; presence of onsite or offsite exposure pathways caused by the storm; presence of petroleum or other spills and status of spill reporting to NYS DEC; description of corrective actions; schedule for corrective actions. This report should be completed and submitted to OER project manager with photographs within 24 hours of the time of safe entry to the property after the storm event.

## 5.8 TRAFFIC CONTROL

Drivers of trucks leaving the NYC VCP Site with soil/fill will be instructed to proceed without stopping in the vicinity of the site to prevent neighborhood impacts. The planned route on local roads for trucks leaving the site will be provided to the OER once the soil disposal facilities have been determined.

## 5.9 DEMOBILIZATION

Demobilization will include:

- As necessary, restoration of temporary access areas and areas that may have been disturbed to accommodate support areas (e.g., staging areas, decontamination areas, storage areas, temporary water management areas, and access area);
- Removal of sediment from erosion control measures and truck wash and disposal of materials in accordance with applicable laws and regulations;
- Equipment decontamination, and;
- General refuse disposal.

Equipment will be decontaminated and demobilized at the completion of all field activities. Investigation equipment and large equipment (*e.g.*, soil excavators) will be washed at the truck inspection station as necessary. In addition, all investigation and remediation derived waste will be appropriately disposed.

## 5.10 REPORTING AND RECORD KEEPING

### Daily Reports

Daily reports providing a general summary of activities for each day of *active remedial work* will be emailed to the OER Project Manager by the end of the following day. Those reports will include:

- Project number and statement of the activities and an update of progress made and locations of work performed;
- Quantities of material imported and exported from the Site;
- Status of on-Site soil/fill stockpiles;
- A summary of all citizen complaints, with relevant details (basis of complaint; actions taken; etc.);
- A summary of CAMP excursions, if any;
- Photograph of notable Site conditions and activities.

The frequency of the reporting period may be revised in consultation with OER project manager based on planned project tasks. Daily email reports are not intended to be the primary

mode of communication for notification to OER of emergencies (accidents, spills), requests for changes to the RAWP or other sensitive or time critical information. However, such information will be included in the daily reports. Emergency conditions and changes to the RAWP will be communicated directly to the OER project manager by personal communication. Daily reports will be included as an Appendix in the Remedial Action Report.

**Record Keeping and Photo-Documentation**

Job-site record keeping for all remedial work will be performed. These records will be maintained on-Site during the project and will be available for inspection by OER staff. Representative photographs will be taken of the Site prior to any remedial activities and during major remedial activities to illustrate remedial program elements and contaminant source areas. Photographs will be submitted at the completion of the project in the RAR in digital format (i.e. jpeg files).

## 5.11 COMPLAINT MANAGEMENT

All complaints from citizens will be promptly reported to OER. Complaints will be addressed and outcomes will also be reported to OER in daily reports. Notices to OER will include the nature of the complaint, the party providing the complaint, and the actions taken to resolve any problems.

## 5.12 DEVIATIONS FROM THE REMEDIAL ACTION WORK PLAN

All changes to the RAWP will be reported to the OER Project Manager and will be documented in daily reports and reported in the Remedial Action Report. The process to be followed if there are any deviations from the RAWP will include a request for approval for the change from OER noting the following:

- Reasons for deviating from the approved RAWP;
- Effect of the deviations on overall remedy; and
- Determination that the remedial action with the deviation(s) is protective of public health and the environment.

# 6.0 REMEDIAL ACTION REPORT

A Remedial Action Report (RAR) will be submitted to OER following implementation of the remedial action defined in this RAWP. The RAR will document that the remedial work required under this RAWP has been completed and has been performed in compliance with this plan. The RAR will include:

- Information required by this RAWP;
- As-built drawings for all constructed remedial elements, required certifications, manifests and other written and photographic documentation of remedial work performed under this remedy;
- Site Management Plan (if Track 1 is not achieved);
- Description of any changes in the remedial action from the elements provided in this RAWP and associated design documents;
- Tabular summary of all end point sampling results and all material characterization results, QA/QC results for end-point sampling, and other sampling and chemical analysis performed as part of the remedial action and DUSR;
- Test results or other evidence demonstrating that remedial systems are functioning properly;
- Account of the source area locations and characteristics of all contaminated material removed from the Site including a map showing source areas;
- Account of the disposal destination of all contaminated material removed from the Site. Documentation associated with disposal of all material will include transportation and disposal records, and letters approving receipt of the material.
- Account of the origin and required chemical quality testing for material imported onto the Site.
- Continue registration of the property with an E-Designation by the NYC Department of Buildings.
- Reports and supporting material will be submitted in digital form.

## Remedial Action Report Certification

The following certification will appear in front of the Executive Summary of the Remedial Action Report. The certification will include the following statements:

*I, Shaik Saad, am currently a professional engineer licensed by the State of New York. I had primary direct responsibility for implementation of the remedial program for the 572 & 568-570 Broome Street Site number.*

*I, Mark E. Robbins am a Qualified Environmental Professional. I had primary direct responsibility for implementation remedial program for the 572 & 568-570 Broome Street Site .*

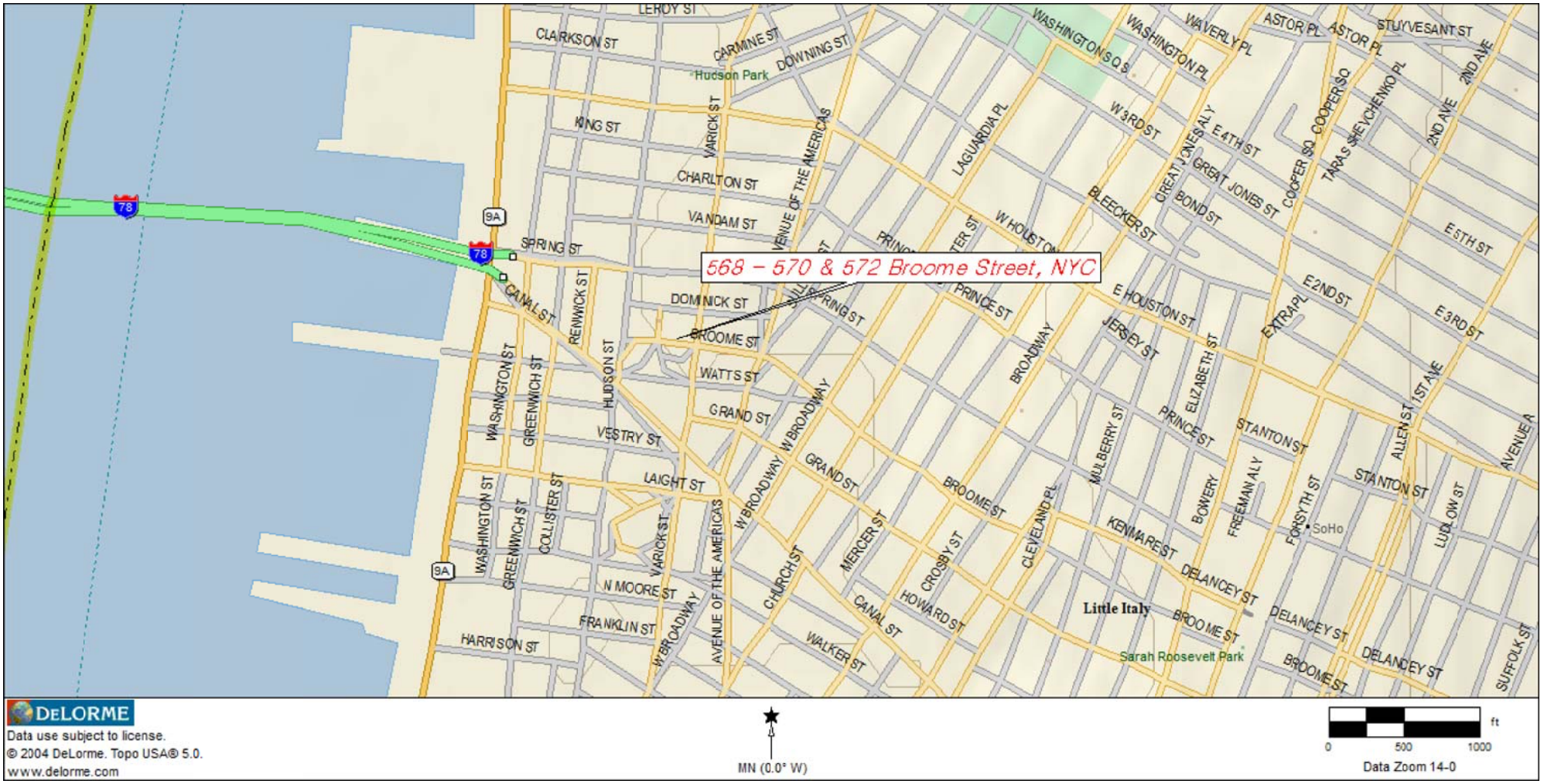
*I certify that the OER-approved Remedial Action Work Plan dated month day year and Stipulations in a letter dated month day, year; if any were implemented and that all requirements in those documents have been substantively complied with. I certify that contaminated soil, fill, liquids or other material from the property were taken to facilities licensed to accept this material in full compliance with applicable laws and regulations.*

# 7.0 SCHEDULE

The table below presents a schedule for the proposed remedial action and reporting. If the schedule for remediation and development activities changes, it will be updated and submitted to OER. Currently, a 24-month remediation period is anticipated.

| Schedule Milestone | Weeks from Remedial Action Start | Duration (weeks) |
|---|---|---|
| OER Approval of RAWP | 0 | - |
| Fact Sheet 2 announcing start of remedy | 0 | - |
| Mobilization | 2 | 1 |
| Remedial Excavation | 5 | 3 |
| Demobilization | 24 | 2 |
| Submit Remedial Action Report | 35 | 2 |

# Figures




**HYDRO TECH ENVIRONMENTAL CORP.**

MAIN OFFICE:
77 ARKAY DRIVE, SUITE G
HAUPPAUGE, NEW YORK 11788
T (631)462-5866 F (631)462-5877

NYC OFFICE:
15 OCEAN AVENUE, 2nd Floor
BROOKLYN, NEW YORK 11225
T (718)636-0800 F (718)636-0900

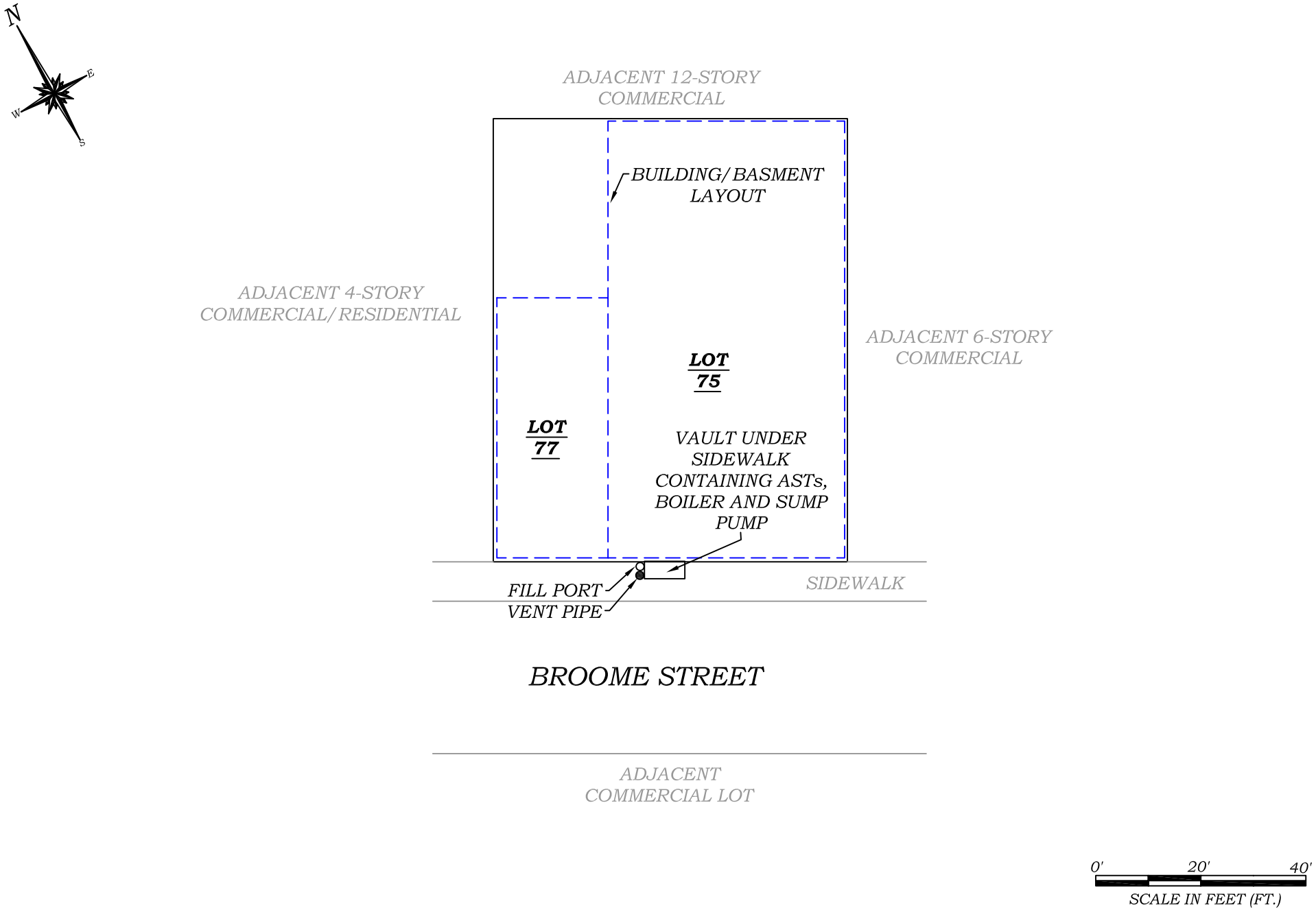
www.hydrotechenvironmental.com

*568 - 570 & 572*
*Broome Street*
*New York, NY*
*HTE Job # 140236*

Drawn By: C.Q.
Reviewed By: M.R
Approved By: M.R
Date: 01/07/15
Scale: AS NOTED

TITLE:

*FIGURE 1: SITE LOCATION MAP*




**HYDRO TECH ENVIRONMENTAL CORP.**

MAIN OFFICE:
77 ARKAY DRIVE, SUITE G
HAUPPAUGE, NEW YORK 11788
T (631)462-5866 F (631)462-5877

NYC OFFICE:
15 OCEAN AVENUE, 2nd Floor
BROOKLYN, NEW YORK 11225
T (718)636-0800 F (718)636-0900

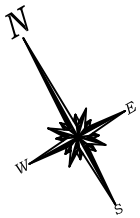
www.hydrotechenvironmental.com

568 - 570 & 572
Broome Street
New York, NY
HTE Job # 140236

Drawn By: C.Q.
Reviewed By: M.R
Approved By: M.R
Date: 01/07/15
Scale: AS NOTED

TITLE:

FIGURE 2: SITE BOUNDARY MAP




ADJACENT 12-STORY
COMMERCIAL

CELLAR
OUTLINE

ADJACENT 4-STORY
COMMERCIAL/ RESIDENTIAL

**PROPOSED 19-STORY**
**BUILDING WITH**
**CELLAR**

ADJACENT 6-STORY
COMMERCIAL

PROPERTY
OUTLINE

SIDEWALK

BROOME STREET

ADJACENT
COMMERCIAL LOT

0' 20' 40'
SCALE IN FEET (FT.)

**HYDRO TECH ENVIRONMENTAL CORP.**

MAIN OFFICE:
77 ARKAY DRIVE, SUITE G
HAUPPAUGE, NEW YORK 11788
T (631)462-5866 F (631)462-5877

NYC OFFICE:
15 OCEAN AVENUE, 2nd Floor
BROOKLYN, NEW YORK 11225
T (718)636-0800 F (718)636-0900

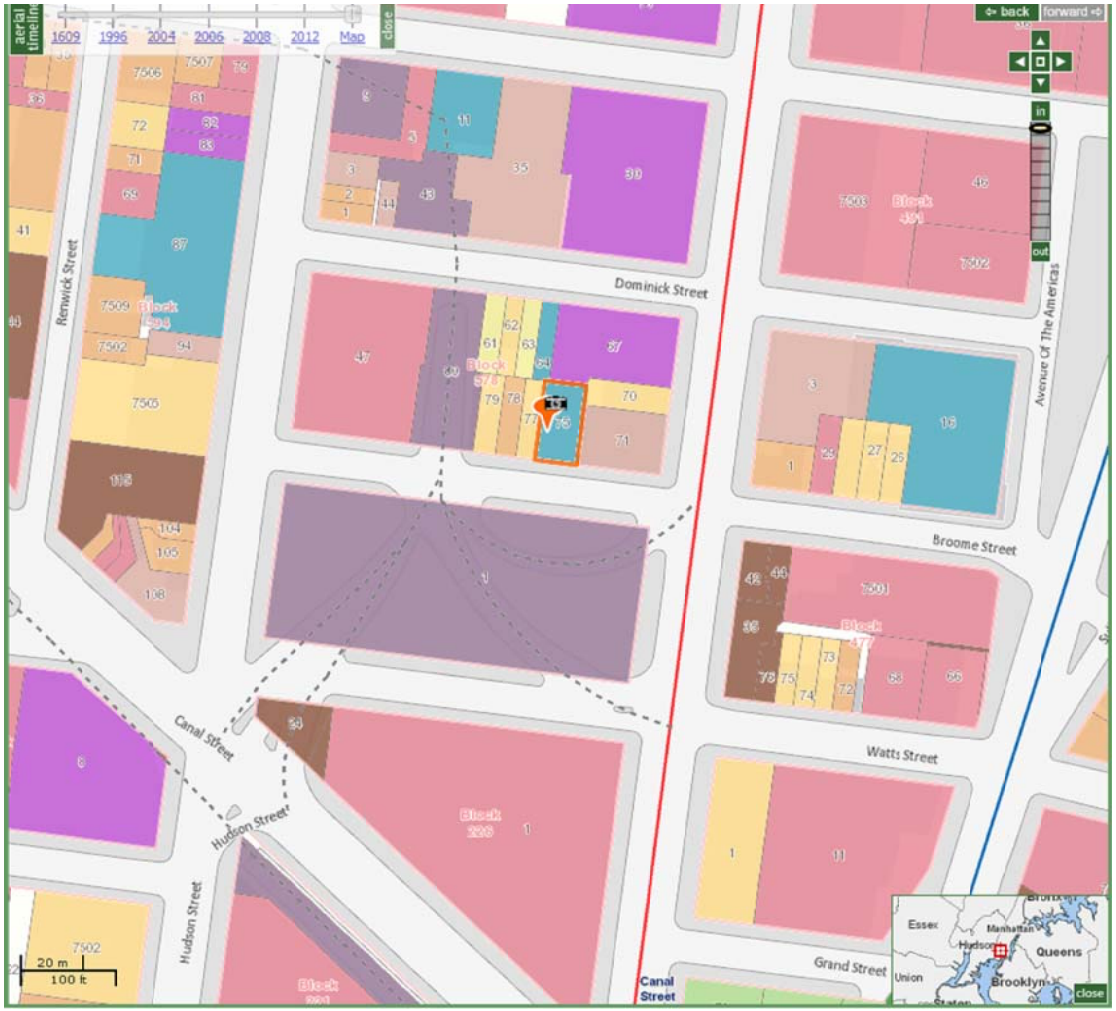
www.hydrotechenvironmental.com

568 - 570 & 572
Broome Street
New York, NY
HTE Job # 140236

Drawn By: C.Q.
Reviewed By: M.R
Approved By: M.R
Date: 01/07/15
Scale: AS NOTED

TITLE:

FIGURE 3: PROPOSED REDEVELOPMENT PLAN




Land Use

All land use categories

2003 2005 2007 2009 2013

- 1 & 2 Family Residential
- Multi-family Residential
- Mixed Use
- Open space & outdoor recreation
- Commercial
- Institutions
- Industrial
- Parking
- Transportation / Utilities
- Vacant Lots

**HYDRO TECH ENVIRONMENTAL CORP.**

MAIN OFFICE:
77 ARKAY DRIVE, SUITE G
HAUPPAUGE, NEW YORK 11788
T (631)462-5866 F (631)462-5877

NYC OFFICE:
15 OCEAN AVENUE, 2nd Floor
BROOKLYN, NEW YORK 11225
T (718)636-0800 F (718)636-0900

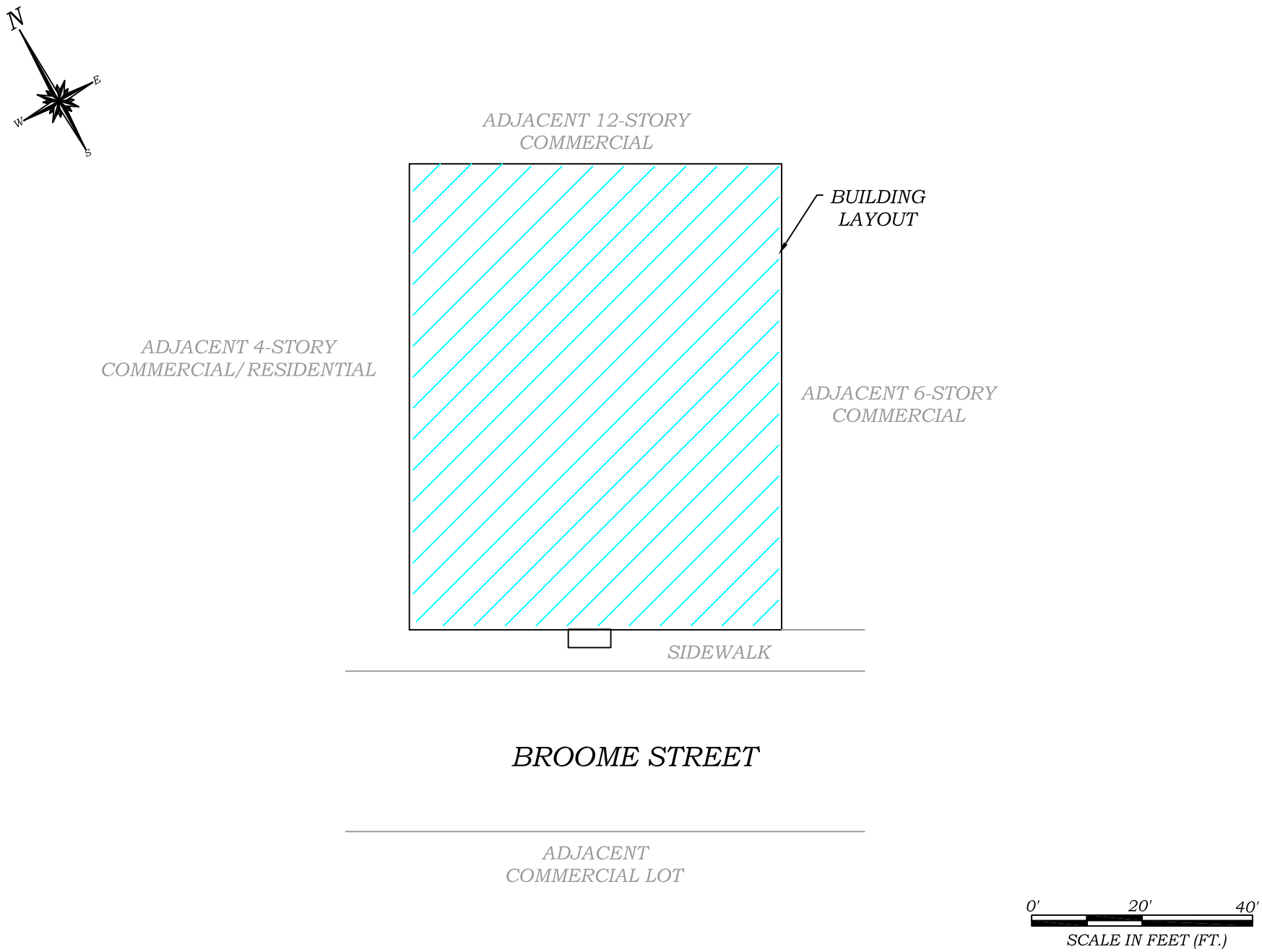
www.hydrotechenvironmental.com

*568 - 570 & 572*
*Broome Street*
*New York, NY*
*HTE Job # 140236*

Drawn By: C.Q.
Reviewed By: M.R
Approved By: M.R
Date: 01/07/15
Scale: AS NOTED

TITLE:

*FIGURE 4: LAND-USE MAP*




**HYDRO TECH ENVIRONMENTAL CORP.**

MAIN OFFICE:
77 ARKAY DRIVE, SUITE G
HAUPPAUGE, NEW YORK 11788
T (631)462-5866 F (631)462-5877

NYC OFFICE:
15 OCEAN AVENUE, 2nd Floor
BROOKLYN, NEW YORK 11225
T (718)636-0800 F (718)636-0900

www.hydrotechenvironmental.com

568 - 570 & 572
Broome Street
New York, NY
HTE Job # 140236

Drawn By: C.Q.
Reviewed By: M.R
Approved By: M.R
Date: 01/07/15
Scale: AS NOTED

TITLE:

FIGURE 5: LOCATIONS OF PLANNED SITE EXCAVATION

# APPENDIX 1
# CITIZEN PARTICIPATION PLAN

The NYC Office of Environmental Remediation and Kiska Group, Ltd. have established this Citizen Participation Plan because the opportunity for citizen participation is an important component of the NYC Voluntary Cleanup Program. This Citizen Participation Plan describes how information about the project will be disseminated to the Community during the remedial process. As part of its obligations under the NYC VCP, Kiska Group, Ltd will maintain a repository for project documents and provide public notice at specified times throughout the remedial program. This Plan also takes into account potential environmental justice concerns in the community that surrounds the project Site. Under this Citizen Participation Plan, project documents and work plans are made available to the public in a timely manner. Public comment on work plans is strongly encouraged during public comment periods. Work plans are not approved by the NYC Office of Environmental Remediation (OER) until public comment periods have expired and all comments are formally reviewed. An explanation of cleanup plans in the form of a public meeting or informational session is available upon request to OER's project manager assigned to this Site, Rebecca Bubb, who can be contacted about these issues or any others questions, comments or concerns that arise during the remedial process at (212) 788-8841

**Project Contact List.** OER has established a Site Contact List for this project to provide public notices in the form of fact sheets to interested members of the Community. Communications will include updates on important information relating to the progress of the cleanup program at the Site as well as to request public comments on the cleanup plan. The Project Contact List includes owners and occupants of adjacent buildings and homes, principal administrators of nearby schools, hospitals and day care centers, the public water supplier that serves the area, established document repositories, the representative Community Board, City Council members, other elected representatives and any local Brownfield Opportunity Area (BOA) grantee organizations. Any member of the public or organization will be added to the Site Contact List on request. A copy of the Site Contact List is maintained by OER's project

manager. If you would like to be added to the Project Contact List, contact NYC OER at (212) 788-8841 or by email at brownfields@cityhall.nyc.gov.

**Repositories.** A document repository is maintained in the nearest public library that maintains evening and weekend hours. This document repository is intended to house, for community review, all principal documents generated during the cleanup program including Remedial Investigation plans and reports, Remedial Action work plans and reports, and all public notices and fact sheets produced during the lifetime of the remedial project. Enrollee will inspect the repositories to ensure that they are fully populated with project information. The repository for this project is:

New York Public Library – Hudson Park Library located at

66 Leroy Street, New York, New York 10014.(212) 243-6876

| | |
|---|---|
| Monday | 11:00 am – 6:00 pm |
| Tuesday | 12:00 – 7:00 pm |
| Wednesday | 11:00 am – 6:00 pm |
| Thursday | 12:00 – 7:00 pm |
| Friday | 10:00 am – 5:00 pm |
| Saturday | 10:00 am – 5:00 pm |
| Sunday | Closed |

**Digital Documentation.** NYC OER strongly encourages the use of digital documents in repositories as a means of minimizing paper use while also increasing convenience in access and ease of use.

**Identify Issues of Public Concern.** There are no known issues of public concern associated with this project.

**Public Notice and Public Comment.** Public notice to all members of the Project Contact List is required at three major steps during the performance of the cleanup program (listed below) and at other points that may be required by OER. Notices will include Fact Sheets with descriptive project summaries, updates on recent and upcoming project activities, repository information, and important phone and email contact information. All notices will be prepared by Kiska Group, Ltd., reviewed and approved by OER prior to distribution and mailed by , Kiska

Group, Ltd.. Public comment is solicited in public notices for all work plans developed under the NYC Voluntary Cleanup Program. Final review of all work plans by OER will consider all public comments. Approval will not be granted until the public comment period has been completed.

**Citizen Participation Milestones.** Public notice and public comment activities occur at several steps during a typical NYC VCP project. See flow chart on the following page, which identifies when during the NYC VCP public notices are issued: These steps include:

- **Public Notice of the availability of the Remedial Investigation Report and Remedial Action Work Plan and a 30-day public comment period on the Remedial Action Work Plan.**

  Public notice in the form of a Fact Sheet is sent to all parties listed on the Site Contact List announcing the availability of the Remedial Investigation Report and Remedial Action Work Plan and the initiation of a 30-day public comment period on the Remedial Action Work Plan. The Fact Sheet summarizes the findings of the RIR and provides details of the RAWP. The public comment period will be extended an additional 15 days upon public request. A public meeting or informational session will be conducted by OER upon request.

- **Public Notice announcing the approval of the RAWP and the start of remediation**

  Public notice in the form of a Fact Sheet is sent to all parties listed on the Site Contact List announcing the approval of the RAWP and the start of remediation.

- **Public Notice announcing the completion of remediation, designation of Institutional and Engineering Controls and issuance of the Notice of Completion**

Public notice in the form of a Fact Sheet is sent to all parties listed on the Site Contact List announcing the completion of remediation, providing a list of all Institutional and Engineering Controls implemented for to the Site and announcing the issuance of the Notice of Completion.

# APPENDIX 2
# SUSTAINABILITY STATEMENT

This Sustainability Statement documents sustainable activities and green remediation efforts planned under this remedial action.

**Reuse of Clean, Recyclable Materials.** Reuse of clean, locally-derived recyclable materials reduces consumption of non-renewable virgin resources and can provide energy savings and greenhouse gas reduction.

An estimate of the quantity (in tons) of clean, non-virgin materials (reported by type of material) reused under this plan will be quantified and reported in the RAR.

**Reduce Consumption of Virgin and Non-Renewable Resources.** Reduced consumption of virgin and non-renewable resources lowers the overall environmental impact of the project on the region by conserving these resources.

An estimate of the quantity (in tons) of virgin and non-renewable resources, the use of which will be avoided under this plan, will be quantified and reported in the RAR.

**Reduced Energy Consumption and Promotion of Greater Energy Efficiency.** Reduced energy consumption lowers greenhouse gas emissions, improves local air quality, lessens in-city power generation requirements, can lower traffic congestion, and provides substantial cost savings.

Best efforts will be made to quantify energy efficiencies achieved during the remediation and will be reported in the Remedial Action Report (RAR). Where energy savings cannot be easily quantified, a gross indicator of the amount of energy saved or the means by which energy savings was achieved will be reported.

**Conversion to Clean Fuels.** Use of clean fuel improves NYC's air quality by reducing harmful emissions.

An estimate of the volume of clean fuels used during remedial activities will be quantified and reported in the RAR.

**Recontamination Control.** Recontamination after cleanup and redevelopment is completed undermines the value of work performed, may result in a property that is less protective of public health or the environment, and may necessitate additional cleanup work later or impede future redevelopment. Recontamination can arise from future releases that occur within the property or by influx of contamination from off-Site.

An estimate of the area of the Site that utilizes recontamination controls under this plan will be reported in the RAR in square feet.

**Storm-water Retention.** Storm-water retention improves water quality by lowering the rate of combined storm-water and sewer discharges to NYC's sewage treatment plants during periods of precipitation, and reduces the volume of untreated influent to local surface waters.

An estimate of the enhanced storm-water retention capability of the redevelopment project will be included in the RAR.

**Linkage with Green Building.** Green buildings provide a multitude of benefits to the city across a broad range of areas, such as reduction of energy consumption, conservation of resources, and reduction in toxic materials use.

The number of Green Buildings that are associated with this brownfield redevelopment property will be reported in the RAR. The total square footage of green building space created as a function of this brownfield redevelopment will be quantified for residential, commercial and industrial/manufacturing uses.

**Paperless Brownfield Cleanup Program.** Kiska Group, Ltd. is participating in OER's Paperless Brownfield Cleanup Program. Under this program, submission of electronic documents will replace submission of hard copies for the review of project documents, communications and milestone reports.

**Low-Energy Project Management Program.** Kiska Group, Ltd. is participating in OER's low-energy project management program. Under this program, whenever possible, meetings are

held using remote communication technologies, such as videoconferencing and teleconferencing to reduce energy consumption and traffic congestion associated with personal transportation.

**Trees and Plantings.** Trees and other plantings provide habitat and add to NYC's environmental quality in a wide variety of ways. Native plant species and native habitat provide optimal support to local fauna, promote local biodiversity, and require less maintenance.

An estimate of the land area that will be vegetated, including the number of trees planted or preserved, will be reported in square feet in the RAR.

# APPENDIX 3

# SOIL/MATERIALS MANAGEMENT PLAN

## 1.1 SOIL SCREENING METHODS

Visual, olfactory and PID soil screening and assessment will be performed under the supervision of a Qualified Environmental Professional and will be reported in the RAR. Soil screening will be performed during invasive work performed during the remedy and development phases prior to issuance of the Notice of Completion.

## 1.2 STOCKPILE METHODS

Excavated soil from suspected areas of contamination (e.g., hot spots, USTs, drains, etc.) will be stockpiled separately and will be segregated from clean soil and construction materials. Stockpiles will be used only when necessary and will be removed as soon as practicable. While stockpiles are in place, they will be inspected daily, and before and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by OER. Excavated soils will be stockpiled on, at minimum, double layers of 8-mil minimum sheeting, will be kept covered at all times with appropriately anchored plastic tarps, and will be routinely inspected. Broken or ripped tarps will be promptly replaced.

All stockpile activities will be compliant with applicable laws and regulations. Soil stockpile areas will be appropriately graded to control run-off in accordance with applicable laws and regulations. Stockpiles of excavated soils and other materials shall be located at least of 50 feet from the property boundaries, where possible. Hay bales or equivalent will surround soil stockpiles except for areas where access by equipment is required. Silt fencing and hay bales will be used as needed near catch basins, surface waters and other discharge points.

## 1.3 CHARACTERIZATION OF EXCAVATED MATERIALS

Soil/fill or other excavated media that is transported off-Site for disposal will be sampled in a manner required by the receiving facility, and in compliance with applicable laws and regulations. Soils proposed for reuse on-Site will be managed as defined in this plan.

## 1.4 MATERIALS EXCAVATION, LOAD-OUT AND DEPARTURE

The PE/QEP overseeing the remedial action will:

- Oversee remedial work and the excavation and load-out of excavated material;
- Ensure that there is a party responsible for the safe execution of invasive and other work performed under this work plan;
- Ensure that Site development activities and development-related grading cuts will not interfere with, or otherwise impair or compromise the remedial activities proposed in this RAWP;
- Ensure that the presence of utilities and easements on the Site has been investigated and that any identified risks from work proposed under this plan are properly addressed by appropriate parties;
- Ensure that all loaded outbound trucks are inspected and cleaned if necessary before leaving the Site;
- Ensure that all egress points for truck and equipment transport from the Site will be kept clean of Site-derived materials during Site remediation.

Locations where vehicles exit the Site shall be inspected daily for evidence of soil tracking off premises. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to Site-derived materials.

Open and uncontrolled mechanical processing of historical fill and contaminated soil on-Site will not be performed without prior OER approval.

## 1.5 OFF-SITE MATERIALS TRANSPORT

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

Outbound truck transport routes will be provided once the soil disposal facility has been determined. This routing takes into account the following factors: (a) limiting transport through residential areas and past sensitive sites; (b) use of mapped truck routes; (c) minimizing off-Site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport. To the extent possible, all trucks loaded with Site materials will travel from the Site using these truck routes. Trucks will not stop or idle in the neighborhood after leaving the project Site.

## 1.6 MATERIALS DISPOSAL OFF-SITE

The following documentation will be established and reported by the PE/QEP for each disposal destination used in this project to document that the disposal of regulated material exported from the Site conforms with applicable laws and regulations: (1) a letter from the PE/QEP or Enrollee to each disposal facility describing the material to be disposed and requesting written acceptance of the material. This letter will state that material to be disposed is regulated material generated at an environmental remediation Site in Brooklyn, New York under a governmental remediation program. The letter will provide the project identity and the name and phone number of the PE/QEP or Enrollee. The letter will include as an attachment a summary of all chemical data for the material being transported; and (2) a letter from each disposal facility stating it is in receipt of the correspondence (1, above) and is approved to accept the material. These documents will be included in the RAR.

The Remedial Action Report will include an itemized account of the destination of all material removed from the Site during this remedial action. Documentation associated with disposal of all material will include records and approvals for receipt of the material. This information will be presented in the RAR.

All impacted soil/fill or other waste excavated and removed from the Site will be managed as regulated material and will be disposed in accordance with applicable laws and regulations. Historic fill and contaminated soils taken off-Site will be handled as solid waste and will not be disposed at a Part 360-16 Registration Facility (also known as a Soil Recycling Facility).

Waste characterization will be performed for off-Site disposal in a manner required by the receiving facility and in conformance with its applicable permits. Waste characterization

sampling and analytical methods, sampling frequency, analytical results and QA/QC will be reported in the RAR. A manifest system for off-Site transportation of exported materials will be employed. Manifest information will be reported in the RAR. Hazardous wastes derived from on-Site will be stored, transported, and disposed of in compliance with applicable laws and regulations.

## 1.7 MATERIALS REUSE ON-SITE

Soil and fill that is derived from the property that meets the soil cleanup objectives established in this plan may be reused on-Site. 'Reuse on-Site' means material that is excavated during the remedy or development, does not leave the property, and is relocated within the same property and on comparable soil/fill material, and addressed pursuant to the NYC VCP agreement subject to Engineering and Institutional Controls. The PE/QEP will ensure that reused materials are segregated from other materials to be exported from the Site and that procedures defined for material reuse in this RAWP are followed.

Organic matter (wood, roots, stumps, etc.) or other waste derived from clearing and grubbing of the Site will not be buried on-Site. Soil or fill excavated from the site for grading or other purposes will not be reused within a cover soil layer or within landscaping berms.

## 1.8 DEMARCATION

After completion of hotspot removal and any other invasive remedial activities, and prior to backfilling, the top of the residual soil/fill will be defined by one of three methods: (1) placement of a demarcation layer. The demarcation layer will consist of geosynthetic fencing or equivalent material to be placed on the surface of residual soil/fill to provide an observable reference layer. A description or map of the approximate depth of the demarcation layer will be provided in the SMP; or (2) a land survey of the top elevation of residual soil/fill before the placement of cover soils, pavement and associated sub-soils, or other materials or structures or, (3) all materials beneath the approved cover will be considered impacted and subject to site management after the remedy is complete. Demarcation may be established by one or any combination of these three methods. As appropriate, a map showing the method of demarcation for the Site and all associated documentation will be presented in the RAR.

This demarcation will constitute the top of the site management horizon. Materials within this horizon require adherence to special conditions during future invasive activities as defined in the Site Management Plan.

## 1.9 IMPORT OF BACKFILL SOIL FROM OFF-SITE SOURCES

This Section presents the requirements for imported fill materials to be used below the cover layer and within the clean soil cover layer. All imported soils will meet OER-approved backfill and cover soil quality objectives for this Site.

A process will be established to evaluate sources of backfill and cover soil to be imported to the Site, and will include an examination of source location, current and historical use(s), and any applicable documentation. Material from industrial sites, spill sites, environmental remediation sites or other potentially contaminated sites will not be imported to the Site.

The following potential sources may be used pending attainment of backfill and cover soil quality objectives:

- Clean soil from construction projects at non-industrial sites in compliance with applicable laws and regulations;
- Clean soil from roadway or other transportation-related projects in compliance with applicable laws and regulations;
- Clean recycled concrete aggregate (RCA) from facilities permitted or registered by the regulations of NYS DEC.

All materials received for import to the Site will be approved by a PE/QEP and will be in compliance with provisions in this RAWP. The RAR will report the source of the fill, evidence that an inspection was performed on the source, chemical sampling results, frequency of testing, and a Site map indicating the locations where backfill or soil cover was placed.

**Source Screening and Testing**

Inspection of imported fill material will include visual, olfactory and PID screening for evidence of contamination. Materials imported to the Site will be subject to inspection, as follows:

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

Composite samples of imported material will be taken at a minimum frequency of one sample for every 500 cubic yards of material. Once it is determined that the fill material meets imported backfill or cover soil chemical requirements and is non-hazardous, and lacks petroleum contamination, the material will be loaded onto trucks for delivery to the Site.

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

## 1.10 FLUIDS MANAGEMENT

All liquids to be removed from the Site, including dewatering fluids, will be handled, transported and disposed in accordance with applicable laws and regulations. Liquids discharged into the New York City sewer system will receive prior approval by New York City Department of Environmental Protection (NYC DEP). The NYC DEP regulates discharges to the New York City sewers under Title 15, Rules of the City of New York Chapter 19. Discharge to the New York City sewer system will require an authorization and sampling data demonstrating that the

groundwater meets the City's discharge criteria. The dewatering fluid will be pretreated as necessary to meet the NYC DEP discharge criteria. If discharge to the City sewer system is not appropriate, the dewatering fluids will be managed by transportation and disposal at an off-Site treatment facility.

Discharge of water generated during remedial construction to surface waters (i.e. a stream or river) is prohibited without a SPDES permit issued by New York State Department of Environmental Conservation.

## 1.11 STORM-WATER POLLUTION PREVENTION

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

## 1.12 CONTINGENCY PLAN

This contingency plan is developed for the remedial construction to address the discovery of unknown structures or contaminated media during excavation. Identification of unknown contamination source areas during invasive Site work will be promptly communicated to OER's Project Manager. Petroleum spills will be reported to the NYS DEC Spill Hotline. These findings will be included in the daily report. If previously unidentified contaminant sources are found during on-Site remedial excavation or development-related excavation, sampling will be performed on contaminated source material and surrounding soils and reported to OER.

Chemical analytical testing will be performed for TAL metals, TCL volatiles and semi-volatiles, TCL pesticides and PCBs, as appropriate.

## 1.13 ODOR, DUST AND NUISANCE CONTROL

**Odor Control**

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

This odor control plan is capable of controlling emissions of nuisance odors. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. OER will be notified of all odor complaint events. Implementation of all odor controls, including halt of work, will be the responsibility of the PE/QEP's certifying the Remedial Action Report.

**Dust Control**

Dust management during invasive on-Site work will include, at a minimum:

- Use of a dedicated water spray methodology for roads, excavation areas and stockpiles.
- Use of properly anchored tarps to cover stockpiles.
- Exercise extra care during dry and high-wind periods.
- Use of gravel or recycled concrete aggregate on egress and other roadways to provide a clean and dust-free road surface.

This dust control plan is capable of controlling emissions of dust. If nuisance dust emissions are identified, work will be halted and the source of dusts will be identified and

corrected. Work will not resume until all nuisance dust emissions have been abated. OER will be notified of all dust complaint events. Implementation of all dust controls, including halt of work, will be the responsibility of the PE/QEP's responsible for certifying the Remedial Action Report.

**Other Nuisances**

Noise control will be exercised during the remedial program. All remedial work will conform, at a minimum, to NYC noise control standards.

Rodent control will be provided, during Site clearing and grubbing, and during the remedial program, as necessary, to prevent nuisances.

# APPENDIX 4

# HEALTH AND SAFETY PLAN

# CONSTRUCTION HEALTH & SAFETY PLAN

**572 & 568-570 Broome Street**
**Block 578 and Lots 77 & 75**
**New York, New York**

**Table of Contents**


1.0 Introduction ..... 2
2.0 Scope of Work ..... 2
3.0 Staffing ..... 3
4.0 Chemical & Waste Description/Characterization ..... 4
5.0 Hazard Assessment ..... 5
6.0 Spill Prevention and Control Plan ..... 7
7.0 Training ..... 7
8.0 Medical Surveillance ..... 8
9.0 Site Control, PPE & Communications ..... 9
10.0 Air Monitoring Plan ..... 11
11.0 Safety Considerations ..... 12
12.0 Decontamination and Disposal Procedures ..... 14
13.0 Emergency Plan ..... 16
14.0 Logs, Reports and Record Keeping ..... 18
15.0 Sanitation ..... 19


**Figures**


1. Directions to Hospital


**Attachments**


A. Health and Safety Fact Sheets

## 1.0 INTRODUCTION

This Construction Health & Safety Plan (CHASP) has been prepared by Hydro Tech Environmental, Corp. (Hydro Tech) as a part of the Remedial Action Work Plan (RAWP) for 572 & 568-570 Broome Street (Block 568 and Lot 77 & 75) and situated in the Hudson Square section of Manhattan, New York.

This CHASP will conform to applicable regulations, safe work practices and the project's requirements, and addresses those activities associated with the development of a multi-story residential building.

The Hydro Tech Project Manager (PM), Site Safety Officer (SSO) and field staff (when necessary) will implement the Plan during construction. Compliance with this HASP is required of all persons and third parties who perform the scope of work documented for this project. Assistance in implementing this CHASP can be obtained from the SSO. The content of this CHASP may change or undergo revisions based upon additional information that is made available to health and safety personnel, monitoring results, or changes in the technical scope of work.

It should be noted that this CHASP does not apply to any other scopes of work that may be performed at the Site that are not specifically outlined in this report. Through preparation of this HASP, Hydro Tech and all Subcontractors (if any) do not guarantee the health or safety of any person entering this Site. Due to the nature of this Site and the activities occurring thereon, it is not possible to discover, evaluate and provide protection for all possible hazards that may be encountered. Only those portions of this CHASP that specifically apply to authorized personnel of Hydro Tech will enact the activities at the Site. Strict adherence to the applicable portions of these health and safety guidelines set forth herein will reduce, but not eliminate the potential for injury at this Site. The health and safety guidelines in this CHASP were prepared specifically for this Site and should not be utilized for any other site without prior research and evaluation by trained health and safety specialists and approval by Hydro Tech.

## 2.0 SCOPE OF WORK

This Construction HASP has been prepared as a part of the RAWP to be implemented during the upcoming development of the Site. Prior environmental assessments identified Volatile Organic Compounds (VOCs) including Acetone, Semi-Volatile Organic Compounds (SVOCs) including benzo(a)anthracene and benzo(b)fluoranthene and Metals including lead and zinc in soil/fill beneath the Site at concentrations exceeding their respective Unrestricted Use Soil Cleanup Objectives (SCOs). A range of vapors associated with chlorinated solvents and petroleum constituents were also detected beneath the Site.

The portions of the construction activities specifically addressed in this Construction HASP will include the following and will be performed in the following sequence:

- Supervision of the excavation of soil/fill and other material
- Supervision of the installation of concrete foundations
- Supervision of the installation of vapor barrier

Prior to any fieldwork, the New York City One-Call Unit will be contacted so that all public utilities can be marked out. The proposed schedule of fieldwork will be coordinated with the developer and the OER.

## 3.0 STAFFING

This section briefly describes the personnel involved in Site remedial activities, their contact information and their health and safety responsibilities. This section also provides directions to hospital in the case of a health emergency.

### EMERGENCY NUMBERS

| Contact | Phone Number |
|---|---|
| Emergency Medical Care | (212) 962-6600 |
| New York City EMS | 911 |
| NYPD | 911 |
| NYFD | 911 |
| National Response Center | (800) 424-8802 |
| Poison Information Center | (800) 562-8816 |
| Chemtree | (800) 424-9555 |

**Project Management/Health and Safety Personnel**

| Title | Contact | Phone Number | Cell Phone |
|---|---|---|---|
| Senior Geologist | Rachel Ataman | (631) 462-5866 | (631) 457-0032 |
| Site Safety Officer | Holly Hawkins | (718) 636-0800 | (631) 457-0033 |
| Project Manager | Holly Hawkins | (718) 636-0800 | (631) 457-0033 |

**Directions to Lincoln Medical and Mental Health Center (See Attached Figure 1)**

Head south on Varick Street toward Watts Street. Follow Varick Street. The road will veer slightly to the right and Varick Street will become W Broadway. Follow W Broadway. Turn right onto Chambers Street. Emergency Medical Care will be on the left.

### PROJECT MANAGER

As necessary, the Project Manager will perform the following:

- Has the overall responsibility for the health and safety of site personnel
- Ensures that adequate resources are provided to the field staff to carry out their responsibilities as outlined below.
- Ensures that fieldwork is scheduled with adequate personnel and equipment resources to complete the job in a safe manner.
- Ensures that adequate communication between field crews and emergency response personnel is maintained.
- Ensures that field site personnel are adequately trained and qualified to work at the Site.

### SITE SAFETY OFFICER

As necessary, the Site Safety Officer will perform the following:

- Directs and coordinates health and safety monitoring activities.
- Ensures that field teams utilize proper personal protective equipment (PPE).
- Conducts initial on-Site, specific training prior to personnel and/or subcontractors proceeding to work.
- Conducts and documents periodic safety briefings; ensures that field team members comply

with this Construction HASP.
- Completes and maintains Accident/Incident Report Forms.
- Notifies corporate administration of all accidents/incidents.
- Determines upgrade or downgrade of PPE based on site conditions and/or downgrade of PPE based on site conditions and/or real-time monitoring results.
- Ensures that monitoring instruments are calibrated daily or as determined by manufacturer's suggested instructions.
- Maintains health and safety field log books.
- Develops and ensures implementation of the Construction HASP.
- Approves revised or new safety protocols for field operations.
- Coordinates revisions of this Construction HASP with field personnel and the SSO Division Contracting Officer.
- Responsible for the development of new company safety protocols and procedures and resolution of any outstanding safety issues which may arise during the conduction of site work.
- Reviews personnel and subcontractors current and up-to-date medical examination and acceptability of health and safety training.

**FIELD PERSONNEL AND SUBCONTRACTORS (IF ANY)**

- Reports any unsafe or potentially hazardous conditions to the SSO
- Maintains knowledge of the information, instructions, and emergency response actions contained in this Construction HASP.
- Comply with rules, regulations and procedures as set forth in this Construction HASP and any revisions that are instituted.
- Prevents admittance to work sites by unauthorized personnel.

## 4.0 CHEMICAL & WASTE DESCRIPTION/CHARACTERIZATION

The following list of compounds is based on the results of the recent subsurface investigation:

Volatile Organic Compounds in soil:

- acetone

Semi-Volatile Organic Compounds in soil:

- benzo(a)anthracene
- benzo(b)fluoranthene

Heavy Metals in soil:

- lead
- zinc

Heavy Metals in groundwater:

- manganese
- sodium

Volatile Organic Compounds in soil vapor:

- BTEX and associated petroleum related compounds
- acetone
- methylene chloride
- TCA
- PCE

**Appendix A** contains Material Safety Data Sheets

The following information references are presented in order to identify the properties, characteristics and hazards of the compounds and metals that may/will be encountered at the Site.

* Dangerous Properties of Industrial Materials - Sax
* Chemical Hazards of the Workplace - Proctor/Hughes
* Condensed Chemical Dictionary - Hawley
* Rapid Guide to Hazardous Chemical in the Workplace - Lewis 1990.
* NIOSH Guide to Chemical Hazards – 1990.
* ACGIH TLV Values and Biological Exposure Indices - 1991-1992.

## 5.0 HAZARD ASSESSMENT AND MITIGATION

The potential hazards associated with planned site activities include chemical, physical and biological hazards associated with the construction. This section discusses those hazards that are anticipated to be encountered during the activities listed in the scope of work.

The potential to encounter chemical hazards is dependent upon the work activity performed (invasive or non-invasive), the duration, and location of the work activity. Such hazards could include inhalation or skin contact with chemicals that could cause: dermatitis, skin burn, being overcome by vapors, or asphyxiation. In addition, the handling of contaminated materials and chemicals could result in fire and/or explosion.

The potential to encounter physical hazards during site work includes: heat stress, exposure to excessive noise, loss of limbs, being crushed, head injuries, cuts and bruises, and other physical hazards due to motor vehicle operation, heavy equipment and power tools.

### CHEMICAL HAZARDS

The potential for personnel and subcontractors to come in contact with chemical hazards may occur during the following tasks:

- Excavation
- Installation of vapor barrier
- Pouring of concrete foundation(s)

*Exposure Pathways*

Exposure to these compounds during ongoing activities may occur through inhalation of contaminated dust particles, inhalation of volatile vapor fume compounds, by way of dermal absorption, and accidental ingestion of the contaminant by either direct or indirect cross contamination activities (eating, smoking, poor hygiene). Indirectly, inhalation of contaminated

dust particles can occur during adverse weather conditions (high or changing wind directions) or during operations that may generate airborne dust such as excavation.

*Dust Suppression*
The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities.

1. Applying water on haul roads.
2. Wetting equipment and excavation faces.
3. Spraying water on buckets during excavation and dumping.
4. Hauling materials in properly sealed or watertight containers.
5. Restricting vehicle speeds to 10mph.
6. Covering excavated areas and material after excavation activity ceases.
7. Reducing the excavation size and/or number of excavations.
8. Applying a dust suppressant, such as calcium chloride, in high vehicle traffic areas.

To evaluate the effectiveness if the dust suppression measures, air monitoring will be performed utilizing real-time dust-monitoring equipment. The requirements for air monitoring during post-remediation soil disturbance activities are presented in Section 5.0.

*Additional Precautions*
Dermal absorption or skin contact with chemical compounds is possible during invasive activities at the Site, including the excavation and/or capping of soils. The use of PPE in accordance with Section 9.0 and strict adherence to proper decontamination procedures should significantly reduce the risk of skin contact.

The potential for accidental ingestion of potentially hazardous chemicals is expected to be remote, when good hygiene practices are used. Unauthorized personnel, including all children, will not be allowed access to the Site.

**PHYSICAL HAZARDS**
A variety of physical hazards may be present during Site activities. These hazards are similar to those associated with any construction type project and include digging or boring operations and excavation activities in the vicinity of underground utility locations. These physical hazards are due to motor vehicles, and heavy equipment operation, the use of improper use of power and hand tools, misuse of pressurized cylinders, walking on objects, tripping over objects, working on surfaces which have the potential to promote falling, mishandling and improper storage of solid and hazardous materials, skin burns, crushing of fingers, toes, limbs, hit on the head by falling objects or hit one's head due to not seeing the object of concern, temporary loss of one's hearing

and/or eyesight. Theses hazards are not unique and are generally familiarly to most hazardous waste site workers at construction sites. Additional task specific safety requirements will be covered during safety briefings.

## 6.0 SPILL PREVENTION AND CONTROL PLAN

Accidental spill and leaks of hazardous and non-hazardous materials will be properly controlled so that they do not adversely impact storm drain systems or receiving waters. A spill prevention and control plan will include the following:

*Spill/Leak Prevention Measures;*
-Place any material under cover (tarp) and away from storm drains or sensitive water bodies
-Properly label all containers so that the contents are easily identifiable
-Berm storage areas so that if a spill or leak occur they are easily contained

*Spill Response Procedures*
- Assessment of the Site and potential impacts by the SSO
- Containment of the material
- Notification of the personnel present at the Site and ensure evacuation procedure if necessary.

*Spill Cleanup Procedures*
-If small non-hazardous spill, use cleanup materials such as absorbents or rags and damp cloths and dispose of properly;
-If large non-hazardous spill or hazardous spill, a private hazmat team may need to be contacted to assess the situation and conduct the cleanup and proper disposal of the material.

*Reporting*
-Petroleum spills will be reported immediately to the NYSDEC Spill Hotline.
-If material is unknown or hazardous, contact the local Fire Department.

*Training*
-The SSO is responsible for providing refreshment training to all employees working on-site about spill prevention, spill response and cleanup on a routine basis.
-The SSO will identify key spill response personnel to assist in the spill control and cleanup procedures.

## 7.0 TRAINING

### GENERAL HEALTH AND SAFETY TRAINING
In accordance with 29 CFR 1910.120, all construction personnel involved with the portions of the scope of work described in Section 2.0 will be briefed by the Project Manager on the potential hazards and the overall requirements in meeting the specifications of this Construction HASP.

The SSO will have the responsibility of ensuring that personnel assigned to this project comply with these requirements. Written certification of completion of any required training, if necessary, will be provided to the SSO.

### MANAGER/SUPERVISOR TRAINING
In accordance with 29 CFR 1910.120, on-Site management and supervisors who will be directly responsible for, or who supervise employees engaged in hazardous waste operation shall receive training as required in this Construction HASP and at least eight (8) additional hours of specialized training on managing such operations at the time of job assignment.

### ANNUAL 8-HOUR REFRESHER TRAINING
Annual 8-hour refresher training will be required of all hazardous waste site field personnel in order to maintain their qualification for fieldwork. The following topics will be reviewed: toxicology, respiratory protection, including air purifying devices and self-contained breathing apparatus (SCBA), medical surveillance, decontamination procedures and personnel protective clothing. In addition, topics deemed necessary by the SSO may be added to the above list.

**SITE SPECIFIC TRAINING**
Prior to commencement of field activities, all personnel assigned to the project will be provided training that will specifically address the activities, procedures, monitoring, and equipment for the site operations. It will include Site and facility layout, hazards, and emergency services at the Site, and will highlight all provisions contained within this Construction HASP. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity.

**ON-SITE SAFETY BRIEFINGS**
Project personnel and visitors will be given periodic on-site health and safety briefings by the SSO, or their designee, to assist site personnel in safely conducting their work activities. The briefings will include information on new operations to be conducted, changes in work practices, or changes in the Site's environmental conditions. The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety audits.

**ADDITIONAL TRAINING**
Additional training may be required by the SSO for participation in certain field tasks during the course of the project. Such additional training could be in the safe operation of heavy or power tool equipment or hazard communication training.

**HAZWOPER TRAINING**
All remedial personnel that will be in direct contact with the native soil/fill materials must complete an initial 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training course and, where necessary, a current 8-hour refresher course

**SUBCONTRACTOR TRAINING**
Subcontractor personnel working on-site may be exempted from the contents of this Construction HASP. The SSO will determine if this exemption is allowed. In any case, the subcontractor personnel who are exposed to hazards are not exempted from the contents of this Construction HASP.

## 8.0 MEDICAL SURVEILLANCE

**GENERAL**
No general or specific medical surveillance or other medical requirements are set forth in this Construction HASP.

## 9.0 SITE CONTROL, PPE & COMMUNICATIONS

**SITE CONTROL**
The area where the activities of the scope of work will be performed is considered to be the Exclusion Zone (EZ). All areas where excavation and handling of contaminated materials take place are considered the EZ. This zone will be clearly delineated by cones, tape, or other means. The SSO may establish more than one EZ where different levels of protection may be employed or where different hazards exist. Personnel are not allowed in the EZ without:

- A buddy
- Appropriate personal protective equipment (as necessary)

The remaining portions of the Site outside of the EZ will consist of a Support Zone (SZ) and a Contamination Reduction Zone (CRZ). Appropriate sanitary facilities, safety equipment, packaged/decontaminated and labeled samples will be located in SZ. Potentially contaminated personnel or materials will be allowed in the CRZ for decontamination as necessary.

**PERSONAL PROTECTIVE EQUIPMENT**

*General*

The level of protection worn by field personnel will be enforced by the SSO. Levels of protection may be upgraded or downgraded at the discretion of the SSO. The decision shall be based on real-time air monitoring, site history data, and prior site experience. Any changes in the level of protection shall be recorded in the health and safety field logbook.

*PPE Specifications*

For tasks requiring Level C PPE, the following equipment shall be used:

- Cotton or disposable coveralls
- Disposable outer coveralls (Poly-coated Tyvek)
- Gloves, inner (latex)
- Gloves, outer (Nitrile®)
- Boots (PVC), steel toe/shank
- Boot covers (as needed)
- Hard Hat
- Hearing protection (as needed)
- Splash suit and face shield for decontamination operations (as needed)

For tasks requiring Level D PPE, the following equipment shall be used:

- Cotton or disposable coveralls
- Gloves, inner (latex)
- Gloves, outer (Nitrile®)
- Boots (PVC) steel toe/shank
- Boot covers (as needed)
- Hard hat
- Hearing protection (as needed)
- Safety glasses

For tasks requiring Level D PPE, the following equipment shall be used:

- Cotton or disposable coveralls
- Gloves, inner (latex)
- Gloves, outer (Nitrile®)
- Boots (PVC) steel toe/shank
- Boot covers (as needed)
- Hard hat
- Hearing protection (as needed)

- Safety glasses

For tasks requiring respiratory protection, the following equipment shall be used:

Level D - No respiratory protective equipment necessary except for a dust mask
Level C - A full-face air-purifying respirator equipped with organic vapor/pesticide-HEPA cartridges
Level B - An air line respirator or a self-contained breathing apparatus (SCBA)

***LEVEL OF PERSONAL PROTECTIVE EQUIPMENT REQUIRED***

| **Activity** | **Level of Protection Respiratory/PPE** |
|---|---|
| Excavations | C/D |
| Foundation Construction | C/D |

**COMMUNICATIONS**
Communications is the ability to talk with others. While working in Level C Protection, personnel may find that communication become a more difficult task and process to accomplish. This is further complicated by distance and space. In order to address this problem, electronic instruments, mechanical devices or hand signals will be used as follows:

- Walkie-Talkies - Hand held radios would be utilized as much as possible by field teams for communication between downrange operations and the Command Post base station.

- Telephones - A mobile telephone will be located in the Command Post vehicle in the Support Zone for communication with emergency support services/facilities. If a telephone is demobilized, the nearest public phones will be identified.
- Air Horns - A member of the downrange field team will carry an air horn and another will be evident in the Support Zone to alert field personnel to an emergency situation.

- Hand Signals - Members of the field team using the buddy system will employ this communication method. Signals become especially important when in the vicinity of heavy moving equipment and when using Level B respiratory equipment. The signals shall become familiar to the entire field team before site operations commence and they will be reinforced and reviewed during site-specific training.

***HAND SIGNALS FOR ON-SITE COMMUNICATION***

| **Signal** | **Meaning** |
|---|---|
| Hand gripping throat | Out of air, can't breathe |
| Grip partners' wrist | Leave area immediately; no debate |
| Hands on top of head | Need assistance |
| Thumbs up | OK, I'm all right; I understand |
| Thumbs down | No; negative, unable to understand you. I'm not all right |

## 10.0 AIR MONITORING PLAN

### GENERAL

Continuous air monitoring in the EZ during invasive tasks will accompany site operations, as indicated in this HASP or as required by the SSO. Monitoring will be performed to verify the adequacy of respiratory protection, to aid in site layout and to document work exposure. All monitoring instruments shall be operated by qualified personnel only and will be calibrated daily prior to use, or more often as necessary. For additional references and information, see Hydro Tech's Site-Specific Air Monitoring Program.

### REAL-TIME MONITORING

*Instrumentation*

A PID (to monitor total volatile organic concentrations) will be used to measure worker breathing zone ambient on-site concentrations during on-site activities. The equipment will be calibrated daily and the results noted in the project field book. A background level will be established, at a minimum, on a daily basis, and recorded in the field book.

The following response actions will be taken based on PID readings in the breathing zone. All work will be performed in level D PPE unless breathing zone volatile organic concentrations exceed 5 ppm. Once levels of 25 ppm are measured, work will be stopped.

| | | | |
|---|---|---|---|
| Volatile Organics | Photoionization Detector (PID) | >5ppm | Temporarily halt work activities & monitor until readings decrease to below 5ppm. |
| | | >5ppm<25ppm | Halt work activities, upgrade to level C continue monitoring. |
| | | >25ppm | Shut down work activities |

During soil excavation, particulate monitoring will be performed using a real-time particulate monitor that will monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

Object to be measured: Dust. Mists, Aerosols
Size range: < 0.1 to 10 microns
Sensitivity: 0.001 mg/m3
Overall Accuracy: = 10% as compared to gravimetric analysis of stearic acid or reference dust.

Particulate levels will be monitored immediately downwind at the working site and integrated over a period not to exceed 15 minutes. The action level will be established at 150 ug/m3 over the

integrated period not to exceed 15 minutes.

*Action Levels*
Action levels for upgrading of PPE in this Construction HASP will apply to all site work during the duration of field activities at the Site. The action level is the presence of visible airborne dust. When airborne dust is observed, specific dust-mitigating procedures will be implemented. These dust-mitigating procedures are documented in Section 6.0.

## 11.0 SAFETY CONSIDERATIONS

### GENERAL
In addition to the specific requirements of this HASP, common sense should be used at all times. The general safety rules and practices below will be in effect at the Site at the discretion of the Project Manager, SSO or other authorized personnel.

- The site will be suitably marked or barricaded as necessary to prevent unauthorized visitors but not hinder emergency services if needed.

- As needed, all open holes, trenches, and obstacles will be properly barricaded in accordance with local site requirements. These requirements will be determined by proximity to traffic ways, both pedestrian and vehicular, and site of the hole, trench, or obstacle. If holes are required to be left open during non-working hours, they will be adequately decked over or barricaded and sufficiently lighted.

- Before any digging or boring operations are conducted, underground utility locations will be identified. All boring, excavation, and other site work will be planned and performed with consideration for underground lines. Any excavation work will be performed in accordance with Hydro Tech's Standard Operating Procedures for Excavations.

- Either workers or other people will enact dust-mitigating procedures when the potential for the inhalation of dust particles is present.

- The act of smoking and/or ignition sources in the vicinity of potentially flammable or contaminated material is strictly prohibited.

- Drilling, boring, and use of cranes and drilling rigs, erection of towers, movement of vehicles and equipment and other activities will be planned and performed with consideration for the location, height, and relative position of aboveground utilities and fixtures, including signs; canopies; building and other structures and construction; and natural features such as trees, boulders, bodies of water, and terrain.

- When working in areas where flammable vapors may be present, particular care shall be exercised with tools and equipment that may be sources of ignition. All tools and equipment provided must be properly bonded and/or grounded. Metal buttons and zippers are prohibited on safety clothing for areas that may contain a flammable or explosive atmosphere.

- Approved and appropriate safety equipment (as specified in this Construction HASP), such as eye protection, hard hats, foot protection, and respirators, must be worn in areas where

required. In addition, eye protection must be worn when sampling soil or water that may be contaminated.

- No smoking, eating, chewing tobacco, gum chewing, or drinking will be allowed in the contaminated areas.
- Contaminated tools and hands must be kept away from the face.
- Personnel must use personal hygiene safe guards (washing up) at the end of the shift or as soon as possible after leaving the Site.
- Each sample must be treated and handled as though it were contaminated.
- Persons with long hair and/or loose fitting clothing that could become entangled in power equipment must take adequate precautions.
- Horseplay is prohibited in the work area.
- Work while under the influence of intoxicants, narcotics, or controlled substances is prohibited.

**POSTED SIGNS**

Posted danger signs will be used where an immediate hazard exists. Caution signs will be posted to warn against potential hazards and to caution against unsafe practices. Traffic control methods and barricades will be used as needed. Wooden stakes and flagging tape, or equally effective material will be used to demarcate all restricted areas.

Other postings may include the OSHA poster, emergency hospital route, and telephone numbers of contact personnel.

**INVASIVE OPERATIONS**

The SSO will be present on-Site during all invasive work (e.g. excavations and capping). The SSO will ensure that appropriate monitoring, levels of protection, and safety procedures are followed. No personnel will enter any excavations for any reasons. All non-essential personnel will stay at least 10 feet back from the edge of the excavation and out of the swing radius of the backhoe. No drums or other potential sources will be sampled or removed during this phase without further additions to the Construction HASP.

The proximity of water, sewer, and electrical lines will be identified prior to invasive operations. The possibility of the presence of underground conduits or vessels containing materials under pressure will also be investigated prior to invasive operations. Properly-sized containment systems will be utilized and consideration of the potential volume of liquid or waste released during operations will be discussed with members of the field team to minimize the potential for spills and provide a method for collection of waste materials. Emergency evacuation procedures and the location of safety equipment will be established prior to start up operations. The use of protective clothing, especially hard hats, boots, and gloves will be required during drilling and other heavy equipment work.

**SOIL, GROUNDWATER AND LIQUID WASTE SAMPLING**

During Site invasive excavation, soil sampling for waste characterization may be required for

disposal purposes. No groundwater or liquid waste sampling is anticipated during site remediation.

**HEAVY EQUIPMENT DECONTAMINATION**
Personnel steam cleaning heavy equipment, if necessary shall use the prescribed level of protection and adhere to the buddy system. Initially this task usually employs Level C. The heavy equipment decontamination shall be restricted to authorized personnel only. Special consideration will be given to wind speed and direction. Downwind areas are to be kept free of personnel to avoid unnecessary exposure to potential airborne contamination.

**ADDITIONAL SAFETY CONSIDERATIONS**
No other additional safety considerations at this time.

## 12.0 DECONTAMINATION AND DISPOSAL PROCEDURES

**CONTAMINATION PREVENTION**
One of the most important aspects of decontamination is the prevention of contamination. Good contamination prevention should minimize worker exposure and help ensure valid sample results by precluding cross-contamination. Procedures for contamination avoidance include:

Personnel:
Do not walk through areas of obvious or known contamination.
Do not directly handle or touch contaminated materials.
Make sure that there are no cuts or tears on PPE.
Fasten all closures in suits; cover with tape if necessary.
Particular care should be taken to prevent any skin injuries.
Stay upwind of airborne contaminants.
Do not carry cigarettes, cosmetics, gum, etc. into contaminated areas.

Sampling and Monitoring:
When required by the SSO, cover instruments with clear plastic, leaving openings for sampling ports. Keep all decontaminated sampling materials in bags prior to emplacement of sample matrix.

Heavy Equipment:
Care should be taken to limit the amount of contamination that comes in contact with heavy equipment (tires). Dust control measures may be needed on roads inside the site boundaries.

**PERSONNEL DECONTAMINATION**
All personnel shall pass through an outlined decontamination procedure when exiting the hot zone at each location. A field wash for equipment and PPE shall be set up at each work location. The system will include a gross wash and rinse for all disposable clothing and boots worn in the EZ. Upon exiting the EZ, all personnel will wash their hands, arms, neck, and face before entering the Support Zone.

**EQUIPMENT DECONTAMINATION**
Equipment used at the Site that is potentially contaminated shall be decontaminated to prevent hazardous materials from leaving the Site. All heavy equipment will be decontaminated at the decontamination pad and inspected by the SSO and Project Manager before it leaves the Site. The decontamination area will provide for the containment of all wastewater from the decontamination process. Respirators, airline and any other personnel equipment that comes in contact with contaminated soils shall pass through a field wash.

**DECONTAMINATION DURING MEDICAL EMERGENCIES**
If emergency life-saving first aid and/or medical treatment are required, normal decontamination procedures may need to be abbreviated or omitted. The Site SSO or designee will accompany contaminated victims to the medical facility to provide advice on matters involving decontamination, when necessary. The outer garments can be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Respiratory equipment must always be removed. Protective clothing can be cut away. If the outer contaminated garments cannot be safely removed, a plastic barrier between the individual and clean surfaces should be used to help prevent contaminating the inside of ambulances and /or medical personnel. Outer garments are then removed at the medical facility.

No attempt will be made to wash or rinse the victim, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material that could also cause severe injury or loss of life to emergency response personnel. For minor medical problems or injuries, the normal decontamination procedures will be followed. Note that heat stroke requires prompt treatment to prevent irreversible damage or death. Protective clothing must be promptly removed. Less serious forms of heat stress also require prompt attention and removal of protective clothing immediately. Decontamination should be omitted or minimized and treatment begun immediately unless the victim is obviously contaminated.

**DISPOSAL PROCEDURES**
The SSO and Project Manager will develop a segregating system of non-hazardous waste and hazardous waste. All discarded material, waste materials, or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating sanitary hazards, or causing litter to be left on site. All potentially contaminated materials, e.g. clothing, gloves, etc., will be bagged or drummed as necessary, labeled and segregated for disposal. All non-contaminated materials shall be collected and bagged for appropriate disposal as normal domestic waste.

## 13.0 EMERGENCY PLAN

The potential for the development of an emergency situation is low considering the low concentrations of hazardous substances at the work site. Nevertheless, an emergency situation could occur. All personnel, prior to the start of work, will know the emergency plan outlined in this section. The emergency plan will be available for use at all times during site work.

Various individual site characteristics will determine preliminary actions taken to assure that this emergency plan is successfully implemented in the event of a site emergency. Careful

consideration must be given to the proximity of neighborhood housing or places of employment, and to the relative possibility of site fire, explosion or release of vapors or gases that could affect the surrounding community.

The Project Manager shall make contact with local fire, police, and other emergency units prior to beginning work on site. In these contacts, the Project Manager will inform the emergency units about the nature and duration of work expected to the Site and the type of contaminants and the possible health or safety effects of emergencies involving these contaminants. At this time, the Project Manager and the emergency response units shall make the necessary arrangements to be prepared for any emergencies that could occur.

The Project Manager shall implement the contingency plan whenever conditions at the Site warrant such action. The Project Manager will be responsible for coordination of the evacuation emergency treatment, and transportation of site personnel as necessary, and notification of emergency response units and the appropriate management staff.

**EVACUATION**

In the event of an emergency situation, such as fire, explosion, or significant release of toxic gases, an air horn or other appropriate device will be sounded for approximately 10 second intervals indicating the initiation of evacuation procedures. All personnel will evacuate and assemble near the entrance to the site. The location shall be upwind of the Site where possible.

For efficient and safe site evacuation and assessment of the emergency situation, the Project Manager will have authority to initiate action if outside services are required. Under no circumstances will incoming personnel or visitors be allowed to proceed into the area once the emergency signal has been given. The SSO or designated SSO must ensure that access for emergency equipment is provided and that all combustion apparatuses have been shut down once the alarm has been sounded. Once the safety of all personnel is established, the Fire Department and other emergency response groups as necessary will be notified by telephone of the emergency.

**POTENTIAL OR ACTUAL FIRE OR EXPLOSION**

Immediately evacuate the Site (air horn will sound for 10-second intervals), notify the local fire and police departments, and other appropriate emergency response groups if an actual fire or explosion has taken place.

**PERSONNEL INJURY**

Emergency first aid shall be applied on site as deemed necessary. If necessary, the individual shall be decontaminated and transported to the nearest medical facility.

The ambulance/rescue squad shall be contacted for transport as necessary in an emergency. However, since some situations may require transport of an injured party by other means, the hospital route is identified below. A map to this facility provided with this HASP in Section 2.2.3.

**ACCIDENT/INCIDENT REPORTING**

As soon as first aid and/or emergency response needs have been met, the employer of the injured party must be immediately notified of any incident. Written confirmation of verbal reports is to be submitted within 24 hours. A standard report form entitled "Accident Data

Report" is to be used for this purpose.

For reporting purposes, the term accident refers to fatalities, lost time injuries, spill, or exposure to hazardous materials (toxic materials, explosive or flammable materials).

Any information released from the health care provider, which is not deemed confidential patient information, is to be attached to the appropriate form. Any medical information that is released by patient consent is to be filed in the individuals' medical records and treated as confidential.

**OVERT PERSONNEL EXPOSURE**

| | |
|---|---|
| SKIN CONTACT: | Use copious amounts of soap and water. Wash/rinse affected area thoroughly, and then provide appropriate medical attention. Eyes should be rinsed for 15 minutes upon chemical contamination. |
| INHALATION: | Move personnel to fresh air and if necessary, decontaminate and transport to hospital. |
| INGESTION: | Decontamination and transport to emergency medical facility. |
| PUNCTURE WOUND OR LACERATION: | Decontaminate and transport to emergency medical facility. |

**ADVERSE WEATHER CONDITIONS**

In the event of adverse weather conditions, the SSO or designee will determine if work can continue without sacrificing the health and safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

* Potential for heat stress and heat-related injuries
* Potential for cold stress and cold-related injuries
* Treacherous weather-related conditions
* Limited visibility
* Potential for electrical storms

Site activities will be limited to daylight hours and acceptable weather conditions. Inclement working conditions include heavy rain, fog, high winds, and lighting. Observe daily weather reports and evacuate if necessary in case of inclement weather conditions.

**EMERGENCY RESPONSE EQUIPMENT LIST**

Some or all of the following will either be available on-Site or be able to be brought to the Site within a 2-hour period:

* 55 Gallon Drums
* 85 Gallon Drums
* Absorbent Pads
* Absorbent Booms
* Speedy-Dry
* Plastic Sheeting
* Hay Bales
* Pneumatic Nibbler

* Back Hoe
* Pressure Washer
* Air Compressor
* Wilden Pumps
* Equipment Storage Trailer
* Submersible Pumps
* Miscellaneous Hand Tools
* Portable Lighting

**LARGE EQUIPMENT**
If necessary, the following large equipment will be brought to the Site within 2-hours:

* Large Vacuum Truck
* Super Sucker
* Dump Trucks
* Drill Rig
* Utility Vehicle

## 14.0 LOGS, REPORTS AND RECORD KEEPING

### Medical and Training Records

The Site Superintendent keeps medical and training records. All subcontractors must provide verification of training and medical qualifications to the Site Superintendent. The Site Superintendent will keep a log of personnel meeting appropriate training and medical qualifications for site work. The log will be kept in the project file. Medical records will be maintained in accordance with 29 CFR 1910.20.

### Onsite Log

A log of personnel onsite each day will be kept by the Site Superintendent. Originals will be kept in the project file.

### Exposure Records

Any monitoring results, laboratory reports, calculations and air sampling data sheets are part of an employee exposure record. These records will be kept in accordance with 29 CFR 1910.20. The originals will be sent to the Hydro Tech records coordinator. For subcontractor employees, the original will be sent to the subcontractor employer and a copy kept in the project file.

### Accident/Incident Reports

An accident/incident report must be completed for all accidents and incidents. Hydro Tech will send the originals to the appropriate Hydro Tech records coordinator for maintenance. Copies will be distributed as stated. A copy of the forms will be kept in the project file.

### OSHA Form 200

An OSHA Form 200 (Log of Occupational Injuries and Illnesses) will be kept at the Site. All recordable injuries or illnesses will be recorded on this form. At the end of the project, the

original will be sent to the Hydro Tech corporate records administrator for maintenance. Subcontractor employers must also meet the requirements of maintaining an OSHA 200 form. The Hydro Tech accident/incident report meets the requirements of the OSHA Form 101 (Supplemental Record) and must be maintained with the OSHA Form 200 for all recordable injuries or illnesses.

**Health and Safety Field Log Book**

The SSO or designee will maintain the logbook in accordance with standard Hydro Tech procedures. Daily site conditions, activities, personnel, calibration records, monitoring results and significant events will be recorded. The original logbooks will become part of the exposure records file.

## 15.0 SANITATION

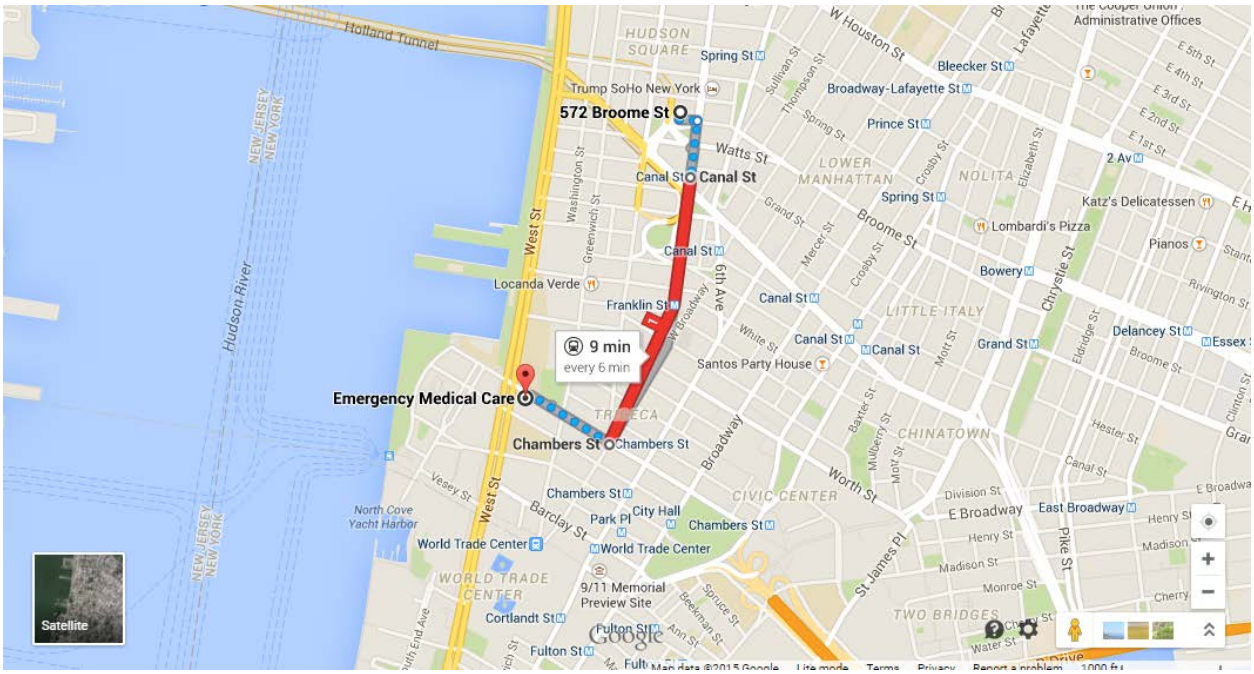
Since sanitary sewer connection has not been established, provisions shall be made for access to sanitary systems by using nearby public facilities consistent with provisions of governing local ordinance codes. This will include the use of outside firms providing and maintaining "Porta Potties" or similar devices.

If a commercial/industrial laundry is used to clean or launder clothing that is potentially contaminated, they shall be informed of the potential harmful effects of exposure to hazardous substances related to the affected clothing.

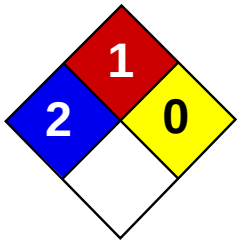
Personnel and subcontractors sites shall follow decontamination procedures described in the Construction HASP. This will generally include, when necessary, site-specific training in shower usage and cleanup, personal hygiene requirements and the donning of protective equipment/clothing.

**FIGURE 1**

**DIRECTIONS TO EMERGENCY MEDICAL CARE**



**ATTACHMENT A**
**HEALTH AND SAFETY FACT SHEETS**




| | |
|---|---|
| Health | 2 |
| Fire | 1 |
| Reactivity | 0 |
| Personal Protection | H |

# Material Safety Data Sheet
## Trichloroethylene MSDS

## Section 1: Chemical Product and Company Identification

**Product Name:** Trichloroethylene

**Catalog Codes:** SLT3310, SLT2590

**CAS#:** 79-01-6

**RTECS:** KX4560000

**TSCA:** TSCA 8(b) inventory: Trichloroethylene

**CI#:** Not available.

**Synonym:**

**Chemical Formula:** C2HCl3

**Contact Information:**

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

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

Order Online: ScienceLab.com

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

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

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

## Section 2: Composition and Information on Ingredients

**Composition:**

| Name | CAS # | % by Weight |
|---|---|---|
| Trichloroethylene | 79-01-6 | 100 |

**Toxicological Data on Ingredients:** Trichloroethylene: ORAL (LD50): Acute: 5650 mg/kg [Rat]. 2402 mg/kg [Mouse]. DERMAL (LD50): Acute: 20001 mg/kg [Rabbit].

## Section 3: Hazards Identification

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

**Potential Chronic Health Effects:**
CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract. Repeated or prolonged exposure to the substance can produce target organs damage.

## Section 4: First Aid Measures

**Eye Contact:**

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

**Skin Contact:**
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

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

**Inhalation:** Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

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

**Ingestion:**
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

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

**Auto-Ignition Temperature:** 420°C (788°F)

**Flash Points:** Not available.

**Flammable Limits:** LOWER: 8% UPPER: 10.5%

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

**Fire Hazards in Presence of Various Substances:** Not available.

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

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

**Special Remarks on Fire Hazards:** Not available.

**Special Remarks on Explosion Hazards:** Not available.

## Section 6: Accidental Release Measures

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

**Large Spill:**
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

## Section 7: Handling and Storage

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

spray. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes

**Storage:**
Keep container dry. Keep in a cool place. Ground all equipment containing material. Carcinogenic, teratogenic or mutagenic materials should be stored in a separate locked safety storage cabinet or room.

## Section 8: Exposure Controls/Personal Protection

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

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

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

**Exposure Limits:**
TWA: 50 STEL: 200 (ppm) from ACGIH (TLV) TWA: 269 STEL: 1070 (mg/m3) from ACGIH Consult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

**Physical state and appearance:** Liquid.

**Odor:** Not available.

**Taste:** Not available.

**Molecular Weight:** 131.39 g/mole

**Color:** Clear Colorless.

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

**Boiling Point:** 86.7°C (188.1°F)

**Melting Point:** -87.1°C (-124.8°F)

**Critical Temperature:** Not available.

**Specific Gravity:** 1.4649 (Water = 1)

**Vapor Pressure:** 58 mm of Hg (@ 20°C)

**Vapor Density:** 4.53 (Air = 1)

**Volatility:** Not available.

**Odor Threshold:** 20 ppm

**Water/Oil Dist. Coeff.:** The product is equally soluble in oil and water; log(oil/water) = 0

**Ionicity (in Water):** Not available.

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

**Solubility:**
Easily soluble in methanol, diethyl ether, acetone. Very slightly soluble in cold water.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Not available.

**Incompatibility with various substances:** Not available.

**Corrosivity:**
Extremely corrosive in presence of aluminum. Non-corrosive in presence of glass.

**Special Remarks on Reactivity:** Not available.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** No.

## Section 11: Toxicological Information

**Routes of Entry:** Dermal contact. Eye contact. Inhalation. Ingestion.

**Toxicity to Animals:**
Acute oral toxicity (LD50): 2402 mg/kg [Mouse]. Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit].

**Chronic Effects on Humans:**
CARCINOGENIC EFFECTS: Classified + (PROVEN) by OSHA. Classified A5 (Not suspected for human.) by ACGIH. The substance is toxic to kidneys, the nervous system, liver, heart, upper respiratory tract.

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

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:** Passes through the placental barrier in human. Detected in maternal milk in human.

**Special Remarks on other Toxic Effects on Humans:** Not available.

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

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

**Toxicity of the Products of Biodegradation:** The products of degradation are more toxic.

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

**Waste Disposal:**

## Section 14: Transport Information

**DOT Classification:** CLASS 6.1: Poisonous material.

**Identification:** : Trichloroethylene : UN1710 PG: III

**Special Provisions for Transport:** Not available.

## Section 15: Other Regulatory Information

**Federal and State Regulations:**
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Trichloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Trichloroethylene Pennsylvania RTK: Trichloroethylene Florida: Trichloroethylene Minnesota: Trichloroethylene Massachusetts RTK: Trichloroethylene New Jersey: Trichloroethylene TSCA 8(b) inventory: Trichloroethylene CERCLA: Hazardous substances.: Trichloroethylene

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

**Other Classifications:**

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

**DSCL (EEC):**
R36/38- Irritating to eyes and skin. R45- May cause cancer.

**HMIS (U.S.A.):**

**Health Hazard:** 2

**Fire Hazard:** 1

**Reactivity:** 0

**Personal Protection:** h

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

**Health:** 2

**Flammability:** 1

**Reactivity:** 0

**Specific hazard:**

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

## Section 16: Other Information

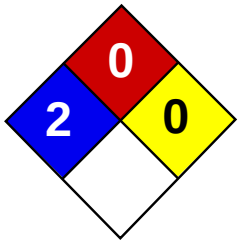
**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/10/2005 08:54 PM

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

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




| | |
|---|---|
| Health | 2 |
| Fire | 0 |
| Reactivity | 0 |
| Personal Protection | G |

# Material Safety Data Sheet
## Tetrachloroethylene MSDS

## Section 1: Chemical Product and Company Identification

**Product Name:** Tetrachloroethylene

**Catalog Codes:** SLT3220

**CAS#:** 127-18-4

**RTECS:** KX3850000

**TSCA:** TSCA 8(b) inventory: Tetrachloroethylene

**CI#:** Not available.

**Synonym:** Perchloroethylene; 1,1,2,2-Tetrachloroethylene; Carbon bichloride; Carbon dichloride; Ankilostin; Didakene; Dilatin PT; Ethene, tetrachloro-; Ethylene tetrachloride; Perawin; Perchlor; Perclene; Perclene D; Percosolvel; Tetrachloroethene; Tetraleno; Tetralex; Tetravec; Tetroguer; Tetropil

**Chemical Name:** Ethylene, tetrachloro-

**Chemical Formula:** C2-Cl4

**Contact Information:**

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

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

Order Online: ScienceLab.com

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

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

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

## Section 2: Composition and Information on Ingredients

**Composition:**

| Name | CAS # | % by Weight |
|---|---|---|
| Tetrachloroethylene | 127-18-4 | 100 |

**Toxicological Data on Ingredients:** Tetrachloroethylene: ORAL (LD50): Acute: 2629 mg/kg [Rat]. DERMAL (LD): Acute: >3228 mg/kg [Rabbit]. MIST(LC50): Acute: 34200 mg/m 8 hours [Rat]. VAPOR (LC50 ): Acute: 5200 ppm 4 hours [Mouse].

## Section 3: Hazards Identification

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

**Potential Chronic Health Effects:**
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (anticipated carcinogen) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, peripheral nervous system, respiratory tract, skin, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

## Section 4: First Aid Measures

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

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

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

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

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

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

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

**Flammability of the Product:** Non-flammable.

**Auto-Ignition Temperature:** Not applicable.

**Flash Points:** Not applicable.

**Flammable Limits:** Not applicable.

**Products of Combustion:** Not available.

**Fire Hazards in Presence of Various Substances:** Not applicable.

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

**Fire Fighting Media and Instructions:** Not applicable.

**Special Remarks on Fire Hazards:** Not available.

**Special Remarks on Explosion Hazards:** Not available.

## Section 6: Accidental Release Measures

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

**Large Spill:**
Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

## Section 7: Handling and Storage

**Precautions:**
Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with skin. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, metals, acids, alkalis.

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

## Section 8: Exposure Controls/Personal Protection

**Engineering Controls:**
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

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

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

**Exposure Limits:**
TWA: 25 (ppm) from OSHA (PEL) [United States] TWA: 25 STEL: 100 (ppm) from ACGIH (TLV) [United States] TWA: 170 (mg/m3) from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

**Physical state and appearance:** Liquid.

**Odor:** Ethereal.

**Taste:** Not available.

**Molecular Weight:** 165.83 g/mole

**Color:** Clear Colorless.

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

**Boiling Point:** 121.3°C (250.3°F)

**Melting Point:** -22.3°C (-8.1°F)

**Critical Temperature:** 347.1°C (656.8°F)

**Specific Gravity:** 1.6227 (Water = 1)

**Vapor Pressure:** 1.7 kPa (@ 20°C)

**Vapor Density:** 5.7 (Air = 1)

**Volatility:** Not available.

**Odor Threshold:** 5 - 50 ppm

**Water/Oil Dist. Coeff.:** The product is more soluble in oil; log(oil/water) = 3.4

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

**Solubility:**
Miscible with alcohol, ether, chloroform, benzene, hexane. It dissolves in most of the fixed and volatile oils. Solubility in water: 0.015 g/100 ml @ 25 deg. C It slowly decomposes in water to yield Trichloroacetic and Hydrochloric acids.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Incompatible materials

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

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:**
Oxidized by strong oxidizing agents. Incompatible with sodium hydroxide, finely divided or powdered metals such as zinc, aluminum, magnesium, potassium, chemically active metals such as lithium, beryllium , barium. Protect from light.

**Special Remarks on Corrosivity:** Slowly corrodes aluminum, iron, and zinc.

**Polymerization:** Will not occur.

## Section 11: Toxicological Information

**Routes of Entry:** Absorbed through skin. Eye contact. Inhalation. Ingestion.

**Toxicity to Animals:**
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2629 mg/kg [Rat]. Acute dermal toxicity (LD50): >3228 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 5200 4 hours [Mouse].

**Chronic Effects on Humans:**
CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (Some evidence.) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. May cause damage to the following organs: kidneys, liver, peripheral nervous system, upper respiratory tract, skin, central nervous system (CNS).

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

**Special Remarks on Toxicity to Animals:**
Lowest Publishe Lethal Dose/Conc: LDL [Rabbit] - Route: Oral; Dose: 5000 mg/kg LDL [Dog] - Route: Oral; Dose: 4000 mg/kg LDL [Cat] - Route: Oral; Dose: 4000 mg/kg

**Special Remarks on Chronic Effects on Humans:**
May cause adverse reproductive effects and birth defects(teratogenic). May affect genetic material (mutagenic). May cause cancer.

**Special Remarks on other Toxic Effects on Humans:**
Acute Potential Health Effects: Skin: Causes skin irritation with possible dermal blistering or burns. Symtoms may include redness, itching, pain, and possible dermal blistering or burns. It may be absorbed through the skin with possible systemic effects. A single prolonged skin exposure is not likely to result in the material being absorbed in harmful amounts. Eyes: Contact causes transient eye irritation, lacrimation. Vapors cause eye/conjunctival irritation. Symptoms may include redness and pain. Inhalation: The main route to occupational exposure is by inhalation since it is readily absorbed through the lungs. It causes respiratory tract irritation, . It can affect behavior/central nervous system (CNS depressant and anesthesia ranging from slight inebriation to death, vertigo, somnolence, anxiety, headache, excitement, hallucinations, muscle incoordination, dizziness, lightheadness, disorentiation, seizures, enotional instability, stupor, coma). It may cause pulmonary edema Ingestion: It can cause nausea, vomiting, anorexia, diarrhea, bloody stool. It may affect the liver, urinary system (proteinuria, hematuria, renal failure, renal tubular disorder), heart (arrhythmias). It may affect behavior/central nervous system with symptoms similar to that of inhalation. Chronic Potential Health Effects: Skin: Prolonged or repeated skin contact may result in excessive drying of the skin, and irritation. Ingestion/Inhalation: Chronic exposure can affect the liver(hepatitis,fatty liver degeneration), kidneys, spleen, and heart (irregular heartbeat/arrhythmias, cardiomyopathy, abnormal EEG), brain, behavior/ central nervous system/peripheral nervous system (impaired memory, numbness of extremeties, peripheral neuropathy and other

## Section 12: Ecological Information

**Ecotoxicity:**
Ecotoxicity in water (LC50): 18.4 mg/l 96 hours [Fish (Fatthead Minnow)]. 18 mg/l 48 hours [Daphnia (daphnia)]. 5 mg/l 96 hours [Fish (Rainbow Trout)]. 13 mg/l 96 hours [Fish (Bluegill sunfish)].

**BOD5 and COD:** Not available.

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

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

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

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

## Section 14: Transport Information

**DOT Classification:** CLASS 6.1: Poisonous material.

**Identification:** : Tetrachloroethylene UNNA: 1897 PG: III

**Special Provisions for Transport:** Marine Pollutant

## Section 15: Other Regulatory Information

**Federal and State Regulations:**
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Tetrachloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Tetrachloroethylene Connecticut hazardous material survey.: Tetrachloroethylene Illinois toxic substances disclosure to employee act: Tetrachloroethylene Illinois chemical safety act: Tetrachloroethylene New York release reporting list: Tetrachloroethylene Rhode Island RTK hazardous substances: Tetrachloroethylene Pennsylvania RTK: Tetrachloroethylene Minnesota: Tetrachloroethylene Michigan critical material: Tetrachloroethylene Massachusetts RTK: Tetrachloroethylene Massachusetts spill list: Tetrachloroethylene New Jersey: Tetrachloroethylene New Jersey spill list: Tetrachloroethylene Louisiana spill reporting: Tetrachloroethylene California Director's List of Hazardous Substances: Tetrachloroethylene TSCA 8(b) inventory: Tetrachloroethylene TSCA 8(d) H and S data reporting: Tetrachloroethylene: Effective date: 6/1/87; Sunset date: 6/1/97 SARA 313 toxic chemical notification and release reporting: Tetrachloroethylene CERCLA: Hazardous substances.: Tetrachloroethylene: 100 lbs. (45.36 kg)

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

**Other Classifications:**

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

**DSCL (EEC):**
R40- Possible risks of irreversible effects. R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. S23- Do not breathe gas/fumes/vapour/spray S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S37- Wear suitable gloves. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

**HMIS (U.S.A.):**

**Health Hazard:** 2

**Fire Hazard:** 0

**Reactivity:** 0

**Personal Protection:** g

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

**Health:** 2

**Flammability:** 0

**Reactivity:** 0

**Specific hazard:**

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

## Section 16: Other Information

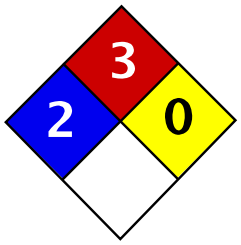
**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/10/2005 08:29 PM

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

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




| | |
|---|---|
| Health | 2 |
| Fire | 3 |
| Reactivity | 0 |
| Personal Protection | H |

# Material Safety Data Sheet
## p-Xylene MSDS

## Section 1: Chemical Product and Company Identification

**Product Name:** p-Xylene

**Catalog Codes:** SLX1120

**CAS#:** 106-42-3

**RTECS:** ZE2625000

**TSCA:** TSCA 8(b) inventory: p-Xylene

**CI#:** Not applicable.

**Synonym:** p-Methyltoluene

**Chemical Name:** 1,4-Dimethylbenzene

**Chemical Formula:** C6H4(CH3)2

**Contact Information:**

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

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

Order Online: ScienceLab.com

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

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

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

## Section 2: Composition and Information on Ingredients

**Composition:**

| Name | CAS # | % by Weight |
|---|---|---|
| {p-}Xylene | 106-42-3 | 100 |

**Toxicological Data on Ingredients:** p-Xylene: ORAL (LD50): Acute: 5000 mg/kg [Rat.]. DERMAL (LD50): Acute: 12400 mg/kg [Rabbit.]. VAPOR (LC50): Acute: 4550 ppm 4 hour(s) [Rat].

## Section 3: Hazards Identification

**Potential Acute Health Effects:**
Very hazardous in case of skin contact (irritant), of eye contact (irritant). Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

**Potential Chronic Health Effects:**
Hazardous in case of skin contact (irritant), of eye contact (irritant).
Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to blood, kidneys, the nervous system, liver.
Repeated or prolonged exposure to the substance can produce target organs damage.

## Section 4: First Aid Measures

**Eye Contact:** Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

**Skin Contact:**
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

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

**Inhalation:** Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

**Serious Inhalation:** Not available.

**Ingestion:**
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

**Flammability of the Product:** Flammable.

**Auto-Ignition Temperature:** 527°C (980.6°F)

**Flash Points:** CLOSED CUP: 25°C (77°F). OPEN CUP: 28.9°C (84°F) (Cleveland).

**Flammable Limits:** LOWER: 1.1% UPPER: 7%

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

**Fire Hazards in Presence of Various Substances:** Highly flammable in presence of open flames and sparks, of heat.

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

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

**Special Remarks on Fire Hazards:**
Explosive in the form of vapor when exposed to heat or flame. Vapor may travel considerable distance to source of ignition and flash back. When heated to decomposition it emits acrid smoke and irritating fumes.

**Special Remarks on Explosion Hazards:** Not available.

## Section 6: Accidental Release Measures

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

**Large Spill:**
Toxic flammable liquid, insoluble or very slightly soluble in water.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

## Section 7: Handling and Storage

**Precautions:**
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes Keep away from incompatibles such as oxidizing agents.

**Storage:**
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

## Section 8: Exposure Controls/Personal Protection

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

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

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

**Exposure Limits:**
TWA: 100 STEL: 150 (ppm) from ACGIH (TLV)
TWA: 434 STEL: 651 (mg/m3) from ACGIHConsult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

**Physical state and appearance:** Liquid. (Liquid.)

**Odor:** Not available.

**Taste:** Not available.

**Molecular Weight:** 106.17 g/mole

**Color:** Colorless.

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

**Boiling Point:** 138°C (280.4°F)

**Melting Point:** 12°C (53.6°F)

**Critical Temperature:** Not available.

**Specific Gravity:** 0.86 (Water = 1)

**Vapor Pressure:** 9 mm of Hg (@ 20°C)

**Vapor Density:** 3.7 (Air = 1)

**Volatility:** Not available.

**Odor Threshold:** 0.62 ppm

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** See solubility in water, methanol, diethyl ether.

**Solubility:**
Easily soluble in methanol, diethyl ether.
Insoluble in cold water, hot water.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Not available.

**Incompatibility with various substances:** Reactive with oxidizing agents.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:** Not available.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** No.

## Section 11: Toxicological Information

**Routes of Entry:** Eye contact.

**Toxicity to Animals:**
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 5000 mg/kg [Rat.].
Acute dermal toxicity (LD50): 12400 mg/kg [Rabbit.].
Acute toxicity of the vapor (LC50): 4550 ppm 4 hour(s) [Rat].

**Chronic Effects on Humans:** The substance is toxic to blood, kidneys, the nervous system, liver.

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

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:**

0347 Animal: embryotoxic, foetotoxic, passes through the placental barrier.
0900 Detected in maternal milk in human.
Narcotic effect; may cause nervous system disturbances.

**Special Remarks on other Toxic Effects on Humans:** Material is irritating to mucous membranes and upper respiratory tract.

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

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

**Toxicity of the Products of Biodegradation:** The products of degradation are more toxic.

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

**Waste Disposal:**

## Section 14: Transport Information

**DOT Classification:** Class 3: Flammable liquid.

**Identification:** : Xylene : UN1307 PG: III

**Special Provisions for Transport:** Not available.

## Section 15: Other Regulatory Information

**Federal and State Regulations:**
Pennsylvania RTK: p-Xylene
Florida: p-Xylene
Massachusetts RTK: p-Xylene
New Jersey: p-Xylene
TSCA 8(b) inventory: p-Xylene
SARA 313 toxic chemical notification and release reporting: p-Xylene
CERCLA: Hazardous substances.: p-Xylene

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

**Other Classifications:**

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

**DSCL (EEC):**
R10- Flammable.
R38- Irritating to skin.
R41- Risk of serious damage to eyes.
R48/20- Harmful: danger of serious

damage to health by prolonged exposure through inhalation.

**HMIS (U.S.A.):**

**Health Hazard:** 2

**Fire Hazard:** 3

**Reactivity:** 0

**Personal Protection:** h

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

**Health:** 2

**Flammability:** 3

**Reactivity:** 0

**Specific hazard:**

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

## Section 16: Other Information

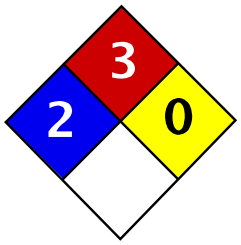
**References:**
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
-Material safety data sheet emitted by: la Commission de la SantÃ© et de la SÃ©curitÃ© du Travail du QuÃ©bec.
-SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
-Guide de la loi et du rÃ¨glement sur le transport des marchandises dangeureuses au canada. Centre de conformitÃ© internatinal LtÃ©e. 1986.

**Other Special Considerations:** Not available.

**Created:** 10/10/2005 08:33 PM

**Last Updated:** 10/10/2005 08:33 PM

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




| | |
|---|---|
| Health | 2 |
| Fire | 3 |
| Reactivity | 0 |
| Personal Protection | J |

# Material Safety Data Sheet
## m-Xylene MSDS

## Section 1: Chemical Product and Company Identification

**Product Name:** m-Xylene

**Catalog Codes:** SLX1066

**CAS#:** 108-38-3

**RTECS:** ZE2275000

**TSCA:** TSCA 8(b) inventory: m-Xylene

**CI#:** Not applicable.

**Synonym:** m-Methyltoluene

**Chemical Name:** 1,3-Dimethylbenzene

**Chemical Formula:** C6H4(CH3)2

**Contact Information:**

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

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

Order Online: ScienceLab.com

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

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

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

## Section 2: Composition and Information on Ingredients

**Composition:**

| Name | CAS # | % by Weight |
|---|---|---|
| {m-}Xylene | 108-38-3 | 100 |

**Toxicological Data on Ingredients:** m-Xylene: ORAL (LD50): Acute: 5000 mg/kg [Rat.]. DERMAL (LD50): Acute: 14100 mg/kg [Rabbit.].

## Section 3: Hazards Identification

**Potential Acute Health Effects:**
Very hazardous in case of skin contact (irritant), of eye contact (irritant). Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

**Potential Chronic Health Effects:**
Hazardous in case of skin contact (irritant), of eye contact (irritant).
Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to blood, kidneys, the nervous system, liver.
Repeated or prolonged exposure to the substance can produce target organs damage.

## Section 4: First Aid Measures

**Eye Contact:** Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

**Skin Contact:**
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

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

**Inhalation:** Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

**Serious Inhalation:** Not available.

**Ingestion:**
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

**Flammability of the Product:** Flammable.

**Auto-Ignition Temperature:** 527°C (980.6°F)

**Flash Points:** CLOSED CUP: 25°C (77°F). OPEN CUP: 28.9°C (84°F) (Cleveland).

**Flammable Limits:** LOWER: 1.1% UPPER: 7%

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

**Fire Hazards in Presence of Various Substances:** Highly flammable in presence of open flames and sparks, of heat.

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

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

**Special Remarks on Fire Hazards:**
Explosive in the form of vapor when exposed to heat or flame. Vapor may travel considerable distance to source of ignition and flash back. When heated to decomposition it emits acrid smoke and irritating fumes.

**Special Remarks on Explosion Hazards:** Not available.

## Section 6: Accidental Release Measures

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

**Large Spill:**
Flammable liquid, insoluble in water.

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

## Section 7: Handling and Storage

**Precautions:**
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes Keep away from incompatibles such as oxidizing agents.

**Storage:**
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

## Section 8: Exposure Controls/Personal Protection

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

**Personal Protection:** Splash goggles. Lab coat. Gloves.

**Personal Protection in Case of a Large Spill:**
Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

**Exposure Limits:**
TWA: 100 STEL: 150 (ppm) from ACGIH (TLV)
TWA: 434 STEL: 651 (mg/m3) from ACGIHConsult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

**Physical state and appearance:** Liquid. (Liquid.)

**Odor:** Not available.

**Taste:** Not available.

**Molecular Weight:** 106.17 g/mole

**Color:** Colorless.

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

**Boiling Point:** 139.3°C (282.7°F)

**Melting Point:** -47.87°C (-54.2°F)

**Critical Temperature:** Not available.

**Specific Gravity:** 0.86 (Water = 1)

**Vapor Pressure:** 6 mm of Hg (@ 20°C)

**Vapor Density:** 3.7 (Air = 1)

**Volatility:** Not available.

**Odor Threshold:** 0.62 ppm

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** See solubility in water, methanol, diethyl ether.

**Solubility:**
Easily soluble in methanol, diethyl ether.
Insoluble in cold water, hot water.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Not available.

**Incompatibility with various substances:** Reactive with oxidizing agents.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:** Not available.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** No.

## Section 11: Toxicological Information

**Routes of Entry:** Eye contact.

**Toxicity to Animals:**
Acute oral toxicity (LD50): 5000 mg/kg [Rat.].
Acute dermal toxicity (LD50): 14100 mg/kg [Rabbit.].

**Chronic Effects on Humans:** The substance is toxic to blood, kidneys, the nervous system, liver.

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

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:**
0347 Animal: embryotoxic, foetotoxic, passes through the placental barrier.
0900 Detected in maternal milk in human.
Narcotic effect; may cause nervous system disturbances.

**Special Remarks on other Toxic Effects on Humans:** Material is irritating to mucous membranes and upper respiratory tract.

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

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

**Toxicity of the Products of Biodegradation:** The products of degradation are more toxic.

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

**Waste Disposal:**

## Section 14: Transport Information

**DOT Classification:** Class 3: Flammable liquid.

**Identification:** : Xylene : UN1307 PG: III

**Special Provisions for Transport:** Not available.

## Section 15: Other Regulatory Information

**Federal and State Regulations:**
Pennsylvania RTK: m-Xylene
Massachusetts RTK: m-Xylene
TSCA 8(b) inventory: m-Xylene
SARA 313 toxic chemical notification and release reporting: m-Xylene
CERCLA: Hazardous substances.: m-Xylene

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

**Other Classifications:**

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

**DSCL (EEC):**
R10- Flammable.
R38- Irritating to skin.
R41- Risk of serious damage to eyes.

**HMIS (U.S.A.):**

**Health Hazard:** 2

**Fire Hazard:** 3

**Reactivity:** 0

**Personal Protection:** j

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

**Health:** 2

**Flammability:** 3

**Reactivity:** 0

**Specific hazard:**

**Protective Equipment:**
Gloves.
Lab coat.
Wear appropriate respirator when
ventilation is inadequate.
Splash goggles.

## Section 16: Other Information

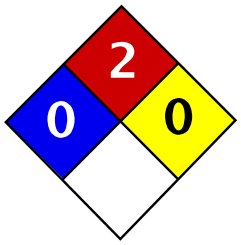
**References:**
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
-Material safety data sheet emitted by: la Commission de la SantÃ© et de la SÃ©curitÃ© du Travail du QuÃ©bec.
-SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
-Guide de la loi et du rÃ¨glement sur le transport des marchandises dangeureuses au canada. Centre de conformitÃ© internatinal LtÃ©e. 1986.

**Other Special Considerations:** Not available.

**Created:** 10/10/2005 08:33 PM

**Last Updated:** 10/10/2005 08:33 PM

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




| | |
|---|---|
| Health | 0 |
| Fire | 2 |
| Reactivity | 0 |
| Personal Protection | H |

# Material Safety Data Sheet
## Mesitylene MSDS

## Section 1: Chemical Product and Company Identification

**Product Name:** Mesitylene

**Catalog Codes:** SLM2410

**CAS#:** 108-67-8

**RTECS:** OX6825000

**TSCA:** TSCA 8(b) inventory: Mesitylene

**CI#:** Not available.

**Synonym:** 1,3,5-Trimethylbenzene

**Chemical Formula:** C9H12

**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 |
|---|---|---|
| Mesitylene | 108-67-8 | 100 |

**Toxicological Data on Ingredients:** Mesitylene: VAPOR (LC50): Acute: 4881.9 ppm 4 hour(s) [Rat].

## Section 3: Hazards Identification

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

**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. Immediately flush eyes with running water for at least 15 minutes,

keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

**Skin Contact:**
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

**Serious Skin Contact:** Not available.

**Inhalation:** Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

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

**Ingestion:**
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

**Flammability of the Product:** Flammable.

**Auto-Ignition Temperature:** 559°C (1038.2°F)

**Flash Points:** CLOSED CUP: 43°C (109.4°F).

**Flammable Limits:** Not available.

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

**Fire Hazards in Presence of Various Substances:** Not available.

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

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

**Special Remarks on Fire Hazards:** Not available.

**Special Remarks on Explosion Hazards:** Not available.

## Section 6: Accidental Release Measures

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

**Large Spill:**
Flammable liquid.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Be careful that the product is not present at a

concentration level above TLV. Check TLV on the MSDS and with local authorities.

## Section 7: Handling and Storage

**Precautions:**
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. Avoid contact with eyes Wear suitable protective clothing If ingested, seek medical advice immediately and show the container or the label.

**Storage:**
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. Keep container dry. Keep in a cool place.

## Section 8: Exposure Controls/Personal Protection

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

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

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

**Exposure Limits:**
TWA: 25 CEIL: 35 (ppm)
TWA: 125 CEIL: 170 (mg/m3)
Consult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

**Physical state and appearance:** Liquid.

**Odor:** Aromatic.

**Taste:** Not available.

**Molecular Weight:** 120.2 g/mole

**Color:** Not available.

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

**Boiling Point:** 164.7°C (328.5°F)

**Melting Point:** -44.8°C (-48.6°F)

**Critical Temperature:** Not available.

**Specific Gravity:** 0.8637 (Water = 1)

**Vapor Pressure:** 1.86 mm of Hg (@ 20°C)

**Vapor Density:** 4.14 (Air = 1)

**Volatility:** Not available.

**Odor Threshold:** 0.23 ppm

**Water/Oil Dist. Coeff.:** The product is equally soluble in oil and water; log(oil/water) = 0

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

**Solubility:** Very slightly soluble in cold water.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Not available.

**Incompatibility with various substances:** Not available.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:** Not available.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** No.

## Section 11: Toxicological Information

**Routes of Entry:** Eye contact. Ingestion.

**Toxicity to Animals:**
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute toxicity of the vapor (LC50): 4881.9 ppm 4 hour(s) [Rat].

**Chronic Effects on Humans:** Not available.

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

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:** Not available.

**Special Remarks on other Toxic Effects on Humans:** Not available.

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

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

**Toxicity of the Products of Biodegradation:** The products of degradation are more toxic.

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

**Waste Disposal:**

## Section 14: Transport Information

**DOT Classification:** Class 3: Flammable liquid.

**Identification:** : 1,3,5-Trimethylbenzene : UN2325 PG: III

**Special Provisions for Transport:** Marine Pollutant

## Section 15: Other Regulatory Information

**Federal and State Regulations:**
Florida: Mesitylene
New Jersey: Mesitylene
TSCA 8(b) inventory: Mesitylene

**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-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F).

**DSCL (EEC):**
R10- Flammable.
R36/37- Irritating to eyes and respiratory system.

**HMIS (U.S.A.):**

**Health Hazard:** 0

**Fire Hazard:** 2

**Reactivity:** 0

**Personal Protection:** h

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

**Health:** 0

**Flammability:** 2

**Reactivity:** 0

**Specific hazard:**

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

## Section 16: Other Information

**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/09/2005 06:06 PM

**Last Updated:** 10/09/2005 06:06 PM

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

# International Chemical Safety Cards

## BENZO(B)FLUORANTHENE

**ICSC: 0720**

BENZO(B)FLUORANTHENE
Benzo(e)acephenanthrylene
2,3-Benzofluoroanthene
$C_{20}H_{12}$
Molecular mass: 252.3

CAS # 205-99-2
RTECS # CU1400000
ICSC # 0720

| TYPES OF HAZARD/ EXPOSURE | ACUTE HAZARDS/ SYMPTOMS | PREVENTION | FIRST AID/ FIRE FIGHTING |
|---|---|---|---|
| **FIRE** | Combustible. | NO open flames. | Water spray, powder. |
| **EXPLOSION** | | | |
| **EXPOSURE** | | PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID ALL CONTACT! | IN ALL CASES CONSULT A DOCTOR! |
| • **INHALATION** | | Local exhaust or breathing protection. | Fresh air, rest. |
| • **SKIN** | MAY BE ABSORBED! | Protective gloves. Protective clothing. | Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid. |
| • **EYES** | | Safety goggles or eye protection in combination with breathing protection. | First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor. |
| • **INGESTION** | | Do not eat, drink, or smoke during work. | Wear protective gloves when inducing vomiting. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention. |

| SPILLAGE DISPOSAL | STORAGE | PACKAGING & LABELLING |
|---|---|---|
| Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment. | Provision to contain effluent from fire extinguishing. Tightly closed. | Unbreakable packaging; put breakable packaging into closed unbreakable container. |

**SEE IMPORTANT INFORMATION ON BACK**

**ICSC: 0720**

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993

# International Chemical Safety Cards

# BENZO(B)FLUORANTHENE

**ICSC: 0720**

| | | |
|---|---|---|
| **I M P O R T A N T D A T A** | **PHYSICAL STATE; APPEARANCE:**<br>COLOURLESS TO YELLOW CRYSTALS.<br><br>**PHYSICAL DANGERS:**<br><br>**CHEMICAL DANGERS:**<br>Upon heating, toxic fumes are formed.<br><br>**OCCUPATIONAL EXPOSURE LIMITS (OELs):**<br>TLV not established. | **ROUTES OF EXPOSURE:**<br>The substance can be absorbed into the body by inhalation of its aerosol and through the skin.<br><br>**INHALATION RISK:**<br>Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.<br><br>**EFFECTS OF SHORT-TERM EXPOSURE:**<br><br>**EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:**<br>This substance is possibly carcinogenic to humans. |
| **PHYSICAL PROPERTIES** | Melting point: 168°C<br>Solubility in water: none | Vapour pressure, Pa at 20°C: <10<br>Octanol/water partition coefficient as log Pow: 6.04 |
| **ENVIRONMENTAL DATA** | This substance may be hazardous to the environment; special attention should be given to the total environment. In the food chain important to humans, bioaccumulation takes place, specifically in oils and fats. | |

**NOTES**

Depending on the degree of exposure, periodic medical examination is indicated. Data are insufficiently available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home.

**ADDITIONAL INFORMATION**

**ICSC: 0720** **BENZO(B)FLUORANTHENE**

© IPCS, CEC, 1993


| | |
|---|---|
| **IMPORTANT LEGAL NOTICE:** | Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. |

# International Chemical Safety Cards

## BENZO(K)FLUORANTHENE

**ICSC: 0721**

BENZO(K)FLUOROANTHENE
11,12-Benzofluoroanthene
Dibenzo(b,j,k)fluorene
$C_{20}H_{12}$
Molecular mass: 252.3

CAS # 207-08-9
RTECS # DF6350000
ICSC # 0721

| TYPES OF HAZARD/ EXPOSURE | ACUTE HAZARDS/ SYMPTOMS | PREVENTION | FIRST AID/ FIRE FIGHTING |
|---|---|---|---|
| **FIRE** | Combustible. | NO open flames. | Water spray, powder. |
| **EXPLOSION** | | | |
| **EXPOSURE** | | PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID ALL CONTACT! | IN ALL CASES CONSULT A DOCTOR! |
| • **INHALATION** | | Local exhaust or breathing protection. | Fresh air, rest. Refer for medical attention. |
| • **SKIN** | MAY BE ABSORBED! | Protective gloves. Protective clothing. | Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid. |
| • **EYES** | | Safety goggles or eye protection in combination with breathing protection if powder. | First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor. |
| • **INGESTION** | | Do not eat, drink, or smoke during work. | Wear protective gloves when inducing vomiting. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention. |

| SPILLAGE DISPOSAL | STORAGE | PACKAGING & LABELLING |
|---|---|---|
| Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment. | Provision to contain effluent from fire extinguishing. Separated from strong oxidants. Tightly closed. | |

**SEE IMPORTANT INFORMATION ON BACK**

**ICSC: 0721**

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993

# International Chemical Safety Cards

# BENZO(K)FLUORANTHENE

**ICSC: 0721**

| | | |
|---|---|---|
| **I M P O R T A N T D A T A** | **PHYSICAL STATE; APPEARANCE:**<br>YELLOW CRYSTALS.<br><br>**PHYSICAL DANGERS:**<br><br>**CHEMICAL DANGERS:**<br>Upon heating, toxic fumes are formed. Reacts with strong oxidants.<br><br>**OCCUPATIONAL EXPOSURE LIMITS (OELs):**<br>TLV not established. | **ROUTES OF EXPOSURE:**<br>The substance can be absorbed into the body by inhalation of its aerosol and through the skin.<br><br>**INHALATION RISK:**<br>Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.<br><br>**EFFECTS OF SHORT-TERM EXPOSURE:**<br><br>**EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:**<br>This substance is possibly carcinogenic to humans. |
| **PHYSICAL PROPERTIES** | Boiling point: 480°C<br>Melting point: 215.7°C | Solubility in water: none<br>Octanol/water partition coefficient as log Pow: 6.84 |
| **ENVIRONMENTAL DATA** | This substance may be hazardous to the environment; special attention should be given to the total environment. In the food chain important to humans, bioaccumulation takes place, specifically in oils and fats. | |

**NOTES**

Data are insufficiently available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home.

**ADDITIONAL INFORMATION**

**ICSC: 0721** **BENZO(K)FLUORANTHENE**

© IPCS, CEC, 1993


| | |
|---|---|
| **IMPORTANT LEGAL NOTICE:** | Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. |

# International Chemical Safety Cards

## BENZ(a)ANTHRACENE

**ICSC: 0385**

BENZ(a)ANTHRACENE
1,2-Benzoanthracene
Benzo(a)anthracene
2,3-Benzphenanthrene
Naphthanthracene
$C_{18}H_{12}$
Molecular mass: 228.3

CAS # 56-55-3
RTECS # CV9275000
ICSC # 0385
EC # 601-033-00-9

| TYPES OF HAZARD/ EXPOSURE | ACUTE HAZARDS/ SYMPTOMS | PREVENTION | FIRST AID/ FIRE FIGHTING |
|---|---|---|---|
| **FIRE** | Combustible. | | Water spray, powder. In case of fire in the surroundings: all extinguishing agents allowed. |
| **EXPLOSION** | Finely dispersed particles form explosive mixtures in air. | Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting. | |
| **EXPOSURE** | | AVOID ALL CONTACT! | |
| • **INHALATION** | | Local exhaust or breathing protection. | Fresh air, rest. |
| • **SKIN** | | Protective gloves. Protective clothing. | Remove contaminated clothes. Rinse and then wash skin with water and soap. |
| • **EYES** | | Safety goggles, face shield, or eye protection in combination with breathing protection. | First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor. |
| • **INGESTION** | | Do not eat, drink, or smoke during work. Wash hands before eating. | Rinse mouth. |

| SPILLAGE DISPOSAL | STORAGE | PACKAGING & LABELLING |
|---|---|---|
| Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: complete protective clothing including self-contained breathing apparatus). | Well closed. | T symbol<br>R: 45<br>S: 53-45 |

**SEE IMPORTANT INFORMATION ON BACK**

**ICSC: 0385**

Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993

# International Chemical Safety Cards

## BENZ(a)ANTHRACENE

**ICSC: 0385**

**IMPORTANT DATA**

**PHYSICAL STATE; APPEARANCE:**
COLOURLESS TO YELLOW-BROWN FLUORESCENT FLAKES OR POWDER.

**PHYSICAL DANGERS:**
Dust explosion possible if in powder or granular form, mixed with air.

**CHEMICAL DANGERS:**

**OCCUPATIONAL EXPOSURE LIMITS (OELs):**
TLV not established.

**ROUTES OF EXPOSURE:**
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

**INHALATION RISK:**
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

**EFFECTS OF SHORT-TERM EXPOSURE:**

**EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:**
This substance is probably carcinogenic to humans.

**PHYSICAL PROPERTIES**

Sublimation point: 435°C
Melting point: 162°C
Relative density (water = 1): 1.274

Solubility in water: none
Vapour pressure, Pa at 20°C: 292
Octanol/water partition coefficient as log Pow: 5.61

**ENVIRONMENTAL DATA**

In the food chain important to humans, bioaccumulation takes place, specifically in seafood.

**NOTES**

This substance is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, it may be encountered as a laboratory chemical in its pure form. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home. Tetraphene is a common name.

**ADDITIONAL INFORMATION**



© IPCS, CEC, 1993

| | |
|---|---|
| **IMPORTANT LEGAL NOTICE:** | Neither the CEC or the IPCS nor any person acting on behalf of the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. |

# Material Safety Data Sheet

## Benzo[a]pyrene, 98%

ACC# 37175

## Section 1 - Chemical Product and Company Identification

**MSDS Name:** Benzo[a]pyrene, 98%
**Catalog Numbers:** AC105600000, AC105600010, AC105601000, AC377200000, AC377200010, AC377201000 AC377201000
**Synonyms:** 3,4-Benzopyrene; 3,4-Benzpyrene; Benzo[def]chrysene.
**Company Identification:**

Acros Organics 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 |
|---|---|---|---|
| 50-32-8 | Benzo[a]pyrene | >96 | 200-028-5 |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: yellow to brown powder.
**Danger!** May cause harm to the unborn child. May impair fertility. May cause eye, skin, and respiratory tract irritation. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Cancer hazard. May cause allergic skin reaction. May cause heritable genetic damage.
**Target Organs:** Reproductive system, skin.

### Potential Health Effects

**Eye:** May cause eye irritation.
**Skin:** May cause skin irritation. May be harmful if absorbed through the skin. May cause an allergic reaction in certain individuals.
**Ingestion:** May cause irritation of the digestive tract. The toxicological properties of this substance have not been fully investigated. May be harmful if swallowed.
**Inhalation:** May cause respiratory tract irritation. The toxicological properties of this substance have not been fully investigated. May be harmful if inhaled.
**Chronic:** May cause cancer in humans. May cause reproductive and fetal effects. Laboratory experiments have resulted in mutagenic effects.

## Section 4 - First Aid Measures

**Eyes:** Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.
**Skin:** Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.
**Ingestion:** Never give anything by mouth to an unconscious person. Get medical aid. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.
**Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
**Notes to Physician:** Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.
**Extinguishing Media:** Use water spray, dry chemical, carbon dioxide, or appropriate foam.
**Flash Point:** Not available.
**Autoignition Temperature:** Not available.
**Explosion Limits, Lower:**Not available.
**Upper:** Not available.
**NFPA Rating:** (estimated) Health: 2; Flammability: 0; Instability: 0

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.
**Spills/Leaks:** Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.
**Storage:** Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.
**Exposure Limits**

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| | | | |

| | | | |
|---|---|---|---|
| Benzo[a]pyrene | 0.2 mg/m3 TWA (as benzene soluble aerosol) (listed under Coal tar pitches). | 0.1 mg/m3 TWA (cyclohexane-extractable fraction) (listed under Coal tar pitches).80 mg/m3 IDLH (listed under Coal tar pitches). | 0.2 mg/m3 TWA (as benzene soluble fraction) (listed under Coal tar pitches). |

**OSHA Vacated PELs:** Benzo[a]pyrene: No OSHA Vacated PELs are listed for this chemical.
**Personal Protective Equipment**
**Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
**Skin:** Wear appropriate protective gloves to prevent skin exposure.
**Clothing:** Wear appropriate protective clothing to prevent skin exposure.
**Respirators:** A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

## Section 9 - Physical and Chemical Properties

**Physical State:** Powder
**Appearance:** yellow to brown
**Odor:** faint aromatic odor
**pH:** Not available.
**Vapor Pressure:** Not available.
**Vapor Density:** Not available.
**Evaporation Rate:**Not available.
**Viscosity:** Not available.
**Boiling Point:** 495 deg C @ 760 mm Hg
**Freezing/Melting Point:**175 - 179 deg C
**Decomposition Temperature:**Not available.
**Solubility:** 1.60x10-3 mg/l @25°C
**Specific Gravity/Density:**Not available.
**Molecular Formula:**C20H12
**Molecular Weight:**252.31

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures.
**Conditions to Avoid:** Dust generation.
**Incompatibilities with Other Materials:** Strong oxidizing agents.
**Hazardous Decomposition Products:** Carbon monoxide, carbon dioxide.
**Hazardous Polymerization:** Has not been reported.

## Section 11 - Toxicological Information

**RTECS#:**
**CAS#** 50-32-8: DJ3675000
**LD50/LC50:**

Not available.

**Carcinogenicity:**
CAS# 50-32-8:

- **ACGIH:** A2 - Suspected Human Carcinogen
- **California:** carcinogen, initial date 7/1/87
- **NTP:** Suspect carcinogen
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

**Epidemiology:** No information found
**Teratogenicity:** No information found
**Reproductive Effects:** Adverse reproductive effects have occurred in experimental animals.
**Mutagenicity:** Mutagenic effects have occurred in humans.Mutagenic effects have occurred in experimental animals.
**Neurotoxicity:** No information found
**Other Studies:**

## Section 12 - Ecological Information

No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
**RCRA P-Series:** None listed.
**RCRA U-Series:**
CAS# 50-32-8: waste number U022.

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| **Shipping Name:** | NOT REGULATED FOR DOMESTIC TRANSPORT | ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOL (Benzo{a} pyrene) |
| **Hazard Class:** | | 9 |
| **UN Number:** | | UN3077 |
| **Packing Group:** | | III |

## Section 15 - Regulatory Information

### US FEDERAL

**TSCA**

CAS# 50-32-8 is listed on the TSCA inventory.

**Health & Safety Reporting List**

None of the chemicals are on the Health & Safety Reporting List.

**Chemical Test Rules**

None of the chemicals in this product are under a Chemical Test Rule.

**Section 12b**

None of the chemicals are listed under TSCA Section 12b.

**TSCA Significant New Use Rule**

None of the chemicals in this material have a SNUR under TSCA.

**CERCLA Hazardous Substances and corresponding RQs**

CAS# 50-32-8: 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 # 50-32-8: immediate, delayed.

**Section 313**

This material contains Benzo[a]pyrene (CAS# 50-32-8, >96%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR

**Clean Air Act:**

This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

**Clean Water Act:**

None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 50-32-8 is listed as a Priority Pollutant under the Clean Water Act.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

**OSHA:**

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

**STATE**

CAS# 50-32-8 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

**California Prop 65**

**The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:**

WARNING: This product contains Benzo[a]pyrene, a chemical known to the state of California to cause cancer.

California No Significant Risk Level: CAS# 50-32-8: 0.06 æg/day NSRL

## European / International Regulations

**European Labeling in Accordance with EC Directives**

**Hazard Symbols:**

T N

**Risk Phrases:**

R 43 May cause sensitization by skin contact.
R 45 May cause cancer.
R 46 May cause heritable genetic damage.
R 60 May impair fertility.
R 61 May cause harm to the unborn child.
R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

**Safety Phrases:**

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

S 53 Avoid exposure - obtain special instructions before use.
S 60 This material and its container must be disposed of as hazardou
s waste.
S 61 Avoid release to the environment. Refer to special instructions
/safety data sheets.

**WGK (Water Danger/Protection)**
CAS# 50-32-8: No information available.
**Canada - DSL/NDSL**
CAS# 50-32-8 is listed on Canada's DSL List.
**Canada - WHMIS**
This product has a WHMIS classification of D2A.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.
**Canadian Ingredient Disclosure List**
CAS# 50-32-8 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

**MSDS Creation Date:** 9/02/1997
**Revision #7 Date:** 6/30/2006

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

# Material Safety Data Sheet

Chrysene, 98%

ACC# 95251

## Section 1 - Chemical Product and Company Identification

**MSDS Name:** Chrysene, 98%
**Catalog Numbers:** AC224140000, AC224140010, AC224140050, AC224145000
**Synonyms:** 1,2-Benzophenanthrene; Benzo(a)phenanthrene; 1,2,5,6-Dibenzonaphthalene.
**Company Identification:**

Acros Organics 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 |
|---|---|---|---|
| 218-01-9 | Chrysene | 98 | 205-923-4 |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: very light beige solid.
**Caution!** May cause eye and skin irritation. May cause respiratory tract irritation. May cause cancer in humans.
**Target Organs:** Liver, skin.

**Potential Health Effects**
**Eye:** May cause eye irritation.
**Skin:** May cause skin irritation.
**Ingestion:** May cause gastrointestinal irritation with nausea, vomiting and diarrhea.
**Inhalation:** May cause respiratory tract irritation.
**Chronic:** May cause cancer according to animal studies.

## Section 4 - First Aid Measures

**Eyes:** Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.
**Skin:** Get medical aid. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.
**Ingestion:** Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.
**Inhalation:** Get medical aid immediately. Remove from exposure and move to fresh air

immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
**Notes to Physician:** Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. This material in sufficient quantity and reduced particle size is capable of creating a dust explosion.
**Extinguishing Media:** Use water spray, dry chemical, carbon dioxide, or chemical foam.
**Flash Point:** Not applicable.
**Autoignition Temperature:** Not available.
**Explosion Limits, Lower:**Not available.
**Upper:** Not available.
**NFPA Rating:** (estimated) Health: ; Flammability: 1; Instability:

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.
**Spills/Leaks:** Vacuum or sweep up material and place into a suitable disposal container. Clean up spills immediately, observing precautions in the Protective Equipment section. Wear a self contained breathing apparatus and appropriate personal protection. (See Exposure Controls, Personal Protection section). Provide ventilation.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Wash hands before eating. Avoid contact with eyes, skin, and clothing. Use only with adequate ventilation. Avoid breathing dust.
**Storage:** Store in a tightly closed container. Store in a cool, dry area away from incompatible substances.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels.
**Exposure Limits**

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| Chrysene | 0.2 mg/m3 TWA (as benzene soluble aerosol) (listed under Coal tar pitches). | 0.1 mg/m3 TWA (cyclohexane-extractable fraction) (listed under Coal tar pitches).80 mg/m3 IDLH (listed under Coal tar pitches). | 0.2 mg/m3 TWA (as benzene soluble fraction) (listed under Coal tar pitches). |

**OSHA Vacated PELs:** Chrysene: No OSHA Vacated PELs are listed for this chemical.
**Personal Protective Equipment**
**Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
**Skin:** Wear appropriate protective gloves to prevent skin exposure.
**Clothing:** Wear appropriate protective clothing to prevent skin exposure.
**Respirators:** Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

## Section 9 - Physical and Chemical Properties

**Physical State:** Solid
**Appearance:** very light beige
**Odor:** Not available.
**pH:** Not available.
**Vapor Pressure:** Not available.
**Vapor Density:** Not available.
**Evaporation Rate:**Not available.
**Viscosity:** Not available.
**Boiling Point:** 448 deg C @ 760 mm Hg
**Freezing/Melting Point:**250-255 deg C
**Decomposition Temperature:**Not available.
**Solubility:** insoluble
**Specific Gravity/Density:**Not available.
**Molecular Formula:**C18H12
**Molecular Weight:**228.29

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures.
**Conditions to Avoid:** Dust generation.
**Incompatibilities with Other Materials:** Strong oxidizing agents.
**Hazardous Decomposition Products:** Carbon monoxide, carbon dioxide.
**Hazardous Polymerization:** Has not been reported.

## Section 11 - Toxicological Information

**RTECS#:**
**CAS#** 218-01-9: GC0700000
**LD50/LC50:**
Not available.

**Carcinogenicity:**
CAS# 218-01-9:

- **ACGIH:** A3 - Confirmed animal carcinogen with unknown relevance to humans

- **California:** carcinogen, initial date 1/1/90
- **NTP:** Known carcinogen (listed as Coal tar pitches).
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

**Epidemiology:** No information found
**Teratogenicity:** No information found
**Reproductive Effects:** No information found
**Mutagenicity:** Chrysene was mutagenic to S. Typhimurium in the presence of an exogenous metabolic system.
**Neurotoxicity:** No information found
**Other Studies:**

## Section 12 - Ecological Information

**Ecotoxicity:** Water flea LC50 = 1.9 mg/L; 2 Hr.; Unspecified Fish toxicity : LC50 (96hr) Neauthes arenacedentata >1ppm.(Rossi,S.S. et al Marine Pollut. Bull. 1978) Invertebrate toxicity : lethal treshold concentration (24hr) Daphnia Magna 0,7æg/l.(* Newsted,J.L. et al Environ. Toxicol. Chem. 1987) Bioaccumulation : 24hr Daphnia Magna log bioconcentration factor 3.7845 (*)
**Environmental:** Degradation studies : biodegradated by white rot fungus (Proc.Annu.Meet.Am.Wood-Preserv.Assoc.1989) May be utilised by axenic cultures of microorganisms e.g. Pseudomonas pancimobilis EPA505, which may have novel degradative systems(Mueller,J.G. et al ppl.Environ.Microbiol.1990; Mueller, J.G. et al Environ.Sci.Technol.1991).
**Physical:** Not found.
**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# 218-01-9: waste number U050.

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| **Shipping Name:** | Not regulated as a hazardous material | No information available. |
| **Hazard Class:** | | |
| **UN Number:** | | |
| **Packing Group:** | | |

## Section 15 - Regulatory Information

## US FEDERAL

**TSCA**

CAS# 218-01-9 is listed on the TSCA inventory.

**Health & Safety Reporting List**

None of the chemicals are on the Health & Safety Reporting List.

**Chemical Test Rules**

None of the chemicals in this product are under a Chemical Test Rule.

**Section 12b**

None of the chemicals are listed under TSCA Section 12b.

**TSCA Significant New Use Rule**

None of the chemicals in this material have a SNUR under TSCA.

**CERCLA Hazardous Substances and corresponding RQs**

CAS# 218-01-9: 100 lb final RQ; 45.4 kg final RQ

**SARA Section 302 Extremely Hazardous Substances**

None of the chemicals in this product have a TPQ.

**Section 313**

This material contains Chrysene (CAS# 218-01-9, 98%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

**Clean Air Act:**

This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

**Clean Water Act:**

None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 218-01-9 is listed as a Priority Pollutant under the Clean Water Act.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

**OSHA:**

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

**STATE**

CAS# 218-01-9 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

**California Prop 65**

**The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:**

WARNING: This product contains Chrysene, a chemical known to the state of California to cause cancer.
California No Significant Risk Level: CAS# 218-01-9: 0.35 æg/day NSRL (oral)

## European / International Regulations

**European Labeling in Accordance with EC Directives**

**Hazard Symbols:**

T

**Risk Phrases:**

R 45 May cause cancer.
R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

**Safety Phrases:**

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 53 Avoid exposure - obtain special instructions before use.
S 60 This material and its container must be disposed of as hazardou s waste.

S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

**WGK (Water Danger/Protection)**

CAS# 218-01-9: No information available.

**Canada - DSL/NDSL**

CAS# 218-01-9 is listed on Canada's DSL List.

**Canada - WHMIS**

This product has a WHMIS classification of D2A.

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

**Canadian Ingredient Disclosure List**

CAS# 218-01-9 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

**MSDS Creation Date:** 6/30/1999
**Revision #4 Date:** 10/03/2005

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

# Material Safety Data Sheet

## Fluoranthene, 98%

ACC# 80991

## Section 1 - Chemical Product and Company Identification

**MSDS Name:** Fluoranthene, 98%
**Catalog Numbers:** AC119170000, AC119170250, AC119171000, AC119175000
**Synonyms:** 1,2-(1,8-Naphthalenediyl)benzene; 1,2-(1,8-Naphthylene)benzene; 1,2-Benzacenaphthene; Benzene, 1,2-(1,8-naphthylene)-; Benzo(j,k)fluorene; Benzo(jk)fluoranthene; Benzo(jk)fluorene
**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 |
|---|---|---|---|
| 206-44-0 | Fluoranthene | 98 | 205-912-4 |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: yellow needles.
**Caution!** Harmful. Causes eye and skin irritation and possible burns. May be harmful if absorbed through the skin. May be harmful if swallowed. May cause heart and liver injury.
**Target Organs:** Heart, liver, lungs.

### Potential Health Effects

**Eye:** Causes eye irritation and possible burns.
**Skin:** May be harmful if absorbed through the skin. Causes severe skin irritation and possible burns.
**Ingestion:** May be harmful if swallowed. May cause rapid heartbeat and cardiac arrythmias. May cause liver injury, pulmonary edema, and respiratory arrest. May cause gastrointestinal disturbances such as nausea.
**Inhalation:** May cause effects similar to those described for ingestion. May produce cardiac failure and pulmonary edema.
**Chronic:** Prolonged or repeated skin contact may cause defatting and dermatitis.

## Section 4 - First Aid Measures

**Eyes:** Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the

upper and lower eyelids. Get medical aid imme diately. Do NOT allow victim to rub eyes or keep eyes closed. Extensiv e 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. Remove contaminated clothing and shoes.
**Ingestion:** Never give anything by mouth to an unconscious person. Get medical aid immediately. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.

**Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
**Notes to Physician:** Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.
**Extinguishing Media:** In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam.
**Flash Point:** Not applicable.
**Autoignition Temperature:** Not applicable.
**Explosion Limits, Lower:**Not available.
**Upper:** Not available.
**NFPA Rating:** (estimated) Health: 2; Flammability: 0; Instability: 0

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.
**Spills/Leaks:** Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well-ventilated area. Do not get in eyes, on skin, or on clothing. Do not ingest or inhale. Use only in a chemical fume hood. Do not breathe dust.
**Storage:** Keep containers tightly closed. Store in a cool, dry area away from incompatible substances.

## 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 adequate ventilation to keep airborne concentrations low.
**Exposure Limits**

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| Fluoranthene | none listed | none listed | none listed |

**OSHA Vacated PELs:** Fluoranthene: No OSHA Vacated PELs are listed for this chemical.
**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 and clothing 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:** Needles
**Appearance:** yellow
**Odor:** None reported.
**pH:** Not available.
**Vapor Pressure:** 0.01 mm Hg @ 20 deg C
**Vapor Density:** Not available.
**Evaporation Rate:**Not available.
**Viscosity:** Not available.
**Boiling Point:** 384 deg C @ 760.00mmHg
**Freezing/Melting Point:**107.00 - 110.00 deg C
**Decomposition Temperature:**Not available.
**Solubility:** insoluble
**Specific Gravity/Density:**1.252 g/cm3
**Molecular Formula:**C16H10
**Molecular Weight:**202.25

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures.
**Conditions to Avoid:** Incompatible materials, strong oxidants.
**Incompatibilities with Other Materials:** Strong oxidizing agents.
**Hazardous Decomposition Products:** Carbon monoxide, carbon dioxide, acrid smoke and fumes.
**Hazardous Polymerization:** Has not been reported.

## Section 11 - Toxicological Information

**RTECS#:**
**CAS#** 206-44-0: LL4025000
**LD50/LC50:**
CAS# 206-44-0:
Oral, rat: LD50 = 2 gm/kg;

Skin, rabbit: LD50 = 3180 mg/kg;
.

**Carcinogenicity:**
CAS# 206-44-0: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

**Epidemiology:** IARC Group 3: Limited or insufficient evidence for carcinogenicity in both animals and humans.Experimental tumorigenic data has been reported.
**Teratogenicity:** No information found
**Reproductive Effects:** No information found
**Mutagenicity:** Mutation in microorganisms: Salmonella typhimurium = 5ug/plate.Mutation in mammalian somatic cells: Human Lymphocyte = 2 umol/L.
**Neurotoxicity:** No information found
**Other Studies:**

## Section 12 - Ecological Information

**Ecotoxicity:** Fish: Bluegill/Sunfish: 3980 um/L; 96 H; (not specified) No data available.
**Environmental:** Remains in the upper few cm of soil, but can be transported to groundwater. Biodegrades from soil in a few years. Will not volatilize from soil or water. Rapidly absorbed to sediment and particulates and will readily bioconcentrate. Unadsorbed substance in water will degrade by photolysis in a days to weeks. Stable in sediment for decades or more. In the atmostphere, photodegrades with half life of 4 - 5 days, but may transport long distances without settling or raining out.
**Physical:** No information available.
**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# 206-44-0: waste number U120.

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| **Shipping Name:** | Not regulated as a hazardous material | No information available. |
| **Hazard Class:** | | |
| **UN Number:** | | |
| **Packing Group:** | | |

## Section 15 - Regulatory Information

## US FEDERAL

**TSCA**
CAS# 206-44-0 is listed on the TSCA inventory.
**Health & Safety Reporting List**
None of the chemicals are on the Health & Safety Reporting List.
**Chemical Test Rules**
None of the chemicals in this product are under a Chemical Test Rule.
**Section 12b**
None of the chemicals are listed under TSCA Section 12b.
**TSCA Significant New Use Rule**
None of the chemicals in this material have a SNUR under TSCA.
**CERCLA Hazardous Substances and corresponding RQs**
CAS# 206-44-0: 100 lb final RQ; 45.4 kg final RQ
**SARA Section 302 Extremely Hazardous Substances**
None of the chemicals in this product have a TPQ.
**SARA Codes**
CAS # 206-44-0: immediate.
**Section 313**
This material contains Fluoranthene (CAS# 206-44-0, 98%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
**Clean Air Act:**
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
**Clean Water Act:**
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 206-44-0 is listed as a Priority Pollutant under the Clean Water Act. CAS# 206-44-0 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# 206-44-0 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Massachusetts.

**California Prop 65**

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

## European/International Regulations

**European Labeling in Accordance with EC Directives**
**Hazard Symbols:**
XN
**Risk Phrases:**
R 21/22 Harmful in contact with skin and if swallowed.

**Safety Phrases:**
S 22 Do not breathe dust.
S 24/25 Avoid contact with skin and eyes.

**WGK (Water Danger/Protection)**
CAS# 206-44-0: No information available.
**Canada - DSL/NDSL**
CAS# 206-44-0 is listed on Canada's NDSL List.
**Canada - WHMIS**

This product has a WHMIS classification of D2B.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

**Canadian Ingredient Disclosure List**

CAS# 206-44-0 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

**MSDS Creation Date:** 9/02/1997
**Revision #5 Date:** 10/03/2005

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

MSDS Number: **L2347** * * * * * *Effective Date:* ***08/10/04*** * * * * * *Supercedes:* ***11/02/01***

**MSDS** **Material Safety Data Sheet**

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

Mallinckrodt CHEMICALS 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.

# LEAD METAL

## 1. Product Identification

**Synonyms:** Granular lead, pigment metal; C.I. 77575
**CAS No.:** 7439-92-1
**Molecular Weight:** 207.19
**Chemical Formula:** Pb
**Product Codes:**
J.T. Baker: 2256, 2266
Mallinckrodt: 5668

## 2. Composition/Information on Ingredients

| Ingredient | CAS No | Percent | Hazardous |
|---|---|---|---|
| Lead | 7439-92-1 | 95 - 100% | Yes |

## 3. Hazards Identification

**Emergency Overview**
---

**POISON! DANGER! MAY BE FATAL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. NEUROTOXIN. AFFECTS THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.**

**J.T. Baker SAF-T-DATA(tm)** Ratings (Provided here for your convenience)
---
Health Rating: 3 - Severe (Life)
Flammability Rating: 0 - None
Reactivity Rating: 0 - None
Contact Rating: 1 - Slight
Lab Protective Equip: GOGGLES; LAB COAT; PROPER GLOVES
Storage Color Code: Blue (Health)
---

**Potential Health Effects**
---

**Inhalation:**

Lead can be absorbed through the respiratory system. Local irritation of bronchia and lungs can occur and, in cases of acute exposure, symptoms such as metallic taste, chest and abdominal pain, and increased lead blood levels may follow. See also Ingestion.
**Ingestion:**
POISON! The symptoms of lead poisoning include abdominal pain and spasms, nausea, vomiting, headache. Acute poisoning can lead to muscle weakness, "lead line" on the gums, metallic taste, definite loss of appetite, insomnia, dizziness, high lead levels in blood and urine with shock, coma and death in extreme cases.
**Skin Contact:**
Lead and lead compounds may be absorbed through the skin on prolonged exposure; the symptoms of lead poisoning described for ingestion exposure may occur. Contact over short periods may cause local irritation, redness and pain.
**Eye Contact:**
Absorption can occur through eye tissues but the more common hazards are local irritation or abrasion.
**Chronic Exposure:**
Lead is a cumulative poison and exposure even to small amounts can raise the body's content to toxic levels. The symptoms of chronic exposure are like those of ingestion poisoning; restlessness, irritability, visual disturbances, hypertension and gray facial color may also be noted.
**Aggravation of Pre-existing Conditions:**
Persons with pre-existing kidney, nerve or circulatory disorders or with skin or eye problems may be more susceptible to the effects of this substance.

---

# 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. Get medical attention.
**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. Powder/dust is flammable when heated or exposed to flame.
**Explosion:**
Not considered to be an explosion hazard.
**Fire Extinguishing Media:**
Use any means suitable for extinguishing surrounding fire. Do not allow water runoff to enter sewers or waterways.
**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. Can produce toxic lead fumes at elevated temperatures and also react with oxidizing materials.

---

# 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. Isolate from incompatible substances. Areas in which exposure to lead

metal or lead compounds may occur should be identified by signs or appropriate means, and access to the area should be limited to authorized persons. 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:**
For lead, metal and inorganic dusts and fumes, as Pb:
-OSHA Permissible Exposure Limit (PEL): 0.05 mg/m3 (TWA)
For lead, elemental and inorganic compounds, as Pb:
-ACGIH Threshold Limit Value (TLV): 0.05 mg/m3 (TWA), A3 animal carcinogen
ACGIH Biological Exposure Indices (BEI): 30 ug/100ml, notation B (see actual Indices for more information).
For lead, inorganic:
-NIOSH Recommended Exposure Limit (REL): 0.1 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 half-face high efficiency particulate respirator (NIOSH type N100 filter) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece high efficiency particulate respirator (NIOSH type N100 filter) may be worn 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.
**Other Control Measures:**
Eating, drinking, and smoking should not be permitted in areas where solids or liquids containing lead compounds are handled, processed, or stored. See OSHA substance-specific standard for more information on personal protective equipment, engineering and work practice controls, medical surveillance, record keeping, and reporting requirements. (29 CFR 1910.1025).

---

# 9. Physical and Chemical Properties

**Appearance:**
Small, white to blue-gray metallic shot or granules.
**Odor:**
Odorless.
**Solubility:**
Insoluble in water.
**Density:**
11.34
**pH:**
No information found.
**% Volatiles by volume @ 21C (70F):**
0
**Boiling Point:**
1740C (3164F)
**Melting Point:**
327.5C (622F)
**Vapor Density (Air=1):**
No information found.
**Vapor Pressure (mm Hg):**
1.77 @ 1000C (1832F)
**Evaporation Rate (BuAc=1):**
No information found.

---

# 10. Stability and Reactivity

**Stability:**
Stable under ordinary conditions of use and storage.
**Hazardous Decomposition Products:**
Does not decompose but toxic lead or lead oxide fumes may form at elevated temperatures.
**Hazardous Polymerization:**
Will not occur.
**Incompatibilities:**
Ammonium nitrate, chlorine trifluoride, hydrogen peroxide, sodium azide, zirconium, disodium acetylide, sodium acetylide and oxidants.
**Conditions to Avoid:**
Heat, flames, ignition sources and incompatibles.

---

# 11. Toxicological Information

**Toxicological Data:**
Investigated as a tumorigen, mutagen, reproductive effector.
**Reproductive Toxicity:**
Lead and other smelter emissions are human reproductive hazards. (Chemical Council on

Environmental Quality; Chemical Hazards to Human Reproduction, 1981).
**Carcinogenicity:**
EPA / IRIS classification: Group B2 - Probable human carcinogen, sufficient animal evidence.

```
--------\Cancer Lists\-------------------------------------------------------
                                        ---NTP Carcinogen---
Ingredient                              Known    Anticipated    IARC Category
-------------------------------------   -----    -----------    -------------
Lead (7439-92-1)                         No          No             2B
```

---

# 12. Ecological Information

**Environmental Fate:**
When released into the soil, this material is not expected to leach into groundwater. This material may bioaccumulate to some extent.
**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
----------------------------------------------   ----  ---  -----  ---------
Lead (7439-92-1)                                  Yes  Yes   Yes      Yes

--------\Chemical Inventory Status - Part 2\---------------------------------
                                                            --Canada--
```

| Ingredient | Korea | DSL | NDSL | Phil. |
|---|---|---|---|---|
| Lead (7439-92-1) | Yes | Yes | No | Yes |

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

| Ingredient | -SARA 302- RQ | TPQ | ------SARA 313------ List | Chemical Catg. |
|---|---|---|---|---|
| Lead (7439-92-1) | No | No | Yes | No |

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

| Ingredient | CERCLA | -RCRA- 261.33 | -TSCA- 8(d) |
|---|---|---|---|
| Lead (7439-92-1) | 10 | 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)

**WARNING:**
THIS PRODUCT CONTAINS CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

**Australian Hazchem Code:** None allocated.
**Poison Schedule:** S6
**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: **0**
**Label Hazard Warning:**
POISON! DANGER! MAY BE FATAL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. NEUROTOXIN. AFFECTS THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.
**Label Precautions:**
Do not get in eyes, on skin, or on clothing.
Do not breathe dust.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
**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:**

**********

**Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.**

**********

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

MSDS Number: **M1599** * * * * * *Effective Date:* ***12/19/05*** * * * * * *Supercedes:* ***08/10/04***

**MSDS** Material Safety Data Sheet

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

Mallinckrodt CHEMICALS 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.

# MERCURY

## 1. Product Identification

**Synonyms:** Quicksilver; hydrargyrum; Liquid Silver
**CAS No.:** 7439-97-6
**Molecular Weight:** 200.59
**Chemical Formula:** Hg
**Product Codes:**
J.T. Baker: 2564, 2567, 2569
Mallinckrodt: 1278, 1280, 1288

## 2. Composition/Information on Ingredients

| Ingredient | CAS No | Percent | Hazardous |
|---|---|---|---|
| Mercury | 7439-97-6 | 90 - 100% | Yes |

## 3. Hazards Identification

**Emergency Overview**
---

**DANGER! CORROSIVE. CAUSES BURNS TO SKIN, EYES, AND RESPIRATORY TRACT. MAY BE FATAL IF SWALLOWED OR INHALED. HARMFUL IF ABSORBED THROUGH SKIN. AFFECTS THE KIDNEYS AND CENTRAL NERVOUS SYSTEM. MAY CAUSE ALLERGIC SKIN REACTION.**

**SAF-T-DATA(tm)** Ratings (Provided here for your convenience)
---
Health Rating: 4 - Extreme (Life)
Flammability Rating: 0 - None
Reactivity Rating: 1 - Slight
Contact Rating: 3 - Severe (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White (Corrosive)
---

**Potential Health Effects**
---

**Inhalation:**
Mercury vapor is highly toxic via this route. Causes severe respiratory tract damage. Symptoms include sore throat, coughing, pain, tightness in chest, breathing difficulties, shortness of breath, headache, muscle weakness, anorexia, gastrointestinal disturbance, ringing in the ear, liver changes, fever, bronchitis and pneumonitis. Can be absorbed through inhalation with symptoms similar to ingestion.
**Ingestion:**
May cause burning of the mouth and pharynx, abdominal pain, vomiting, corrosive ulceration, bloody diarrhea. May be followed by a rapid and weak pulse, shallow breathing, paleness, exhaustion, tremors and collapse. Delayed death may occur from renal failure. Gastrointenstinal uptake of mercury is less than 5% but its ability to penetrate tissues presents some hazard. Initial symptoms may be thirst, possible abdominal discomfort.
**Skin Contact:**
Causes irritaton and burns to skin. Symptoms include redness and pain. May cause skin allergy and sensitization. Can be absorbed through the skin with symptoms to parallel ingestion.
**Eye Contact:**
Causes irritation and burns to eyes. Symptoms include redness, pain, blurred vision; may cause serious and permanent eye damage.
**Chronic Exposure:**
Chronic exposure through any route can produce central nervous system damage. May cause muscle tremors, personality and behavior changes, memory loss, metallic taste, loosening of the teeth, digestive disorders, skin rashes, brain damage and kidney damage. Can cause skin allergies and accumulate in the body. Repeated skin contact can cause the skin to turn gray in color. A suspected reproductive hazard; may damage the developing fetus and decrease fertility in males and females.
**Aggravation of Pre-existing Conditions:**
Persons with nervous disorders, or impaired kidney or respiratory function, or a history of allergies or a known sensitization to mercury may be more susceptible to the effects of the substance.

# 4. First Aid Measures

**Inhalation:**
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
**Ingestion:**
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.
**Skin Contact:**
Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. 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.
**Explosion:**
Not considered to be an explosion hazard.
**Fire Extinguishing Media:**
Use any means suitable for extinguishing surrounding fire. Do not allow water runoff to enter sewers or waterways.
**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. Undergoes hazardous reactions in the presence of heat and sparks or ignition. Smoke may contain toxic mercury or mercuric oxide. Smoke may contain toxic mercury or mercuric oxide.

---

# 6. Accidental Release Measures

Ventilate area of leak or spill. Clean-up personnel require protective clothing and respiratory protection from vapor.

Spills: Pick up and place in a suitable container for reclamation or disposal in a method that does not generate misting. Sprinkle area with sulfur or calcium polysulfide to suppress mercury. Do not flush to sewer. 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.

J. T. Baker CINNASORB® and RESISORB® are recommended for spills of this product.

## 7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Do not use or store on porous work surfaces (wood, unsealed concrete, etc.). Follow strict hygiene practices. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

## 8. Exposure Controls/Personal Protection

**Airborne Exposure Limits:**
- OSHA Acceptable Ceiling Concentration:
mercury and mercury compounds: 0.1 mg/m3 (TWA), skin
- ACGIH Threshold Limit Value (TLV):
inorganic and metallic mercury, as Hg: 0.025 mg/m3 (TWA) skin, A4 Not classifiable as a human carcinogen.
- ACGIH Biological Exposure Indices:
total inorganic mercury in urine (preshift): 35 ug/g creatinine;
total inorganic mercury in blood (end of shift): 15 ug/l.

**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 half-face respirator with a mercury vapor or chlorine gas cartridge may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece respirator with a mercury vapor or chlorine gas cartridge may be worn up to 50 times the exposure limit, or the maximum use concentraiton specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece 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 a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

# 9. Physical and Chemical Properties

**Appearance:**
Silver-white, heavy, mobile, liquid metal.
**Odor:**
Odorless.
**Solubility:**
Insoluble in water.
**Density:**
13.55
**pH:**
No information found.
**% Volatiles by volume @ 21C (70F):**
100
**Boiling Point:**
356.7C (675F)
**Melting Point:**
-38.87C (-38F)
**Vapor Density (Air=1):**
7.0
**Vapor Pressure (mm Hg):**
0.0018 @ 25C (77F)
**Evaporation Rate (BuAc=1):**
4

---

# 10. Stability and Reactivity

**Stability:**
Stable under ordinary conditions of use and storage.
**Hazardous Decomposition Products:**
At high temperatures, vaporizes to form extremely toxic fumes.
**Hazardous Polymerization:**
Will not occur.
**Incompatibilities:**
Acetylenes, ammonia, ethylene oxide, chlorine dioxide, azides, metal oxides, methyl silane, lithium, rubidium, oxygen, strong oxidants, metal carbonyls.
**Conditions to Avoid:**
Heat, flames, ignition sources, metal surfaces and incompatibles.

---

# 11. Toxicological Information

**Toxicological Data:**
Investigated as a tumorigen, mutagen, reproductive effector.
**Reproductive Toxicity:**
All forms of mercury can cross the placenta to the fetus, but most of what is known has

been learned from experimental animals. See Chronic Health Hazards.
**Carcinogenicity:**
EPA / IRIS classification: Group D1 - Not classifiable as a human carcinogen.

```
--------\Cancer Lists\-------------------------------------------------------
                                        ---NTP Carcinogen---
Ingredient                              Known    Anticipated    IARC Category
------------------------------------    -----    -----------    -------------
Mercury (7439-97-6)                      No          No              3
```

# 12. Ecological Information

**Environmental Fate:**
This material has an experimentally-determined bioconcentration factor (BCF) of greater than 100. This material is expected to significantly bioaccumulate.
**Environmental Toxicity:**
This material is expected to be toxic to aquatic life. The LC50/96-hour values for fish are less than 1 mg/l.

# 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste 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

**Domestic (Land, D.O.T.)**
**----------**
**Proper Shipping Name:** RQ, MERCURY
**Hazard Class:** 8
**UN/NA:** UN2809
Packing Group: III
**Information reported for product/size:** 1LB

**International (Water, I.M.O.)**
**----------**
**Proper Shipping Name:** MERCURY
**Hazard Class:** 8
**UN/NA:** UN2809
Packing Group: III
**Information reported for product/size:** 1LB

**International (Air, I.C.A.O.)**
**----------**
**Proper Shipping Name:** MERCURY
**Hazard Class:** 8
**UN/NA:** UN2809
Packing Group: III
**Information reported for product/size:** 1LB

---

# 15. Regulatory Information

```
--------\Chemical Inventory Status - Part 1\---------------------------------
Ingredient                                        TSCA  EC   Japan  Australia
----------------------------------------------  ----  ---  -----  ---------
Mercury (7439-97-6)                               Yes  Yes   No       Yes

--------\Chemical Inventory Status - Part 2\---------------------------------
                                                         --Canada--
Ingredient                                        Korea  DSL   NDSL  Phil.
----------------------------------------------  -----  ---   ----  -----
Mercury (7439-97-6)                               Yes   Yes   No     Yes

--------\Federal, State & International Regulations - Part 1\----------------
                                            -SARA 302-    ------SARA 313------
Ingredient                                  RQ    TPQ     List  Chemical Catg.
----------------------------------------  ---   -----   ----  --------------
Mercury (7439-97-6)                         No    No      Yes        No

--------\Federal, State & International Regulations - Part 2\----------------
                                                         -RCRA-    -TSCA-
Ingredient                                  CERCLA     261.33     8(d)
----------------------------------------  ------     ------    ------
Mercury (7439-97-6)                         1          U151       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 / Liquid)
```

**WARNING:**
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

**Australian Hazchem Code:** 2Z
**Poison Schedule:** S7
**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: **0** Reactivity: **0**
**Label Hazard Warning:**
DANGER! CORROSIVE. CAUSES BURNS TO SKIN, EYES, AND RESPIRATORY TRACT. MAY BE FATAL IF SWALLOWED OR INHALED. HARMFUL IF ABSORBED THROUGH SKIN. AFFECTS THE KIDNEYS AND CENTRAL NERVOUS SYSTEM. MAY CAUSE ALLERGIC SKIN REACTION.
**Label Precautions:**
Do not get in eyes, on skin, or on clothing.
Do not breathe vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
**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 while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases get medical attention immediately.
**Product Use:**
Laboratory Reagent.
**Revision Information:**
MSDS Section(s) changed since last revision of document include: 3.
**Disclaimer:**
**********

**Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.**
**********

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

# Material Safety Data Sheet

## Phenanthrene, 90%

ACC# 59921

## Section 1 - Chemical Product and Company Identification

**MSDS Name:** Phenanthrene, 90%
**Catalog Numbers:** AC130100000, AC130100010, AC130102500
**Synonyms:**
**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 |
|---|---|---|---|
| 85-01-8 | Phenanthrene | 90.0 | 201-581-5 |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: brown solid.
**Caution!** Powdered material may form explosive dust-air mixtures. May cause allergic skin reaction. May cause eye and skin irritation. May cause respiratory tract irritation. Cancer suspect agent.
**Target Organs:** None.

**Potential Health Effects**
**Eye:** May cause eye irritation.
**Skin:** May cause skin irritation. May cause photosensitive skin reactions in certain individuals.
**Ingestion:** May cause irritation of the digestive tract.
**Inhalation:** Inhalation of dust may cause respiratory tract irritation.
**Chronic:** No information found.

## Section 4 - First Aid Measures

**Eyes:** Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid imme diately.
**Skin:** Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
**Ingestion:** If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

**Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.
**Notes to Physician:** Treat symptomatically.

## 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. Dusts at sufficient concentrations can form explosive mixtures with air. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.
**Extinguishing Media:** Use water spray or dry chemical.
**Flash Point:** Not available.
**Autoignition Temperature:** Not available.
**Explosion Limits, Lower:**Not available.
**Upper:** Not available.
**NFPA Rating:** (estimated) Health: 1; Flammability: 1; Instability: 0

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.
**Spills/Leaks:** Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation. Do not let this chemical enter the environment.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.
**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.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Use adequate ventilation to keep airborne concentrations low.
**Exposure Limits**

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---|---|---|---|
| Phenanthrene | 0.2 mg/m3 TWA (as benzene soluble aerosol) (listed under Coal tar pitches). | 0.1 mg/m3 TWA (cyclohexane-extractable fraction) (listed under Coal tar pitches).80 mg/m3 IDLH (listed under Coal tar pitches). | 0.2 mg/m3 TWA (as benzene soluble fraction) (listed under Coal tar pitches). |

**OSHA Vacated PELs:** Phenanthrene: No OSHA Vacated PELs are listed for this chemical.

**Personal Protective Equipment**
**Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
**Skin:** Wear appropriate protective gloves to prevent skin exposure.
**Clothing:** Wear appropriate protective clothing to prevent skin exposure.
**Respirators:** Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

## Section 9 - Physical and Chemical Properties

**Physical State:** Solid
**Appearance:** brown
**Odor:** none reported
**pH:** Not available.
**Vapor Pressure:** 1 mm Hg @116c
**Vapor Density:** Not available.
**Evaporation Rate:**Not available.
**Viscosity:** Not available.
**Boiling Point:** 340 deg C
**Freezing/Melting Point:**101 deg C
**Decomposition Temperature:**Not available.
**Solubility:** insoluble
**Specific Gravity/Density:**1.0630g/cm3
**Molecular Formula:**C14H10
**Molecular Weight:**178.23

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures.
**Conditions to Avoid:** Incompatible materials, dust generation, strong oxidants.
**Incompatibilities with Other Materials:** Strong oxidizing agents.
**Hazardous Decomposition Products:** Carbon monoxide, carbon dioxide.
**Hazardous Polymerization:** Has not been reported.

## Section 11 - Toxicological Information

**RTECS#:**
**CAS#** 85-01-8: SF7175000
**LD50/LC50:**
CAS# 85-01-8:
Oral, mouse: LD50 = 700 mg/kg;
Oral, rat: LD50 = 1.8 gm/kg;
.

**Carcinogenicity:**
CAS# 85-01-8:

- **ACGIH:** A1 - Confirmed Human Carcinogen (as benzene soluble aerosol) (listed as 'Coal tar pitches').
- **California:** Not listed.
- **NTP:** Known carcinogen (listed as Coal tar pitches).
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

**Epidemiology:** No data available.
**Teratogenicity:** No data available.
**Reproductive Effects:** No data available.
**Mutagenicity:** No data available.
**Neurotoxicity:** No data available.
**Other Studies:**

## Section 12 - Ecological Information

No information available.

## Section 13 - Disposal Considerations

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

## Section 14 - Transport Information

| | US DOT | Canada TDG |
|---|---|---|
| **Shipping Name:** | Not regulated as a hazardous material | No information available. |
| **Hazard Class:** | | |
| **UN Number:** | | |
| **Packing Group:** | | |

## Section 15 - Regulatory Information

### US FEDERAL

**TSCA**
CAS# 85-01-8 is listed on the TSCA inventory.
**Health & Safety Reporting List**
None of the chemicals are on the Health & Safety Reporting List.
**Chemical Test Rules**
None of the chemicals in this product are under a Chemical Test Rule.
**Section 12b**
None of the chemicals are listed under TSCA Section 12b.

**TSCA Significant New Use Rule**
None of the chemicals in this material have a SNUR under TSCA.
**CERCLA Hazardous Substances and corresponding RQs**
CAS# 85-01-8: 5000 lb final RQ; 2270 kg final RQ
**SARA Section 302 Extremely Hazardous Substances**
None of the chemicals in this product have a TPQ.
**SARA Codes**
CAS # 85-01-8: immediate.
**Section 313**
This material contains Phenanthrene (CAS# 85-01-8, 90.0%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
**Clean Air Act:**
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
**Clean Water Act:**
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
CAS# 85-01-8 is listed as a Priority Pollutant under the Clean Water Act.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
**OSHA:**
None of the chemicals in this product are considered highly hazardous by OSHA.
**STATE**
CAS# 85-01-8 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, (listed as Coal tar pitches), Massachusetts.

**California Prop 65**

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

## European / International Regulations
**European Labeling in Accordance with EC Directives**
**Hazard Symbols:**
T
**Risk Phrases:**
R 45 May cause cancer.

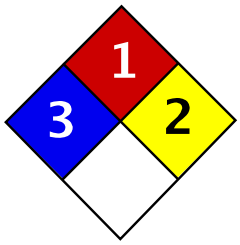
**Safety Phrases:**
S 24/25 Avoid contact with skin and eyes.

**WGK (Water Danger/Protection)**
CAS# 85-01-8: No information available.
**Canada - DSL/NDSL**
CAS# 85-01-8 is listed on Canada's DSL List.
**Canada - WHMIS**
This product has a WHMIS classification of D2B.
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.
**Canadian Ingredient Disclosure List**
CAS# 85-01-8 is listed on the Canadian Ingredient Disclosure List.

## Section 16 - Additional Information

**MSDS Creation Date:** 7/14/1998
**Revision #3 Date:** 10/03/2005

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




| | |
|---|---|
| Health | 3 |
| Fire | 1 |
| Reactivity | 2 |
| Personal Protection | E |

# Material Safety Data Sheet
## Arsenic MSDS

## Section 1: Chemical Product and Company Identification

**Product Name:** Arsenic

**Catalog Codes:** SLA1006

**CAS#:** 7440-38-2

**RTECS:** CG0525000

**TSCA:** TSCA 8(b) inventory: Arsenic

**CI#:** Not applicable.

**Synonym:**

**Chemical Name:** Arsenic

**Chemical Formula:** As

**Contact Information:**

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

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

Order Online: ScienceLab.com

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

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

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

## Section 2: Composition and Information on Ingredients

**Composition:**

| Name | CAS # | % by Weight |
|---|---|---|
| Arsenic | 7440-38-2 | 100 |

**Toxicological Data on Ingredients:** Arsenic: ORAL (LD50): Acute: 763 mg/kg [Rat]. 145 mg/kg [Mouse].

## Section 3: Hazards Identification

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

**Potential Chronic Health Effects:**
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to kidneys, lungs, the nervous system, mucous membranes.
Repeated or prolonged exposure to the substance can produce target organs damage.

## Section 4: First Aid Measures

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

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

**Serious Skin Contact:** Not available.

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

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

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

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

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

**Auto-Ignition Temperature:** Not available.

**Flash Points:** Not available.

**Flammable Limits:** Not available.

**Products of Combustion:** Some metallic oxides.

**Fire Hazards in Presence of Various Substances:** Flammable in presence of open flames and sparks, of heat, of oxidizing materials.

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

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

**Special Remarks on Fire Hazards:**
Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits highly toxic fumes.

**Special Remarks on Explosion Hazards:** Not available.

## Section 6: Accidental Release Measures

**Small Spill:** Use appropriate tools to put the spilled solid in a convenient waste disposal container.

**Large Spill:**
Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not

present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

## Section 7: Handling and Storage

**Precautions:**
Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids, moisture.

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

## Section 8: Exposure Controls/Personal Protection

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

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

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

**Exposure Limits:**
TWA: 0.01 from ACGIH (TLV) [United States] [1995]
Consult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

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

**Odor:** Not available.

**Taste:** Not available.

**Molecular Weight:** 74.92 g/mole

**Color:** Silvery.

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

**Boiling Point:** Not available.

**Melting Point:** Sublimation temperature: 615°C (1139°F)

**Critical Temperature:** Not available.

**Specific Gravity:** 5.72 (Water = 1)

**Vapor Pressure:** Not applicable.

**Vapor Density:** Not available.

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

**Solubility:** Insoluble in cold water, hot water.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Not available.

**Incompatibility with various substances:** Reactive with oxidizing agents, acids, moisture.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:** Not available.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** Will not occur.

## Section 11: Toxicological Information

**Routes of Entry:** Inhalation. Ingestion.

**Toxicity to Animals:** Acute oral toxicity (LD50): 145 mg/kg [Mouse].

**Chronic Effects on Humans:**
CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH.
Causes damage to the following organs: kidneys, lungs, the nervous system, mucous membranes.

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

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:** Not available.

**Special Remarks on other Toxic Effects on Humans:** Not available.

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

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

**Toxicity of the Products of Biodegradation:** The products of degradation are as toxic as the original product.

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

**Waste Disposal:**

## Section 14: Transport Information

**DOT Classification:** CLASS 6.1: Poisonous material.

**Identification:** : Arsenic UNNA: UN1558 PG: II

**Special Provisions for Transport:** Not available.

## Section 15: Other Regulatory Information

**Federal and State Regulations:**
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Arsenic
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Arsenic
Pennsylvania RTK: Arsenic
Massachusetts RTK: Arsenic
TSCA 8(b) inventory: Arsenic

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

**Other Classifications:**

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

**DSCL (EEC):**
R22- Harmful if swallowed.
R45- May cause cancer.

**HMIS (U.S.A.):**

**Health Hazard:** 3

**Fire Hazard:** 1

**Reactivity:** 2

**Personal Protection:** E

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

**Health:** 3

**Flammability:** 1

**Reactivity:** 2

**Specific hazard:**

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

## Section 16: Other Information

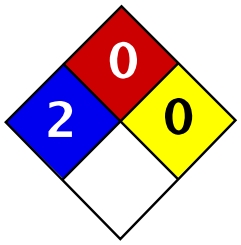
**References:**
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
-Liste des produits purs tératogènes, mutagènes, cancérogènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec.
-Material safety data sheet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

**Other Special Considerations:** Not available.

**Created:** 10/09/2005 04:16 PM

**Last Updated:** 10/09/2005 04:16 PM

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




| | |
|---|---|
| Health | 2 |
| Fire | 0 |
| Reactivity | 0 |
| Personal Protection | E |

# Material Safety Data Sheet
## Nickel metal MSDS

## Section 1: Chemical Product and Company Identification

**Product Name:** Nickel metal

**Catalog Codes:** SLN2296, SLN1342, SLN1954

**CAS#:** 7440-02-0

**RTECS:** QR5950000

**TSCA:** TSCA 8(b) inventory: Nickel metal

**CI#:** Not applicable.

**Synonym:** Nickel Metal shot; Nickel metal foil.

**Chemical Name:** Nickel

**Chemical Formula:** Ni

**Contact Information:**

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

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

Order Online: ScienceLab.com

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

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

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

## Section 2: Composition and Information on Ingredients

**Composition:**

| Name | CAS # | % by Weight |
|---|---|---|
| Nickel metal | 7440-02-0 | 100 |

**Toxicological Data on Ingredients:** Nickel metal LD50: Not available. LC50: Not available.

## Section 3: Hazards Identification

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

**Potential Chronic Health Effects:**
Slightly hazardous in case of skin contact (sensitizer), of ingestion, of inhalation (lung sensitizer).
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to skin.
The substance may be toxic to kidneys, lungs, liver, upper respiratory tract.
Repeated or prolonged exposure to the substance can produce target organs damage.

## Section 4: First Aid Measures

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

**Skin Contact:**
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

**Serious Skin Contact:** Not available.

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

**Serious Inhalation:** Not available.

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

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

**Flammability of the Product:** Non-flammable.

**Auto-Ignition Temperature:** Not applicable.

**Flash Points:** Not applicable.

**Flammable Limits:** Not applicable.

**Products of Combustion:** Not available.

**Fire Hazards in Presence of Various Substances:** Not applicable.

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

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

**Special Remarks on Fire Hazards:** Material in powder form, capable of creating a dust explosion. This material is flammable in powder form only.

**Special Remarks on Explosion Hazards:**
Material in powder form, capable of creating a dust explosion.
Mixtures containing Potassium Perchlorate with Nickel & Titanium powders & infusorial earth can explode.
Adding 2 or 3 drops of approximately 90% peroxyformic acid to powdered nickel will result in explosion.
Powdered nickel reacts explosively upon contact with fused ammonium nitrate at temperatures below 200 deg. C.

## Section 6: Accidental Release Measures

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

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

## Section 7: Handling and Storage

**Precautions:**
Keep locked up.. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Keep away from incompatibles such as oxidizing agents, combustible materials, metals, acids.

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

## Section 8: Exposure Controls/Personal Protection

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

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

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

**Exposure Limits:**
TWA: 1 (mg/m3) from ACGIH (TLV) [United States] Inhalation Respirable.
TWA: 0.5 (mg/m3) [United Kingdom (UK)]
TWA: 1 (mg/m3) from OSHA (PEL) [United States] InhalationConsult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

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

**Odor:** Odorless.

**Taste:** Not available.

**Molecular Weight:** 58.71 g/mole

**Color:** Silvery.

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

**Boiling Point:** 2730°C (4946°F)

**Melting Point:** 1455°C (2651°F)

**Critical Temperature:** Not available.

**Specific Gravity:** Density: 8.908 (Water = 1)

**Vapor Pressure:** Not applicable.

**Vapor Density:** Not available.

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

**Solubility:**
Insoluble in cold water, hot water.
Insoluble in Ammonia.
Soluble in dilute Nitric Acid.
Slightly soluble in Hydrochloric Acid, Sulfuric Acid.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Incompatible materials

**Incompatibility with various substances:** Reactive with oxidizing agents, combustible materials, metals, acids.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:**
Incompatible with strong acids, selenium, sulfur, wood and other combustibles, nickel nitrate, aluminum, aluminum trichloride, ethylene, p-dioxan, hydrogen, methanol, non-metals, oxidants, sulfur compounds, aniline, hydrogen sulfide, flammable solvents, hydrazine, and metal powders (especially zinc, aluminum, and magnesium), ammonium nitrate, nitryl fluoride, bromine pentafluoride, potassium perchlorate + titanium powder + indusorial earth.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** Will not occur.

## Section 11: Toxicological Information

**Routes of Entry:** Inhalation. Ingestion.

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

**Chronic Effects on Humans:**
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.
Causes damage to the following organs: skin.
May cause damage to the following organs: kidneys, lungs, liver, upper respiratory tract.

**Other Toxic Effects on Humans:**

Hazardous in case of inhalation.
Slightly hazardous in case of skin contact (irritant, sensitizer), of ingestion.

**Special Remarks on Toxicity to Animals:**
Lowest Published Lethal Dose/Conc:
LDL [Rat] - Route: Oral; Dose: 5000 mg/kg
LDL [Guinea Pig] - Route: Oral; Dose: 5000 mg/kg

**Special Remarks on Chronic Effects on Humans:** May cause cancer based on animal test data

**Special Remarks on other Toxic Effects on Humans:**
Acute Potential Health Effects:
Skin: Nickel dust and fume can irritate skin.
Eyes: Nickel dust and fume can irritate eyes.
Inhalation: Inhalation of dust or fume may cause respiratory tract irritation with non-productive cough, hoarseness, sore throat, headache, vertigo, weakness, chest pain, followed by delayed effects, including tachypnea, dyspnea, and ARDS. Death due to ARDS has been reported following inhalation of high concentrations of respirable metallic nickel dust. Later effects may include pulmonary edema and fibrosis.
Ingestion: Metallic nickel is generally considered not to be acutely toxic if ingested. Ingestion may cause nausea, vomiting, abdominal , and diarrhea. Nickel may damage the kidneys(proteinuria), and may affect liver function. It may also affect behavior (somnolence), and cardiovascular system (increased cornary artery resistance, decreased myocardial contractility, myocardial damage, regional or general arteriolar or venus dilation).
Chronic Potential Health Effects:
Skin: May cause skin allergy. Nickel and nickel compounds are among the most common sensitizers inducing allergic contact dermatitis.
Inhalation: Chronic inhalation nickel dust or fume can cause chronic hypertrophic rhinitis, sinusitis, nasal polyps, perforation of the nasal septum, chronic pulmonary irritation, fibrosis, pulmonary edema, pulmonary eosinophilia, Pneumoconiosis, allergies (asthma-like allergy), and cancer of the nasal sinus cavities, lungs, and possibly other organs. Future exposures can cause asthma attacks with shortness of breath, wheezing, cough, and/or chest tightness. Chronic inhalation of nickel dust or fume may also affect the liver (impaired liver function tests), and blood (changes in red blood cell count).
Ingestion: Prolonged or repeated ingestion of nickel can be a source chronic urticaria and other signs of allergy. Chronic ingestion of NIckel may also affect respiration and cause pneumoconiosis or fibrosis.
Note: In the general population, sensitization occurs from exposure to nickel-containing coins, jewelry, watches,

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

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

**Toxicity of the Products of Biodegradation:** The products of degradation are as toxic as the original product.

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

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

## Section 14: Transport Information

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

**Identification:** Not applicable.

**Special Provisions for Transport:** Not applicable.

## Section 15: Other Regulatory Information

**Federal and State Regulations:**
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Nickel metal
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Nickel metal
Connecticut hazardous material survey.: Nickel metal
Illinois toxic substances disclosure to employee act: Nickel metal
Illinois chemical safety act: Nickel metal
New York release reporting list: Nickel metal
Rhode Island RTK hazardous substances: Nickel metal
Pennsylvania RTK: Nickel metal
Michigan critical material: Nickel metal
Massachusetts RTK: Nickel metal
Massachusetts spill list: Nickel metal
New Jersey: Nickel metal
New Jersey spill list: Nickel metal
Louisiana spill reporting: Nickel metal
California Director's List of Hazardous Substances: Nickel metal
TSCA 8(b) inventory: Nickel metal

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

**Other Classifications:**

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

**DSCL (EEC):**
R40- Possible risks of irreversible effects.
R43- May cause sensitization by skin contact.
S22- Do not breathe dust.
S36- Wear suitable protective clothing.

**HMIS (U.S.A.):**

**Health Hazard:** 2

**Fire Hazard:** 0

**Reactivity:** 0

**Personal Protection:** E

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

**Health:** 2

**Flammability:** 0

**Reactivity:** 0

**Specific hazard:**

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

## Section 16: Other Information

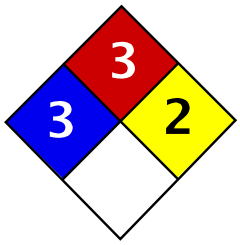
**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/10/2005 08:42 PM

**Last Updated:** 10/10/2005 08:42 PM

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




| | |
|---|---|
| Health | 3 |
| Fire | 3 |
| Reactivity | 2 |
| Personal Protection | J |

# Material Safety Data Sheet
## Calcium MSDS

## Section 1: Chemical Product and Company Identification

**Product Name:** Calcium

**Catalog Codes:** SLC2782

**CAS#:** 7440-70-2

**RTECS:** EV8040000

**TSCA:** TSCA 8(b) inventory: Calcium

**CI#:** Not available.

**Synonym:**

**Chemical Formula:** Ca

**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 |
|---|---|---|
| Calcium | 7440-70-2 | 100 |

**Toxicological Data on Ingredients:** Calcium LD50: Not available. LC50: Not available.

## Section 3: Hazards Identification

**Potential Acute Health Effects:**
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Corrosive to eyes and skin. The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death.

**Potential Chronic Health Effects:**
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to lungs, mucous membranes.
Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage.

## Section 4: First Aid Measures

**Eye Contact:** Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

**Skin Contact:**
If the chemical got onto the clothed portion of the body, remove the contaminated clothes as quickly as possible, protecting your own hands and body. Place the victim under a deluge shower. If the chemical got on the victim's exposed skin, such as the hands : Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

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

**Inhalation:** Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

**Serious Inhalation:**
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

**Ingestion:**
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

**Flammability of the Product:** Flammable.

**Auto-Ignition Temperature:** Not available.

**Flash Points:** Not available.

**Flammable Limits:** Not available.

**Products of Combustion:** Some metallic oxides.

**Fire Hazards in Presence of Various Substances:** Not available.

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

**Fire Fighting Media and Instructions:**
Flammable solid.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog.

**Special Remarks on Fire Hazards:** Not available.

**Special Remarks on Explosion Hazards:** Not available.

## Section 6: Accidental Release Measures

**Small Spill:** Use appropriate tools to put the spilled solid in a convenient waste disposal container.

**Large Spill:**
Corrosive solid. Flammable solid that, in contact with water, emits flammable gases.
Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Cover with dry earth, sand or other non-combustible material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal.

## Section 7: Handling and Storage

**Precautions:**
Keep under inert atmosphere. Keep container dry. Do not breathe dust. Never add water to this product Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If you feel unwell, seek medical attention and show the label when possible. Avoid contact with skin and eyes Keep away from incompatibles such as acids, moisture.

**Storage:**
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. Keep container dry. Keep in a cool place.

## Section 8: Exposure Controls/Personal Protection

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

**Personal Protection:**
Splash goggles. Lab coat. Vapor and 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. Vapor and 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.

**Odor:** Not available.

**Taste:** Not available.

**Molecular Weight:** 40.08 g/mole

**Color:** Not available.

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

**Boiling Point:** 1484°C (2703.2°F)

**Melting Point:** 839°C (1542.2°F)

**Critical Temperature:** Not available.

**Specific Gravity:** 1.54 (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:** Not available.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Not available.

**Incompatibility with various substances:**
Highly reactive with acids.
Reactive with moisture.
The product reacts violently with water to emit flammable but non toxic gases.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:** Not available.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** No.

## Section 11: Toxicological Information

**Routes of Entry:** Eye contact. Inhalation. Ingestion.

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

**Chronic Effects on Humans:** The substance is toxic to lungs, mucous membranes.

**Other Toxic Effects on Humans:** 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:** Not available.

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

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

**Toxicity of the Products of Biodegradation:** The products of degradation are less toxic.

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

**Waste Disposal:**

## Section 14: Transport Information

**DOT Classification:** CLASS 4.3: Material that emits flammable gases on contact with water.

**Identification:** : Calcium : UN1401 PG: II

**Special Provisions for Transport:** Not available.

## Section 15: Other Regulatory Information

**Federal and State Regulations:**
Pennsylvania RTK: Calcium
Massachusetts RTK: Calcium
TSCA 8(b) inventory: Calcium

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

**Other Classifications:**

**WHMIS (Canada):**
CLASS B-6: Reactive and very flammable material.
CLASS E: Corrosive solid.

**DSCL (EEC):** R36/38- Irritating to eyes and skin.

**HMIS (U.S.A.):**

**Health Hazard:** 3

**Fire Hazard:** 3

**Reactivity:** 2

**Personal Protection:** j

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

**Health:** 3

**Flammability:** 3

**Reactivity:** 2

**Specific hazard:**

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

## Section 16: Other Information

**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/11/2005 11:30 AM

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

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

| | |
|---|---|
| Health | 3 |
| Fire | 1 |
| Reactivity | 0 |
| Personal Protection | E |

# Material Safety Data Sheet
## Cadmium MSDS

## Section 1: Chemical Product and Company Identification

**Product Name:** Cadmium

**Catalog Codes:** SLC3484, SLC5272, SLC2482

**CAS#:** 7440-43-9

**RTECS:** EU9800000

**TSCA:** TSCA 8(b) inventory: Cadmium

**CI#:** Not applicable.

**Synonym:**

**Chemical Name:** Cadmium

**Chemical Formula:** Cd

**Contact Information:**

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

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

Order Online: ScienceLab.com

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

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

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

## Section 2: Composition and Information on Ingredients

**Composition:**

| Name | CAS # | % by Weight |
|---|---|---|
| Cadmium | 7440-43-9 | 100 |

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

## Section 3: Hazards Identification

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

**Potential Chronic Health Effects:**
CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to kidneys, lungs, liver.
Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

## Section 4: First Aid Measures

**Eye Contact:** No known effect on eye contact, rinse with water for a few minutes.

**Skin Contact:**
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

**Serious Skin Contact:** Not available.

**Inhalation:** Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

**Serious Inhalation:**
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

**Ingestion:**
Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

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

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

**Flash Points:** Not available.

**Flammable Limits:** Not available.

**Products of Combustion:** Some metallic oxides.

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

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

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

**Special Remarks on Fire Hazards:**
Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits toxic fumes.

**Special Remarks on Explosion Hazards:** Not available.

## Section 6: Accidental Release Measures

**Small Spill:** Use appropriate tools to put the spilled solid in a convenient waste disposal container.

**Large Spill:**
Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

## Section 7: Handling and Storage

**Precautions:**
Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

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

## Section 8: Exposure Controls/Personal Protection

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

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

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

**Exposure Limits:**
TWA: 0.01 (ppm)
Consult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

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

**Odor:** Not available.

**Taste:** Not available.

**Molecular Weight:** 112.4 g/mole

**Color:** Silvery.

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

**Boiling Point:** 765°C (1409°F)

**Melting Point:** 320.9°C (609.6°F)

**Critical Temperature:** Not available.

**Specific Gravity:** 8.64 (Water = 1)

**Vapor Pressure:** Not applicable.

**Vapor Density:** Not available.

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

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

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Not available.

**Incompatibility with various substances:** Reactive with oxidizing agents.

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

**Special Remarks on Reactivity:** Reacts violently with potassium.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** No.

## Section 11: Toxicological Information

**Routes of Entry:** Inhalation. Ingestion.

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

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

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

**Special Remarks on Toxicity to Animals:** Not available.

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

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

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

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

**Toxicity of the Products of Biodegradation:** The products of degradation are as toxic as the original product.

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

**Waste Disposal:**

## Section 14: Transport Information

**DOT Classification:**

**Identification:**

**Special Provisions for Transport:**

## Section 15: Other Regulatory Information

**Federal and State Regulations:**
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Cadmium
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Cadmium
Pennsylvania RTK: Cadmium
Massachusetts RTK: Cadmium
TSCA 8(b) inventory: Cadmium
SARA 313 toxic chemical notification and release reporting: Cadmium
CERCLA: Hazardous substances.: Cadmium

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

**Other Classifications:**

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

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

**HMIS (U.S.A.):**

**Health Hazard:** 3

**Fire Hazard:** 1

**Reactivity:** 0

**Personal Protection:** E

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

**Health:** 3

**Flammability:** 1

**Reactivity:** 0

**Specific hazard:**

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

## Section 16: Other Information

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

**Other Special Considerations:** Not available.

**Created:** 10/09/2005 04:29 PM

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

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

| | |
|---|---|
| Health | 2 |
| Fire | 1 |
| Reactivity | 0 |
| Personal Protection | E |

# Material Safety Data Sheet
## Copper MSDS

## Section 1: Chemical Product and Company Identification

**Product Name:** Copper

**Catalog Codes:** SLC4939, SLC2152, SLC3943, SLC1150, SLC2941, SLC4729, SLC1936, SLC3727, SLC5515

**CAS#:** 7440-50-8

**RTECS:** GL5325000

**TSCA:** TSCA 8(b) inventory: Copper

**CI#:** Not available.

**Synonym:**

**Chemical Name:** Not available.

**Chemical Formula:** Cu

**Contact Information:**

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

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

Order Online: ScienceLab.com

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

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

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

## Section 2: Composition and Information on Ingredients

**Composition:**

| Name | CAS # | % by Weight |
|---|---|---|
| Copper | 7440-50-8 | 100 |

**Toxicological Data on Ingredients:** Copper LD50: Not available. LC50: Not available.

## Section 3: Hazards Identification

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

**Potential Chronic Health Effects:**
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to lungs, mucous membranes.
Repeated or prolonged exposure to the substance can produce target organs damage.

## Section 4: First Aid Measures

**Eye Contact:** Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

**Skin Contact:**
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

**Serious Skin Contact:** Not available.

**Inhalation:** Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

**Serious Inhalation:** Not available.

**Ingestion:**
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

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

**Auto-Ignition Temperature:** Not available.

**Flash Points:** Not available.

**Flammable Limits:** Not available.

**Products of Combustion:** Some metallic oxides.

**Fire Hazards in Presence of Various Substances:** Not available.

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

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

**Special Remarks on Fire Hazards:** Not available.

**Special Remarks on Explosion Hazards:** Not available.

## Section 6: Accidental Release Measures

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

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

## Section 7: Handling and Storage

**Precautions:**
Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not breathe dust. Avoid contact with eyes Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If you feel unwell, seek medical attention and show the label when possible.

**Storage:**
Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

## Section 8: Exposure Controls/Personal Protection

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

**Personal Protection:**
Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

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

**Exposure Limits:**
TWA: 1 (mg/m3) from ACGIH [1990]
Consult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

**Physical state and appearance:** Solid.

**Odor:** Not available.

**Taste:** Not available.

**Molecular Weight:** 63.54 g/mole

**Color:** Not available.

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

**Boiling Point:** 2595°C (4703°F)

**Melting Point:** 1083°C (1981.4°F)

**Critical Temperature:** Not available.

**Specific Gravity:** 8.94 (Water = 1)

**Vapor Pressure:** Not applicable.

**Vapor Density:** Not available.

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

**Solubility:** Insoluble in cold water.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Not available.

**Incompatibility with various substances:** Not available.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:** Not available.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** No.

## Section 11: Toxicological Information

**Routes of Entry:** Absorbed through skin. Eye contact. Inhalation. Ingestion.

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

**Chronic Effects on Humans:** The substance is toxic to lungs, mucous membranes.

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

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:** Human: passes through the placenta, excreted in maternal milk.

**Special Remarks on other Toxic Effects on Humans:** Not available.

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

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

**Toxicity of the Products of Biodegradation:** The products of degradation are as toxic as the original product.

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

**Waste Disposal:**

## Section 14: Transport Information

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

**Identification:** Not applicable.

**Special Provisions for Transport:** Marine Pollutant

## Section 15: Other Regulatory Information

**Federal and State Regulations:**
Pennsylvania RTK: Copper
Massachusetts RTK: Copper
TSCA 8(b) inventory: Copper
CERCLA: Hazardous substances.: Copper

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

**Other Classifications:**

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

**DSCL (EEC):** R36- Irritating to eyes.

**HMIS (U.S.A.):**

**Health Hazard:** 2

**Fire Hazard:** 1

**Reactivity:** 0

**Personal Protection:** E

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

**Health:** 2

**Flammability:** 1

**Reactivity:** 0

**Specific hazard:**

**Protective Equipment:**
Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator

when ventilation is inadequate.
Splash goggles.

## Section 16: Other Information

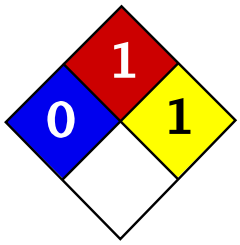
**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/09/2005 04:58 PM

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

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




| | |
|---|---|
| Health | 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

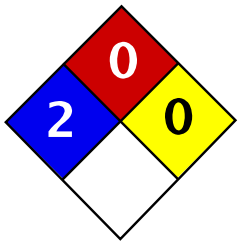
**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/09/2005 06:00 PM

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

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




| | |
|---|---|
| Health | 2 |
| Fire | 0 |
| Reactivity | 0 |
| Personal Protection | E |

# Material Safety Data Sheet
## Nickel metal MSDS

## Section 1: Chemical Product and Company Identification

**Product Name:** Nickel metal

**Catalog Codes:** SLN2296, SLN1342, SLN1954

**CAS#:** 7440-02-0

**RTECS:** QR5950000

**TSCA:** TSCA 8(b) inventory: Nickel metal

**CI#:** Not applicable.

**Synonym:** Nickel Metal shot; Nickel metal foil.

**Chemical Name:** Nickel

**Chemical Formula:** Ni

**Contact Information:**

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

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

Order Online: ScienceLab.com

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

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

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

## Section 2: Composition and Information on Ingredients

**Composition:**

| Name | CAS # | % by Weight |
|---|---|---|
| Nickel metal | 7440-02-0 | 100 |

**Toxicological Data on Ingredients:** Nickel metal LD50: Not available. LC50: Not available.

## Section 3: Hazards Identification

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

**Potential Chronic Health Effects:**
Slightly hazardous in case of skin contact (sensitizer), of ingestion, of inhalation (lung sensitizer).
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to skin.
The substance may be toxic to kidneys, lungs, liver, upper respiratory tract.
Repeated or prolonged exposure to the substance can produce target organs damage.

## Section 4: First Aid Measures

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

**Skin Contact:**
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

**Serious Skin Contact:** Not available.

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

**Serious Inhalation:** Not available.

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

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

**Flammability of the Product:** Non-flammable.

**Auto-Ignition Temperature:** Not applicable.

**Flash Points:** Not applicable.

**Flammable Limits:** Not applicable.

**Products of Combustion:** Not available.

**Fire Hazards in Presence of Various Substances:** Not applicable.

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

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

**Special Remarks on Fire Hazards:** Material in powder form, capable of creating a dust explosion. This material is flammable in powder form only.

**Special Remarks on Explosion Hazards:**
Material in powder form, capable of creating a dust explosion.
Mixtures containing Potassium Perchlorate with Nickel & Titanium powders & infusorial earth can explode.
Adding 2 or 3 drops of approximately 90% peroxyformic acid to powdered nickel will result in explosion.
Powdered nickel reacts explosively upon contact with fused ammonium nitrate at temperatures below 200 deg. C.

## Section 6: Accidental Release Measures

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

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

## Section 7: Handling and Storage

**Precautions:**
Keep locked up.. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Keep away from incompatibles such as oxidizing agents, combustible materials, metals, acids.

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

## Section 8: Exposure Controls/Personal Protection

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

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

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

**Exposure Limits:**
TWA: 1 (mg/m3) from ACGIH (TLV) [United States] Inhalation Respirable.
TWA: 0.5 (mg/m3) [United Kingdom (UK)]
TWA: 1 (mg/m3) from OSHA (PEL) [United States] InhalationConsult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

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

**Odor:** Odorless.

**Taste:** Not available.

**Molecular Weight:** 58.71 g/mole

**Color:** Silvery.

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

**Boiling Point:** 2730°C (4946°F)

**Melting Point:** 1455°C (2651°F)

**Critical Temperature:** Not available.

**Specific Gravity:** Density: 8.908 (Water = 1)

**Vapor Pressure:** Not applicable.

**Vapor Density:** Not available.

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

**Solubility:**
Insoluble in cold water, hot water.
Insoluble in Ammonia.
Soluble in dilute Nitric Acid.
Slightly soluble in Hydrochloric Acid, Sulfuric Acid.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Incompatible materials

**Incompatibility with various substances:** Reactive with oxidizing agents, combustible materials, metals, acids.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:**
Incompatible with strong acids, selenium, sulfur, wood and other combustibles, nickel nitrate, aluminum, aluminum trichloride, ethylene, p-dioxan, hydrogen, methanol, non-metals, oxidants, sulfur compounds, aniline, hydrogen sulfide, flammable solvents, hydrazine, and metal powders (especially zinc, aluminum, and magnesium), ammonium nitrate, nitryl fluoride, bromine pentafluoride, potassium perchlorate + titanium powder + indusorial earth.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** Will not occur.

## Section 11: Toxicological Information

**Routes of Entry:** Inhalation. Ingestion.

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

**Chronic Effects on Humans:**
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.
Causes damage to the following organs: skin.
May cause damage to the following organs: kidneys, lungs, liver, upper respiratory tract.

**Other Toxic Effects on Humans:**

Hazardous in case of inhalation.
Slightly hazardous in case of skin contact (irritant, sensitizer), of ingestion.

**Special Remarks on Toxicity to Animals:**
Lowest Published Lethal Dose/Conc:
LDL [Rat] - Route: Oral; Dose: 5000 mg/kg
LDL [Guinea Pig] - Route: Oral; Dose: 5000 mg/kg

**Special Remarks on Chronic Effects on Humans:** May cause cancer based on animal test data

**Special Remarks on other Toxic Effects on Humans:**
Acute Potential Health Effects:
Skin: Nickel dust and fume can irritate skin.
Eyes: Nickel dust and fume can irritate eyes.
Inhalation: Inhalation of dust or fume may cause respiratory tract irritation with non-productive cough, hoarseness, sore throat, headache, vertigo, weakness, chest pain, followed by delayed effects, including tachypnea, dyspnea, and ARDS. Death due to ARDS has been reported following inhalation of high concentrations of respirable metallic nickel dust. Later effects may include pulmonary edema and fibrosis.
Ingestion: Metallic nickel is generally considered not to be acutely toxic if ingested. Ingestion may cause nausea, vomiting, abdominal , and diarrhea. Nickel may damage the kidneys(proteinuria), and may affect liver function. It may also affect behavior (somnolence), and cardiovascular system (increased cornary artery resistance, decreased myocardial contractility, myocardial damage, regional or general arteriolar or venus dilation).
Chronic Potential Health Effects:
Skin: May cause skin allergy. Nickel and nickel compounds are among the most common sensitizers inducing allergic contact dermatitis.
Inhalation: Chronic inhalation nickel dust or fume can cause chronic hypertrophic rhinitis, sinusitis, nasal polyps, perforation of the nasal septum, chronic pulmonary irritation, fibrosis, pulmonary edema, pulmonary eosinophilia, Pneumoconiosis, allergies (asthma-like allergy), and cancer of the nasal sinus cavities, lungs, and possibly other organs. Future exposures can cause asthma attacks with shortness of breath, wheezing, cough, and/or chest tightness. Chronic inhalation of nickel dust or fume may also affect the liver (impaired liver function tests), and blood (changes in red blood cell count).
Ingestion: Prolonged or repeated ingestion of nickel can be a source chronic urticaria and other signs of allergy. Chronic ingestion of NIckel may also affect respiration and cause pneumoconiosis or fibrosis.
Note: In the general population, sensitization occurs from exposure to nickel-containing coins, jewelry, watches,

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

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

**Toxicity of the Products of Biodegradation:** The products of degradation are as toxic as the original product.

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

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

## Section 14: Transport Information

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

**Identification:** Not applicable.

**Special Provisions for Transport:** Not applicable.

## Section 15: Other Regulatory Information

**Federal and State Regulations:**
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Nickel metal
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Nickel metal
Connecticut hazardous material survey.: Nickel metal
Illinois toxic substances disclosure to employee act: Nickel metal
Illinois chemical safety act: Nickel metal
New York release reporting list: Nickel metal
Rhode Island RTK hazardous substances: Nickel metal
Pennsylvania RTK: Nickel metal
Michigan critical material: Nickel metal
Massachusetts RTK: Nickel metal
Massachusetts spill list: Nickel metal
New Jersey: Nickel metal
New Jersey spill list: Nickel metal
Louisiana spill reporting: Nickel metal
California Director's List of Hazardous Substances: Nickel metal
TSCA 8(b) inventory: Nickel metal

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

**Other Classifications:**

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

**DSCL (EEC):**
R40- Possible risks of irreversible effects.
R43- May cause sensitization by skin contact.
S22- Do not breathe dust.
S36- Wear suitable protective clothing.

**HMIS (U.S.A.):**

**Health Hazard:** 2

**Fire Hazard:** 0

**Reactivity:** 0

**Personal Protection:** E

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

**Health:** 2

**Flammability:** 0

**Reactivity:** 0

**Specific hazard:**

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

## Section 16: Other Information

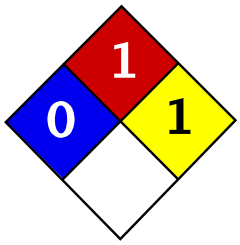
**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/10/2005 08:42 PM

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

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




| | |
|---|---|
| Health | 1 |
| Fire | 1 |
| Reactivity | 1 |
| Personal Protection | E |

# Material Safety Data Sheet
## Zinc Metal MSDS

## Section 1: Chemical Product and Company Identification

**Product Name:** Zinc Metal

**Catalog Codes:** SLZ1054, SLZ1159, SLZ1267, SLZ1099, SLZ1204

**CAS#:** 7440-66-6

**RTECS:** ZG8600000

**TSCA:** TSCA 8(b) inventory: Zinc Metal

**CI#:** Not applicable.

**Synonym:** Zinc Metal Sheets; Zinc Metal Shot; Zinc Metal Strips

**Chemical Name:** Zinc Metal

**Chemical Formula:** Zn

**Contact Information:**

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

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

Order Online: ScienceLab.com

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

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

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

## Section 2: Composition and Information on Ingredients

**Composition:**

| Name | CAS # | % by Weight |
|---|---|---|
| Zinc Metal | 7440-66-6 | 100 |

**Toxicological Data on Ingredients:** Zinc Metal LD50: Not available. LC50: Not available.

## Section 3: Hazards Identification

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

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

## Section 4: First Aid Measures

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

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

**Serious Skin Contact:** Not available.

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

**Serious Inhalation:** Not available.

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

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

**Flammability of the Product:** Flammable.

**Auto-Ignition Temperature:** 480°C (896°F)

**Flash Points:** Not available.

**Flammable Limits:** Not available.

**Products of Combustion:** Not available.

**Fire Hazards in Presence of Various Substances:**
Slightly flammable to flammable in presence of open flames and sparks, of heat, of oxidizing materials, of acids, of alkalis, of moisture.
Non-flammable in presence of shocks.

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

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

**Special Remarks on Fire Hazards:**
Zinc + NaOH causes ignition.
Oxidation of zinc by potassium proceeds with incandescence.
Residues from zinc dust /acetic acid reduction operations may ignite after long delay if discarded into waste bins with paper.
Incandescent reaction when Zinc and Arsenic or Tellurium, or Selenium are combined.
When hydrazine mononitrate is heated in contact with zinc, a flamming decomposition occurs at temperatures a little above its melting point.
Contact with acids and alkali hydroxides (sodium hydroxide, postasium hydroxide, calcium hydroxide, etc.) results in evolution of hydrogen with sufficient heat of reaction to ignite the hydrogen gas.
Zinc foil ignites if traces of moisture are present.
It is water reactive and produces flammable gases on contact with water. It may ignite on contact with water or

moist air.

**Special Remarks on Explosion Hazards:** Not available.

## Section 6: Accidental Release Measures

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

**Large Spill:**
Flammable solid that, in contact with water, emits flammable gases.
Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Cover with dry earth, sand or other non-combustible material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

## Section 7: Handling and Storage

**Precautions:**
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe dust. Keep away from incompatibles such as oxidizing agents, acids, alkalis, moisture.

**Storage:**
Keep container tightly closed. Keep container in a cool, well-ventilated area. Keep from any possible contact with water. Do not allow water to get into container because of violent reaction.

## Section 8: Exposure Controls/Personal Protection

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

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

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

**Exposure Limits:** Not available.

## Section 9: Physical and Chemical Properties

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

**Odor:** Not available.

**Taste:** Not available.

**Molecular Weight:** 65.39 g/mole

**Color:** Bluish-grey

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

**Boiling Point:** 907°C (1664.6°F)

**Melting Point:** 419°C (786.2°F)

**Critical Temperature:** Not available.

**Specific Gravity:** Not available.

**Vapor Pressure:** Not applicable.

**Vapor Density:** Not available.

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

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

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Excess heat, incompatible materials, moisture

**Incompatibility with various substances:**
Reactive with oxidizing agents, acids, alkalis.
Slightly reactive to reactive with moisture.
The product may react violently with water to emit flammable but non toxic gases.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:**
Incompatible with acids, halogenated hydrocarbons, $NH_4NO_3$, barium oxide, $Ba(NO_3)_2$, Cadmium, $CS_2$, chlorates, $Cl_2$, $CrO_3$, $F_2$, Hydroxylamine, $Pb(N_3)_2$, $MnCl_2$, $HNO_3$, performic acid, $KClO_3$, $KNO_3$, $N_2O_2$, Selenium, $NaClO_3$, $Na_2O_2$, Sulfur, Te, water, $(NH_4)_2S$, $As_2O_3$, $CS_2$, $CaCl_2$, chlorinated rubber, catalytic metals, halocarbons, o-nitroanisole, nitrobenzene, nonmetals, oxidants, paint primer base, pentacarbonoyliron, transition metal halides, seleninyl bromide, HCl, $H_2SO_4$, (Mg +$Ba(NO_3)_2$ +$BaO_2$), (ethyl acetoacetate +tribromoneopentyl alcohol.
Contact with Alkali Hydroxides(Sodium Hydroxide, Potassium Hydroxide, Calcium Hydroxide, etc) results in evolution of hydrogen.
Ammonium nitrate + zinc + water causes a violent reaction with evolution of steam and zinc oxide.
May react with water.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** Will not occur.

## Section 11: Toxicological Information

**Routes of Entry:** Inhalation. Ingestion.

**Toxicity to Animals:**

LD50: Not available.
LC50: Not available.

**Chronic Effects on Humans:** Not available.

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

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:** Not available.

**Special Remarks on other Toxic Effects on Humans:**
Acute Potential Health Effects:
Skin: May cause skin irritation. Dermal exposure to zinc may produce leg pains, fatigue, anorexia and weight loss.
Eyes: May cause eye irritation.
Ingestion: May be harmul if swallowed. May cause digestive tract irritation with tightness in throat, nausea, vomiting, diarrhea, loss of appetite, malaise, abdominal pain. fever, and chills. May affect behavior/central nervous system and autonomic nervous system with ataxia, lethargy, staggering gait, mild derrangement in cerebellar function, lightheadness, dizzness, irritability, muscular stiffness, and pain. May also affect blood.
Inhalation: Inhalation of zinc dust or fumes may cause respiratory tract and mucous membrane irritation with cough and chest pain. It can also cause "metal fume fever", a flu-like condition characterized appearance of chills, headached fever, maliase, fatigue, sweating, extreme thirst, aches in the legs and chest, and difficulty in breathing. A sweet taste may also be be present in metal fume fever, as well as a dry throat, aches, nausea, and vomiting, and pale grey cyanosis.
The toxicological properties of this substance have not been fully investisgated.

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

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

**Toxicity of the Products of Biodegradation:** Not available.

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

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

## Section 14: Transport Information

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

**Identification:** Not applicable.

**Special Provisions for Transport:** Not applicable.

## Section 15: Other Regulatory Information

**Federal and State Regulations:**

New York release reporting list: Zinc Metal
Rhode Island RTK hazardous substances: Zinc Metal
Pennsylvania RTK: Zinc Metal
Florida: Zinc Metal
Michigan critical material: Zinc Metal
Massachusetts RTK: Zinc Metal
New Jersey: Zinc Metal
California Director's List of Hazardous Substances: Zinc Metal
TSCA 8(b) inventory: Zinc Metal
TSCA 12(b) one time export: Zinc Metal
SARA 313 toxic chemical notification and release reporting: Zinc Metal
CERCLA: Hazardous substances.: Zinc Metal: 1000 lbs. (453.6 kg)

**Other Regulations:** EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

**Other Classifications:**

**WHMIS (Canada):** Not Available

**DSCL (EEC):**
R15- Contact with water liberates
extremely flammable gases.
R17- Spontaneously flammable in air.
S7/8- Keep container tightly closed and dry.

**HMIS (U.S.A.):**

**Health Hazard:** 1

**Fire Hazard:** 1

**Reactivity:** 1

**Personal Protection:** E

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

**Health:** 0

**Flammability:** 1

**Reactivity:** 1

**Specific hazard:**

**Protective Equipment:**
Gloves.
Lab coat.
Dust respirator. Be sure to use an
approved/certified respirator or
equivalent.
Safety glasses.

## Section 16: Other Information

**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/10/2005 12:18 AM

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

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

Department of Health and Human Services
Agency for Toxic Substances & Disease Registry



**ToxFAQs™: Chemical Agent Briefing Sheets (CABS)**

# Lead

Email this page
Printer-friendly version

**January 2006**

PDF Version


- What is lead?
- What are the forms of lead?
- What are the common uses of lead?
- What are the routes of exposure for lead?
- Who are the populations most at risk and how are they usually exposed?
- What are the possible toxic effects of lead?
- How can I reduce the risk of exposure to lead?
- What are the safety guidelines for lead exposure?
- What are the most important or common mediating factors?
- Is there a test to see if my child or I have been exposed to lead?
- Future Research Needs
- For more information


## What is lead?

Lead is a heavy, bluish-gray metal that has a low melting point. It occurs naturally in the Earth's crust, but it is not a particularly abundant element. It is rarely found naturally as a metal, but rather in its divalent (2+) oxidative state in ore deposits widely distributed throughout the world. The most important lead containing ores are galena (PbS), anglesite ($PbSO_4$), and cerussite ($PbCO_3$). Natural lead is a mixture of four stable isotopes: $^{208}Pb$ (51%–53%), $^{206}Pb$ (23.5%–27%), $^{207}Pb$ (20.5%–23%), and $^{204}Pb$ (1.35%–1.5%).

## What are the forms of lead?

- Metallic lead
- Inorganic lead and lead compounds (or lead salts)
- Organic lead (containing carbon)

## What are the common uses of lead?

The largest use for lead is in storage batteries in cars and other vehicles. Lead may be used as a pure metal, alloyed with other metals, or as chemical compounds.

Lead used by industry comes from mined ores ("primary") or from recycled scrap metal or batteries ("secondary"). However, most lead today is obtained from recovery of recycled scrap, mostly lead-acid batteries.

Human activities, such as lead mining and smelting operations and manufacturing and use of lead products (*e.g.*, leaded gasoline, lead-based paint), have resulted in the contamination of many industrial and residential areas with lead.

| Form | Uses |
|---|---|
| **Metallic lead** | Certain uses of lead, such as leaded gasoline, lead-based paints for domestic use, lead-based solder in food cans and water pipes, lead sinkers, and ammunition, have been reduced or banned to minimize lead's harmful effects on people and animals. |
| **Lead and lead compounds (or lead salts), such as**<br>• **lead acetate**<br>• **lead chloride**<br>• **lead nitrate**<br>• **lead oxide**<br>• **lead phosphate**<br>• **lead acetate** | • **Cosmetics and hair dye** - Some hair dyes and some non-Western cosmetics, such as kohl and surma, contain lead.<br>• **Fishing equipment** - Most fishing weights and sinkers are made from lead.<br>• **Folk remedies** - Many non-Western folk remedies used to treat diarrhea or other ailments may contain substantial amounts of lead. Examples of these include alarcon, ghasard, alkohl, greta, azarcon, |

| | |
|---|---|
| • **lead sulfate**<br>• **lead sulfide** | liga, bali goli, pay-loo-ah, coral, and rueda.<br>• **Glazing** - Applied to some ceramicware can contain lead.<br>• **Lead based paint** - Although the sale of residential lead-based paint was banned in the United States in 1978, it remains a major source of lead exposure for young children residing in older houses.<br>• **Lead batteries** - Production of lead-acid batteries is the major use of lead.<br>• **Lead-based solder** - Has been banned for use in water distribution systems, but many buildings and homes contain lead pipes or lead-based solder. Lead-based solder also is used for electrical circuitry applications.<br>• **Lead-shot** and **ammunition** - It is the second highest production use of lead.<br>• Other uses of lead include the production of lead alloys, soldering materials, shielding for x-ray machines, and manufacturing of corrosion- and acid-resistant materials used in the building industry. |
| **Organic**<br>• **tetraethyl lead**<br>• **tetramethyl lead** | The use of lead in gasoline was phased out in the 1980s, and has been banned since January 1, 1996. The use of lead in gasoline has contributed to its dispersion throughout the environment. During the combustion of gasoline containing these alkyllead compounds, significant amounts of inorganic lead can be released to the surrounding areas.<br>**Current Uses**<br>• Gasoline for off-road vehicles, farm equipment, and airplanes<br>**Past Uses**<br>• Gasoline additives (to increase octane rating) |

## What are the routes of exposure for lead?

People are most likely to be exposed to lead by consuming contaminated food and drinking water. Exposure can also occur by inadvertently ingesting contaminated soil, dust, or lead-based paint.

| Form | Routes of Exposure |
|---|---|
| **Metallic lead**<br>**Lead and lead compounds (or lead salts), such as**<br>• **lead acetate**<br>• **lead chloride**<br>• **lead nitrate**<br>• **lead oxide**<br>• **lead phosphate**<br>• **lead subacetate**<br>• **lead sulfate**<br>• **lead sulfide** | • Ingestion is the primary source of exposure to the general population.<br>• Lead paint is a major source of environmental exposure for children who ingest flaking paint, paint chips, and weathered powdered paint (mostly from deteriorated housing units in urban areas). Lead paint can also contribute to soil/dust lead which can be inadvertently ingested via hand-to-mouth activity of young children.<br>• Lead can leach into drinking water from lead-based solder used in water pipes.<br>• Lead can leach into foods or liquids stored in ceramic containers made with lead glazing.<br>• Engaging in hobbies such as casting ammunition, making fishing weights, and stained glass can result in exposure to lead.<br>• Exposure by inhalation can result during activities such as soldering with lead solder or sanding or sandblasting lead-based paint. |
| **Organic**<br>• **tetraethyl lead**<br>• **tetramethyl lead** | • Inhalation<br>• Dermal studies in animals have shown that organic lead is well absorbed through the skin |

## Who are the populations most at risk and how are they usually exposed?

People living near hazardous waste sites, lead smelters or refineries, battery recycling or crushi ng centers, or other industrial lead sources may be exposed to lead and chemicals that contain lead. Workers in occupations that have sources of lead exposure ( *e.g.*, plumbers, miners, mechanics, and lead smelter or refinery workers).

Certain hobbies, folk remedies, home activities, and car repairs ( *e.g.*, radiator repair) can contribute to lead exposure. Smoking cigarettes or breathing second-hand smoke increases exposure because tobacco smoke contains small amounts of lead.

Pregnant women, the developing fetuses, and young children are particularly vulnerable to the effe cts of lead. Young children are more likely to play in dirt and to place their hands and other objects in their

mouths, thereby increasing the opportunity for exposure via ingestion of lead-contaminated soil an d dust.

### What are the possible toxic effects of lead?

The most sensitive targets for lead toxicity are the developing nervous system, the hematological and cardiovascular systems, and the kidney. However, because of lead's many modes of action in biologi cal systems, lead could potentially affect any system or organs in the body. The effects are the same whether it is breathed or swallowed.

**Blood Lead Concentrations Corresponding to Adverse Health Effects**

| Life Stage | Effect | Blood lead (µg/dL) |
|---|---|---|
| **Children** | Depressed ALAD* activity | <5 |
| | Neurodevelopmental effects | <10 |
| | Sexual maturation | <10 |
| | Depressed vitamin D | >15 |
| | Elevated EP** | >15 |
| | Depressed NCV*** | >30 |
| | Depressed hemoglobin | >40 |
| | Colic | >60 |
| **Adults** | Depressed GFR**** | <10 |
| | Elevated blood pressure | <10 |
| | Elevated EP (females) | >20 |
| | Enzymuria/proteinuria | >30 |
| | Peripheral neuropathy | >40 |
| | Neurobehavioral effects | >40 |
| | Altered thyroid hormone | >40 |
| | Reduced fertility | >40 |
| | Depressed hemoglobin | >50 |
| **Elderly adults** | Depressed ALAD* | <5 |
| | Neurobehavioral effects | >4 |

*aminolevulinic acid dehydratase (ALAD)

**erythrocyte porphyrin (EP)

***nerve conduction velocity (NCV)

****glomerular filtration rate (GFR)

Source: ATSDR Toxicological Profile for Lead (Draft for Public Comment), 2005.

### How can I reduce the risk of exposure to lead?

- Do not allow children to chew or mouth surfaces that may have been painted with lead-based paint (homes built before 1978).
- If you have a water lead problem, the U.S. Environmental Protection Agency (EPA) recommends that you flush your cold water pipes if they have not been used in over 6 hours by running water until it is cold (5 seconds to 2 minutes) before drinking or cooking with it.
- Avoid some types of paints and pigments that contain lead and are used as make-up or hair coloring; keep these kinds of products away from children.
- Hire a professional contractor, who is required to follow certain health safety requirements for remediation or renovation involving lead-based paint, (www.epa.gov/lead/pubs/leadinfo.htm#remodeling).
- Wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

### What are the safety guidelines for lead exposure?

**Air**

- National Institute for Occupational Safety and Health (NIOSH)

  Recommended exposure limit (REL) time-weighted average (TWA) - 0.05 $mg/m^3$
  Immediately dangerous to life or health (IDLH) - 100 $mg/m^3$

- Occupational Safety and Health Administration (OSHA)

  Air - workplace 50 $\mu g/m^3$
  Action level - 40 µg/100 g of whole blood

- The American Conference of Governmental Industrial Hygienists (ACGIH)

Threshold limit values (TLV)/(TWA) - 0.05 mg/m$^3$
TLV/TWA guideline for lead arsenate - 150 µg/m$^3$
TLV/TWA guideline for other forms of lead - 50 µg lead/m$^3$

- U.S. Environmental Protection Agency (EPA)

  National Primary and Secondary Ambient Air Quality Standards - 1.5 µg/m$^3$

- World Health Organization (WHO)

  Air quality guidelines -- 0.5 µg/m$^3$

**Water**

- EPA

  Maximum contaminant level (MCL) - action level 0.015 mg/L
  Action level for public supplies - 15 µg/L

- WHO

  Drinking Water Quality Guidelines - 0.01 mg/L

**Blood**

- Centers for Disease Control and Prevention (CDC)

  Level of concern for children - 10 µg/dL

- OSHA

  Cause for written notification and medical exam - 40 µg/dL
  Cause for medical removal from exposure - 50 µg/dL

- ACGIH

  Advisory; biological exposure index - 30 µg/dL

**Food**

- Food and Drug Administration (FDA)

  Bottled drinking water - 0.005 mg/L

**Other**

- ACGIH

  Biological exposure indices (lead in blood) - 30 µg/100 mL

- Consumer Product Safety Commission

  Paint - 600 ppm

- FDA

  Ceramicware (µg/mL leaching solution) - 0.5-3.0 µg/mL

µg/m$^3$: micrograms per cubic meter
µg/dL: micrograms per deciliter
µg/L: micrograms per liter
g: gram
mg/L: milligrams per liter
mL: milliliter
ppm: parts per million

### What are the most important or common mediating factors?

Factors that determine the severity of the health effects from lead exposure include

- Dose
- Age of the person exposed
  - the developing nervous system is the most sensitive system to the effects of lead
  - the efficiency of lead absorption from the gastrointestinal tract is greater in children than in adults
- Life stages of women (childbirth, lactating, menopause)
- Occupational exposures
- Duration of exposure
- Health and lifestyle of the person exposed
- Nutritional status of the person exposed
  - a diet adequate in calcium and iron may decrease lead absorption

The toxic effects of lead exposure may be worse in individuals with inherited genetic diseases or gene polymorphisms such as thalassemia, individuals with glucose-6-phosphate dehydrogenase (G6PD) deficiency, and carriers of certain gene polymorphic forms (*e.g.*, ALAD and vitamin D receptor). Research continues about this topic.

### Is there a test to see if my child or I have been exposed to lead?

| | |
|---|---|
| **Blood** | • The screening test of choice is blood lead levels.<br>• Blood tests are commonly used to screen children for lead poisoning.<br>• Analysis of lead in whole blood is the most common and accurate method of assessing lead exposure.<br>• Exposure to lead also can be evaluated by measuring erythrocyte protoporphyrin (EP) in blood samples. EP is a part of red blood cells known to increase when the amount of lead in the blood is high. However, the EP level is not sensitive enough to identify children with elevated blood lead levels below about 25 micrograms per deciliter (µg/dL). |
| **Bone and Teeth** | • X-ray fluorescence techniques have been used to determine lead concentration in bones and teeth. It is not widely available and is used mostly in research.<br>• Lead partitions to bone over a lifetime of exposure; therefore, bone lead measurements may be a better indicator of cumulative exposure than blood lead. |
| **Urine** | • Measurements of urinary lead levels have been used to assess lead exposure.<br>• The measurement of lead excreted in urine following chelation with calcium disodium EDTA (EDTA provocation) has been used to detect elevated body burden of lead in adults and children. |
| **Hair and Nails** | • These are not reliable for testing due to errors external contamination. They are relatively poor predictors of blood lead, particularly at low concentrations. |

### Future Research Needs

To close current gaps in the scientific database on the health effects of lead, a long–term resear ch program is needed that might include the following:

- Further short-term studies or studies in vitro designed to clarify mechanisms of action for the various toxicities might be useful.
- Studies identifying exposures during different developmental periods can help identify critical periods of vulnerability for immunocompetence, development of sex organs, or neurobehavioral parameters.
- Chronic-duration exposure studies in animals would expand information on the toxicity of lead. Special studies that examine biochemical and morphological effects of lead may provide new information on mechanisms of action of lead, particularly for the effects of greatest concern such as neurobehavioral changes in children.
- Development of new and more sensitive tests of specific neuropsychological functions.
- Further investigation of links between lead and amyotrophic lateral sclerosis, essential tremor, schizophrenia, and Parkinson's disease.
- Epidemiological studies designed in a manner that permits more rigorous assessments of effect modification.
- Studies about the long-term consequences of lead-related neurobehavioral deficits detected in infants and children and the manifestation of chronic neurobehavioral problems in adolescence and adulthood.
- Further characterization of bone lead concentration as a biomarker of exposure for various effect end points (*e.g.*, blood pressure and renal effects).
- Studies of the potential prevalence of elevated bone lead stores in women of reproductive age and the associated risk that this poses to fetal development by mobilization of maternal bone stores during pregnancy.
- Further clarification of the role of some genetic polymorphisms.
- Evaluation of cohorts from prospective studies into adulthood for potential late-appearing effects including cancer.

### For more information

- Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile for Lead

  http://www.atsdr.cdc.gov/toxprofiles/tp13.html

- ATSDR ToxFAQs™ for Lead

  http://www.atsdr.cdc.gov/tfacts13.html

- ATSDR Case Studies in Environmental Medicine Lead Toxicity

  http://www.atsdr.cdc.gov/csem/lead/

- ATSDR Interaction Profile for Chemical Mixtures for Arsenic, Cadmium, Chromium, and Lead

  http://www.atsdr.cdc.gov/interactionprofiles/ip04.html

- ATSDR Interaction Profile for Chemical Mixtures for Lead, Manganese, Zinc, and Copper

  http://www.atsdr.cdc.gov/interactionprofiles/ip06.html

- ATSDR Interaction Profile for Chemical Mixtures for Chlorpyrifos, Lead, Mercury, and Methylmercury

  http://www.atsdr.cdc.gov/interactionprofiles/ip11.html

- Centers for Disease Control and Prevention Lead Web Page

  http://www.cdc.gov/lead/

- U.S. Environmental Protection Agency Lead Web Page

  http://www.epa.gov/lead/

- U.S. Department of Labor, Occupational Safety & Health Administration

  http://www.osha.gov/SLTC/lead/

**For more information, contact:**

*Agency for Toxic Substances and Disease Registry*
*Division of Toxicology and Environmental Medicine*
*1600 Clifton Road NE, Mailstop F-32*
*Atlanta, GA 30333*
*Phone: 1-800-CDC-INFO (800-232-4636)*
*TTY 888-232-6348*

*FAX: (770)-488-4178*
*Email: CDCINFO@cdc.gov*

This page was updated on 01/04/2008

# Mercury

Mercury is a naturally occurring metal found in air, water, and soil. It exists in several forms, including elemental (or metallic) mercury, inorganic mercury compounds, and organic mercury compounds:

- **Elemental mercury** is liquid at room temperature and is used in thermometers, fluorescent light bulbs, some electrical switches, and some industrial processes.
- **Inorganic mercury** compounds are formed when mercury combines with other elements to form salts, which are usually powders or crystals. Inorganic mercury compounds are found naturally in the environment. Some forms of inorganic mercury have been used in antiseptic creams, ointments, and preservatives.
- **Organic mercury** compounds are formed when mercury combines with carbon. Microscopic organisms can produce organic mercury compounds (methylmercury) in contaminated water and soil, which can accumulate in the food chain. Other special types of organomercurials have been used as medical preservatives and medicines.

## How People Are Exposed to Mercury

- Eating fish or shellfish that is contaminated with methylmercury, which is the main source of general human exposures to mercury;
- Breathing air contaminated with elemental mercury vapors (e.g., in workplaces such as dental offices and industries that use mercury or in locations where a mercury spill or release has occurred);
- Having dental fillings that contain mercury; and
- Practicing cultural or religious rituals that use mercury.

## How Mercury Affects People's Health

- Short-term exposure to extremely high levels of elemental mercury vapors can result in lung damage, nausea, diarrhea, increases in blood pressure or heart rate, skin rashes, eye irritation, and injury to the nervous system.
- Prolonged exposure to lower levels of elemental mercury can permanently damage the brain and kidneys.
- The developing brain of a fetus can be injured if the mother is exposed to methylmercury.

## Levels of Mercury in U.S. Population

Scientists tested levels of mercury in the blood of 16,780 participants who took part in CDC's national study known as the National Health and Nutrition Examination Survey (NHANES). These findings are based on total blood mercury levels in the U.S. general

population for persons aged 1 year and older who participated in NHANES during 2003-2006, as well as trends in the total mercury of children aged 1–5 and females aged 16–49 during 1999–2006.

- In the total population during 2003–2006, the total blood mercury levels for non–Hispanic blacks and non–Hispanic whites were higher than those for Mexican Americans.
- Across the age groups in the total population during 2003-2006, total blood mercury levels increased with age, peaked at the fifth or sixth decade, depending on race/ethnicity, and then declined.
- In the most recent survey period of 2005–2006, the 95th percentile levels for total blood mercury in children aged 1-5 years and females aged 16-49 years were 1.43 µg/L and 4.48 µg/L, respectively. The 95th percentile means that 95 percent of the U.S. population's exposure is below this estimated level. Conversely, only 5 percent of the population will have values at this level or higher.
- Over the four survey periods from 1999-2006, blood mercury levels increased slightly for non–Hispanic white children and decreased slightly for non–Hispanic black and Mexican American children. Female children had slightly higher blood mercury levels than male children.

**For More Information**

- Agency for Toxic Substances and Disease Registry
  Detailed information about mercury and public health is available at http://www.atsdr.cdc.gov/alerts/970626.html and http://www.atsdr.cdc.gov/cabs/mercury/index.html
- CDC Emergency Preparedness and Response
  Case definitions of mercury, toxicology FAQs, and toxicological profile at http://emergency.cdc.gov/agent/mercury/

May 2009

The Centers for Disease Control and Prevention (CDC) protects people's health and safety by preventing and controlling diseases and injuries; enhances health decisions by providing credible information on critical health issues; and promotes healthy living through strong partnerships with local, national, and international organizations.

Department of Health and Human Services
Agency for Toxic Substances & Disease Registry

ATSDR Home › ToxFAQs™ Arsenic

## ToxFAQs™

**ToxFAQs™**
**for**
**Arsenic**
(*Arsénico*)
August 2007

**PDF Version, 92 KB**

**CAS#**: 7440-38-2

**This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.**


- Highlights
- What is arsenic?
- What happens to arsenic when it enters the environment?
- How might I be exposed to arsenic?
- How can arsenic affect my health?
- How likely is arsenic to cause cancer?
- How does arsenic affect children?
- How can families reduce their risk for exposure to arsenic?
- Is there a medical test to show whether I've been exposed to arsenic?
- Has the federal government made recommendations to protect human health?
- References
- Contact Information


### Highlights

Exposure to higher than average levels of arsenic occur mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic has been found in at least 1,149 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

### What is arsenic?

Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds.

Inorganic arsenic compounds are mainly used to preserve wood. Copper chromated arsenate (CCA) is used to make "pressure-treated" lumber. CCA is no longer used in the U.S. for residential uses; it is still used in industrial applications. Organic arsenic compounds are used as pesticides, primarily on cotton fields and orchards.

### What happens to arsenic when it enters the environment?

- Arsenic occurs naturally in soil and minerals and may enter the air, water, and land from wind-blown dust and may get into water from runoff and leaching.
- Arsenic cannot be destroyed in the environment. It can only change its form.
- Rain and snow remove arsenic dust particles from the air.
- Many common arsenic compounds can dissolve in water. Most of the arsenic in water will ultimately end up in soil or sediment.
- Fish and shellfish can accumulate arsenic; most of this arsenic is in an organic form called arsenobetaine that is much less harmful.

### How might I be exposed to arsenic?

- Ingesting small amounts present in your food and water or breathing air containing arsenic.
- Breathing sawdust or burning smoke from wood treated with arsenic.
- Living in areas with unusually high natural levels of arsenic in rock.
- Working in a job that involves arsenic production or use, such as copper or lead smelting, wood treating, or pesticide application.

### How can arsenic affect my health?

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs.

Ingesting very high levels of arsenic can result in death. Exposure to lower levels can cause naus ea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of “pins an d needles” in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of th e skin and the appearance of small “corns” or “warts” on the palms, soles, and torso.

Skin contact with inorganic arsenic may cause redness and swelling.

Almost nothing is known regarding health effects of organic arsenic compounds in humans. Studies i n animals show that some simple organic arsenic compounds are less toxic than inorganic forms. Ingestion of methyl and dimethyl compounds can cause diarrhea and damage to the kidneys.

### How likely is arsenic to cause cancer?

Several studies have shown that ingestion of inorganic arsenic can increase the risk of skin cance r and cancer in the liver, bladder, and lungs. Inhalation of inorganic arsenic can cause increased risk of lung cancer. The Department of Health and Human Services (DHHS) and the EPA have determined that inorganic arsenic is a known human carcinogen. The International Agency for R esearch on Cancer (IARC) has determined that inorganic arsenic is carcinogenic to humans.

### How does arsenic affect children?

There is some evidence that long-term exposure to arsenic in children may result in lower IQ score s. There is also some evidence that exposure to arsenic in the womb and early childhood may increase mortality in young adults.

There is some evidence that inhaled or ingested arsenic can injure pregnant women or their unborn babies, although the studies are not definitive. Studies in animals show that large doses of arsenic that cause illness in pregnant fem ales, can also cause low birth weight, fetal malformations, and even fetal death. Arsenic can cross the placenta and has been found in fetal ti ssues. Arsenic is found at low levels in breast milk.

### How can families reduce their risk for exposure to arsenic?

- If you use arsenic-treated wood in home projects, you should wear dust masks, gloves, and protecti ve clothing to decrease exposure to sawdust.
- If you live in an area with high levels of arsenic in water or soil, you should use cleaner source s of water and limit contact with soil.
- If you work in a job that may expose you to arsenic, be aware that you may carry arsenic home on y our clothing, skin, hair, or tools. Be sure to shower and change clothes before going home.

### Is there a medical test to show whether I've been exposed to arsenic?

There are tests available to measure arsenic in your blood, urine, hair, and fingernails. The urin e test is the most reliable test for arsenic exposure within the last few days. Tests on hair and fingernails can measure exposure to high levels of ars enic over the past 6-12 months. These tests can determine if you have been exposed to above-average levels of arsenic. They cannot predict whether the arsenic levels in your body will affect your health.

### Has the federal government made recommendations to protect human health?

The EPA has set limits on the amount of arsenic that industrial sources can release to the environ ment and has restricted or cancelled many of the uses of arsenic in pesticides. EPA has set a limit of 0.01 parts per million (ppm) for arsenic in drinking water.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit (PEL ) of 10 micrograms of arsenic per cubic meter of workplace air (10 $\mu g/m^3$) for 8 hour shifts and 40 hour work weeks.

### References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Arsenic *(Update)*. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

### Where can I get more information?

**For more information, contact**:

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Environmental Medicine
1600 Clifton Road NE, Mailstop F-62
Atlanta, GA 30333
Phone: 1-800-CDC-INFO • 888-232-6348 (TTY)
FAX: 770-488-4178
Email: cdcinfo@cdc.gov

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state heal th or environmental quality department if you have any more questions or concerns.

This page was updated on 10/05/2007

U.S. Environmental Protection Agency

# Pesticides: Topical & Chemical Fact Sheets



# Assessing Health Risks from Pesticides

January 1999
735-F-99-002

The Federal Government, in cooperation with the States, carefully regulates pesticides to ensure that they do not pose unreasonable risks to human health or the environment. As part of that effort, the Environmental Protection Agency (EPA) requires extensive test data from pesticide producers that demonstrate pesticide products can be used without posing harm to human health and the environment. EPA scientists and analysts carefully review these data to determine whether to register (license) a pesticide product or a use and whether specific restrictions are necessary. This fact sheet is a brief overview of EPA's process for assessing potential risks to human health when evaluating pesticide products.

## Background

There are more than 865 active ingredients registered as pesticides, which are formulated into thousands of pesticide products that are available in the marketplace. About 350 pesticides are used on the foods we eat, and to protect our homes and pets.

EPA plays a critical role in evaluating these chemicals prior to registration, and in reevaluating older pesticides already on the market, to ensure that they can be used with a reasonable certainty of no harm. The process EPA uses for evaluating the health impacts of a pesticide is called risk assessment.

EPA uses the National Research Council's four-step process for human health risk assessment:

**Step One**: Hazard Identification
**Step Two**: Dose-Response Assessment
**Step Three**: Exposure Assessment
**Step Four**: Risk Characterization

## Step One: Hazard Identification (Toxicology)

The first step in the risk assessment process is to identify potential health effects that may occur from different types of pesticide exposure. EPA considers the full spectrum of a pesticide's potential health effects.

Generally, for human health risk assessments, many toxicity studies are conducted on animals by pesticide companies in independent laboratories and evaluated for acceptability by EPA scientists. EPA evaluates pesticides for a wide range of adverse effects, from eye and skin irritation to cancer and birth defects in laboratory animals. EPA may also consult the public literature or other sources of supporting information on any aspect of the chemical.

## Step Two: Dose-Response Assessment

Paracelsus, the Swiss physician and alchemist, the "father" of modern toxicology (1493-1541) said,

> "The dose makes the poison."

In other words, **the amount of a substance a person is exposed to** is as important as **how toxic the chemical might be**. For example, small doses of aspirin can be beneficial to people, but at very high doses, this common medicine can be deadly. In some individuals, even at very low doses, aspirin may be deadly.

Dose-response assessment involves considering the dose levels at which adverse effects were observed in test animals, and using these dose levels to calculate an equal dose in humans.

## Step Three: Exposure Assessment

People can be exposed to pesticides in three ways:

1. Inhaling pesticides (inhalation exposure),
2. Absorbing pesticides through the skin (dermal exposure), and
3. Getting pesticides in their mouth or digestive tract (oral exposure).

Depending on the situation, pesticides could enter the body by any one or all of these routes. Typical sources of pesticide exposure include:

- **Food**
  Most of the foods we eat have been grown with the use of pesticides. Therefore, pesticide residues may be present inside or on the surfaces of these foods.

- **Home and Personal Use Pesticides**
  You might use pesticides in and around your home to control insects, weeds, mold, mildew, bacteria, lawn and garden pests and to protect your pets from pests such as fleas. Pesticides may also be used as insect repellants which are directly applied to the skin or clothing.

- **Pesticides in Drinking Water**
  Some pesticides that are applied to farmland or other land structures can make their way in small amounts to the ground water or surface water systems that feed drinking water supplies.

- **Worker Exposure to Pesticides**
  Pesticide applicators, vegetable and fruit pickers and others who work around pesticides can be exposed due to the nature of their jobs. To address the unique risks workers face from occupational exposure, EPA evaluates occupational exposure through a separate program. All pesticides registered by EPA have been shown to be safe when used properly.

## Step Four: Risk Characterization

Risk characterization is the final step in assessing human health risks from pesticides. It is the process of combining the hazard, dose-response and exposure assessments to describe the overall risk from a pesticide. It explains the assumptions used in assessing exposure as well as the uncertainties that are built into the dose-response assessment. The strength of the overall database is considered, and broad

conclusions are made. EPA's role is to evaluate both toxicity and exposure and to determine the risk associated with use of the pesticide.

Simply put,

RISK = TOXICITY x EXPOSURE.

This means that the risk to human health from pesticide exposure depends on both the toxicity of the pesticide and the likelihood of people coming into contact with it. At least *some* exposure and *some* toxicity are required to result in a risk. For example, if the pesticide is very poisonous, but no people are exposed, there is no risk. Likewise, if there is ample exposure but the chemical is non-toxic, there is no risk. However, usually when pesticides are used, there is some toxicity and exposure, which results in a potential risk.

EPA recognizes that effects vary between animals of different species and from person to person. To account for this variability, *uncertainty factors* are built into the risk assessment. These uncertainty factors create an additional margin of safety for protecting people who may be exposed to the pesticides. FQPA requires EPA to use an extra 10-fold safety factor, if necessary, to protect infants and children from effects of the pesticide.

## Types of Toxicity Tests EPA Requires for Human Health Risk Assessments

EPA evaluates studies conducted over different periods of time and that measure specific types of effects. These tests are evaluated to screen for potential health effects in infants, children and adults.

**Acute Testing**: Short-term exposure; a single exposure (dose).

- Oral, dermal (skin), and inhalation exposure
- Eye irritation
- Skin irritation
- Skin sensitization
- Neurotoxicity

**Sub-chronic Testing**: Intermediate exposure; repeated exposure over a longer period of time (i.e., 30-90 days).

- Oral, dermal (skin), and inhalation
- Neurotoxicity (nerve system damage)

**Chronic Toxicity Testing**: Long-term exposure; repeated exposure lasting for most of the test animal's life span. Intended to determine the effects of a pesticide after prolonged and repeated exposures.

- Chronic effects (non-cancer)
- Carcinogenicity (cancer)

Developmental and Reproductive Testing: Identify effects in the fetus of an exposed pregnant female (birth defects) and how pesticide exposure affects the ability of a test animal to successfully reproduce.

Mutagenicity Testing: Assess a pesticide's potential to affect the cell's genetic components.

Hormone Disruption: Measure effects for their potential to disrupt the endocrine system. The endocrine system consists of a set of glands and the hormones they produce that help guide the development, growth, reproduction, and behavior of animals including humans.

## Risk Management

Once EPA completes the risk assessment process for a pesticide, we use this information to determine if (when used according to label directions), there is a reasonable certainty that the pesticide will not harm a person's health.

Using the conclusions of a risk assessment, EPA can then make a more informed decision regarding whether to approve a pesticide chemical or use, as proposed, or whether additional protective measures are necessary to limit occupational or non-occupational exposure to a pesticide. For example, EPA may prohibit a pesticide from being used on certain crops because consuming too much food treated with the pesticide may result in an unacceptable risk to consumers. Another example of protective measures is requiring workers to wear personal protective equipment (PPE) such as a respirator or chemical resistant gloves, or not allowing workers to enter treated crop fields until a specific period of time has passed.

If, after considering all appropriate risk reduction measures, the pesticide still does not meet EPA's safety standard, the Agency will not allow the proposed chemical or use. Regardless of the specific measures enforced, EPA's primary goal is to ensure that legal uses of the pesticide are protective of human health, especially the health of children, and the environment.

## Human Health Risk Assessment and the Law

Federal law requires detailed evaluation of pesticides to protect human health and the environment. In 1996, Congress made significant changes to strengthen pesticide laws through the Food Quality Protection Act (FQPA). Many of these changes are key elements of the current risk assessment process. FQPA required that EPA consider:

- **A New Safety Standard**: FQPA strengthened the safety standard that pesticides must meet before being approved for use. EPA must ensure with a reasonable certainty that no harm will result from the legal uses of the pesticide.
- **Exposure from All Sources**: In evaluating a pesticide, EPA must estimate the combined risk from that pesticide from all non-occupational sources, such as:
  - Food Sources
  - Drinking Water Sources
  - Residential Sources
- **Cumulative Risk**: EPA is required to evaluate pesticides in light of similar toxic effects that different pesticides may share, or "a common mechanism of toxicity." At this time, EPA is developing a methodology for this type of assessment.
- **Special Sensitivity of Children to Pesticides**: EPA must ascertain whether there is an increased susceptibility from exposure to the pesticide to infants and children. EPA must build an additional 10-fold safety factor into risk assessments to ensure the protection of infants and children, unless it is determined that a lesser margin of safety will be safe for infants and children.

## For More Information

If you would like more information about EPA's pesticide programs, contact the Communication Service Branch at (703) 305-5017 or visit the Pesticides Web site.

For more information on specific pesticides, or to inquire about the symptoms of pesticide poisoning, call the National Pesticide Information Center (NPIC), a toll-free hotline information at: 1-800-858-7378, or visit their Web site EXIT Disclaimer .

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY



CONTENTS

Highlights
What are polychlorinated biphenyls (PCBs)?
What happens to polychlorinated biphenyls (PCBs) when they enter the environment?
How might I be exposed to polychlorinated biphenyls (PCBs)?
How can polychlorinated biphenyls (PCBs) affect my health?
How likely are polychlorinated biphenyls (PCBs) to cause cancer?
How do polychlorinated biphenyls (PCBs) affect children?
How can families reduce the risk of exposure to polychlorinated biphenyls (PCBs)??
Is there a medical test to show whether I've been exposed to polychlorinated biphenyls (PCBs)?
Has the federal government made recommendations to protect human health?
References

February 2001

# ToxFAQs™ for Polychlorinated Biphenyls (PCBs)

*(Bifenilos Policlorados (BPCs))*

**This fact sheet answers the most frequently asked health questions about polychlorinated biphenyls (PCBs). For more information, you may call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.**

**HIGHLIGHTS: Polychlorinated biphenyls (PCBs) are a mixture of individual chemicals which are no longer produced in the United States, but are still found in the environment. Health effects that have been associated with exposure to PCBs include acne-like skin conditions in adults and neurobehavioral and immunological changes in children. PCBs are known to cause cancer in animals. PCBs have been found in at least 500 of the 1,598 National Priorities List sites identified by the Environmental Protection Agency (EPA).**

## What are polychlorinated biphenyls (PCBs)?

Polychlorinated biphenyls are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. Some PCBs can exist as a vapor in air. PCBs have no known smell or taste. Many commercial PCB mixtures are known in the U.S. by the trade name Aroclor.

PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators. The manufacture of PCBs was stopped in the U.S. in 1977 because of evidence they build up in the environment and can cause harmful health effects. Products made before 1977 that may contain PCBs include old fluorescent lighting fixtures and electrical devices containing PCB capacitors,

Contact Information

RELATED RESOURCES

ToxFAQ™ 35k

ToxFAQ™ en Español 32k

Public Health Statement 125k

Public Health Statement en Español 321k

Toxicological Profile 13.6MB

A-Z INDEX

A B C
D E
F G H I
J K
L M N O P
Q R S
T U
V W X Y Z

ATSDR RESOURCES

ToxFAQs™

ToxFAQs™ en Español

Public Health Statements

Toxicological Profiles

Minimum Risk Levels

MMGs

MHMIs

Interaction Profiles

Priority List of Hazardous Substances

Division of Toxicology

and old microscope and hydraulic oils.

back to top

## What happens to polychlorinated biphenyls (PCBs) when they enter the environment?

- PCBs entered the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs.
- PCBs can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators.
- PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. In water, a small amount of PCBs may remain dissolved, but most stick to organic particles and bottom sediments. PCBs also bind strongly to soil.
- PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water.

back to top

## How might I be exposed to polychlorinated biphenyls (PCBs)?

- Using old fluorescent lighting fixtures and electrical devices and appliances, such as television sets and refrigerators, that were made 30 or more years ago. These items may leak small amounts of PCBs into the air when they get hot during operation, and could be a source of skin exposure.
- Eating contaminated food. The main dietary sources of PCBs are fish (especially sportfish caught in contaminated lakes or rivers), meat, and dairy products.
- Breathing air near hazardous waste sites and drinking contaminated well water.
- In the workplace during repair and maintenance of PCB transformers; accidents, fires or spills involving transformers, fluorescent lights, and other old electrical devices; and disposal of PCB materials.

back to top

## How can polychlorinated biphenyls (PCBs) affect my health?

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population examined children of mothers who were exposed to PCBs.

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

back to top

## How likely are polychlorinated biphenyls (PCBs) to cause cancer?

Few studies of workers indicate that PCBs were associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats that ate food containing high levels of PCBs for two years developed liver cancer. The Department of Health and Human Services (DHHS) has concluded that PCBs may reasonably be anticipated to be carcinogens. The EPA and the International Agency for Research on Cancer (IARC) have determined that PCBs are probably carcinogenic to humans.

back to top

## How do polychlorinated biphenyls (PCBs) affect children?

Women who were exposed to relatively high levels of PCBs in the workplace or ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies from women who did not have these exposures. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behavior. Some of these behaviors, such as problems with motor skills and a decrease in short-term memory, lasted for several years. Other studies suggest that the immune system was affected in children born to and nursed by mothers exposed to increased levels of PCBs. There are no reports of structural birth defects caused by exposure to PCBs or of health effects of PCBs in older children. The most likely way infants will be exposed to PCBs is from breast milk. Transplacental transfers of PCBs were also reported In most cases, the benefits of breast-feeding outweigh any risks from exposure to PCBs in mother's milk.

back to top

## How can families reduce the risk of exposure to polychlorinated biphenyls (PCBs)?

- You and your children may be exposed to PCBs by eating fish or wildlife caught from contaminated locations. Certain states, Native American tribes, and U.S. territories have issued advisories to warn people about PCB-contaminated fish and fish-eating wildlife. You can reduce your family's exposure to PCBs by obeying these advisories.
- Children should be told not play with old appliances, electrical equipment, or transformers, since they may contain PCBs.
- Children should be discouraged from playing in the dirt near hazardous waste sites and in areas where there was a transformer fire. Children should also be discouraged from eating dirt and putting dirty hands, toys or other objects in their mouths, and should wash hands frequently.
- If you are exposed to PCBs in the workplace it is possible to carry them home on your clothes, body, or tools. If this is the case, you should shower and change clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

back to top

## Is there a medical test to show whether I've been exposed to polychlorinated biphenyls (PCBs)?

Tests exist to measure levels of PCBs in your blood, body fat, and breast milk, but these are not routinely conducted. Most people normally have low levels of PCBs in their body because nearly everyone has been environmentally exposed to PCBs. The tests can show if your PCB levels are elevated, which would indicate past exposure to above-normal levels of PCBs, but cannot determine when or how long you were exposed or whether you will develop health effects.

back to top

## Has the federal government made recommendations to protect human health?

The EPA has set a limit of 0.0005 milligrams of PCBs per liter of drinking water (0.0005 mg/L). Discharges, spills or accidental releases of 1 pound or more of PCBs into the environment must be reported to the EPA. The Food and Drug Administration (FDA) requires that infant foods, eggs, milk and other dairy products, fish and shellfish, poultry and red meat contain no more than 0.2-3 parts of PCBs per million parts (0.2-3 ppm) of food. Many states have established fish and wildlife consumption advisories for PCBs.

back to top

## References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for polychlorinated biphenyls (PCBs). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

back to top

## Where can I get more information?

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

**For more information, contact**:

Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE, Mailstop F-32
Atlanta, GA 30333
Phone: 1-888-42-ATSDR (1-888-422-8737)
FAX: (770)-488-4178
Email: ATSDRIC@cdc.gov

back to top

ATSDR Department of Health and Human Services
Agency for Toxic Substances & Disease Registry

Home › CERCLA 2007 CERCLA Substance List

## 2007 CERCLA Priority List of Hazardous Substances

| 2007 RANK | SUBSTANCE NAME | TOTAL POINTS | 2005 RANK | CAS # |
|---|---|---|---|---|
| 1 | ARSENIC | 1672.58 | 1 | 007440-38-2 |
| 2 | LEAD | 1534.07 | 2 | 007439-92-1 |
| 3 | MERCURY | 1504.69 | 3 | 007439-97-6 |
| 4 | VINYL CHLORIDE | 1387.75 | 4 | 000075-01-4 |
| 5 | POLYCHLORINATED BIPHENYLS | 1365.78 | 5 | 001336-36-3 |
| 6 | BENZENE | 1355.96 | 6 | 000071-43-2 |
| 7 | CADMIUM | 1324.22 | 8 | 007440-43-9 |
| 8 | POLYCYCLIC AROMATIC HYDROCARBONS | 1316.98 | 7 | 130498-29-2 |
| 9 | BENZO(A)PYRENE | 1312.45 | 9 | 000050-32-8 |
| 10 | BENZO(B)FLUORANTHENE | 1266.55 | 10 | 000205-99-2 |
| 11 | CHLOROFORM | 1223.03 | 11 | 000067-66-3 |
| 12 | DDT, P,P'- | 1193.36 | 12 | 000050-29-3 |
| 13 | AROCLOR 1254 | 1182.63 | 13 | 011097-69-1 |
| 14 | AROCLOR 1260 | 1177.77 | 14 | 011096-82-5 |
| 15 | DIBENZO(A,H)ANTHRACENE | 1165.88 | 15 | 000053-70-3 |
| 16 | TRICHLOROETHYLENE | 1154.73 | 16 | 000079-01-6 |
| 17 | DIELDRIN | 1150.91 | 17 | 000060-57-1 |
| 18 | CHROMIUM, HEXAVALENT | 1149.98 | 18 | 018540-29-9 |
| 19 | PHOSPHORUS, WHITE | 1144.77 | 19 | 007723-14-0 |
| 20 | CHLORDANE | 1133.21 | 21 | 000057-74-9 |
| 21 | DDE, P,P'- | 1132.49 | 20 | 000072-55-9 |
| 22 | HEXACHLOROBUTADIENE | 1129.63 | 22 | 000087-68-3 |
| 23 | COAL TAR CREOSOTE | 1124.32 | 23 | 008001-58-9 |
| 24 | ALDRIN | 1117.22 | 25 | 000309-00-2 |
| 25 | DDD, P,P'- | 1114.83 | 24 | 000072-54-8 |
| 26 | BENZIDINE | 1114.24 | 26 | 000092-87-5 |
| 27 | AROCLOR 1248 | 1112.20 | 27 | 012672-29-6 |
| 28 | CYANIDE | 1099.48 | 28 | 000057-12-5 |
| 29 | AROCLOR 1242 | 1093.14 | 29 | 053469-21-9 |
| 30 | AROCLOR | 1091.52 | 62 | 012767-79-2 |
| 31 | TOXAPHENE | 1086.65 | 30 | 008001-35-2 |
| 32 | HEXACHLOROCYCLOHEXANE, GAMMA- | 1081.63 | 32 | 000058-89-9 |
| 33 | TETRACHLOROETHYLENE | 1080.43 | 31 | 000127-18-4 |
| 34 | HEPTACHLOR | 1072.67 | 33 | 000076-44-8 |
| 35 | 1,2-DIBROMOETHANE | 1064.06 | 34 | 000106-93-4 |
| 36 | HEXACHLOROCYCLOHEXANE, BETA- | 1060.22 | 37 | 000319-85-7 |
| 37 | ACROLEIN | 1059.07 | 36 | 000107-02-8 |
| 38 | DISULFOTON | 1058.85 | 35 | 000298-04-4 |
| 39 | BENZO(A)ANTHRACENE | 1057.96 | 38 | 000056-55-3 |
| 40 | 3,3'-DICHLOROBENZIDINE | 1051.61 | 39 | 000091-94-1 |

| | | | | |
|---|---|---|---|---|
| 41 | ENDRIN | 1048.57 | 41 | 000072-20-8 |
| 42 | BERYLLIUM | 1046.12 | 40 | 007440-41-7 |
| 43 | HEXACHLOROCYCLOHEXANE, DELTA- | 1038.27 | 42 | 000319-86-8 |
| 44 | 1,2-DIBROMO-3-CHLOROPROPANE | 1035.55 | 43 | 000096-12-8 |
| 45 | PENTACHLOROPHENOL | 1028.01 | 45 | 000087-86-5 |
| 46 | HEPTACHLOR EPOXIDE | 1027.12 | 44 | 001024-57-3 |
| 47 | CARBON TETRACHLORIDE | 1023.32 | 46 | 000056-23-5 |
| 48 | AROCLOR 1221 | 1018.41 | 47 | 011104-28-2 |
| 49 | COBALT | 1015.57 | 50 | 007440-48-4 |
| 50 | DDT, O,P'- | 1014.71 | 49 | 000789-02-6 |
| 51 | AROCLOR 1016 | 1014.33 | 48 | 012674-11-2 |
| 52 | DI-N-BUTYL PHTHALATE | 1007.49 | 52 | 000084-74-2 |
| 53 | NICKEL | 1005.40 | 55 | 007440-02-0 |
| 54 | ENDOSULFAN | 1004.65 | 54 | 000115-29-7 |
| 55 | ENDOSULFAN SULFATE | 1003.56 | 53 | 001031-07-8 |
| 56 | DIAZINON | 1002.08 | 57 | 000333-41-5 |
| 57 | ENDOSULFAN, ALPHA | 1001.30 | 58 | 000959-98-8 |
| 58 | XYLENES, TOTAL | 996.07 | 59 | 001330-20-7 |
| 59 | CIS-CHLORDANE | 995.08 | 51 | 005103-71-9 |
| 60 | DIBROMOCHLOROPROPANE | 994.87 | 60 | 067708-83-2 |
| 61 | METHOXYCHLOR | 994.47 | 61 | 000072-43-5 |
| 62 | BENZO(K)FLUORANTHENE | 981.26 | 63 | 000207-08-9 |
| 63 | ENDRIN KETONE | 978.99 | 64 | 053494-70-5 |
| 64 | TRANS-CHLORDANE | 973.99 | 56 | 005103-74-2 |
| 65 | CHROMIUM(VI) OXIDE | 969.58 | 66 | 001333-82-0 |
| 66 | METHANE | 959.78 | 67 | 000074-82-8 |
| 67 | ENDOSULFAN, BETA | 959.19 | 65 | 033213-65-9 |
| 68 | AROCLOR 1232 | 955.64 | 68 | 011141-16-5 |
| 69 | ENDRIN ALDEHYDE | 954.86 | 69 | 007421-93-4 |
| 70 | BENZOFLUORANTHENE | 951.48 | 70 | 056832-73-6 |
| 71 | TOLUENE | 947.50 | 71 | 000108-88-3 |
| 72 | 2-HEXANONE | 942.02 | 72 | 000591-78-6 |
| 73 | 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN | 938.11 | 73 | 001746-01-6 |
| 74 | ZINC | 932.89 | 74 | 007440-66-6 |
| 75 | DIMETHYLARSINIC ACID | 922.06 | 75 | 000075-60-5 |
| 76 | DI(2-ETHYLHEXYL)PHTHALATE | 919.02 | 76 | 000117-81-7 |
| 77 | CHROMIUM | 908.52 | 77 | 007440-47-3 |
| 78 | NAPHTHALENE | 896.67 | 78 | 000091-20-3 |
| 79 | 1,1-DICHLOROETHENE | 891.19 | 79 | 000075-35-4 |
| 80 | METHYLENE CHLORIDE | 888.96 | 81 | 000075-09-2 |
| 81 | AROCLOR 1240 | 888.11 | 80 | 071328-89-7 |
| 82 | 2,4,6-TRINITROTOLUENE | 883.59 | 82 | 000118-96-7 |
| 83 | BROMODICHLOROETHANE | 870.00 | 83 | 000683-53-4 |
| 84 | HYDRAZINE | 864.41 | 85 | 000302-01-2 |
| 85 | 1,2-DICHLOROETHANE | 863.99 | 84 | 000107-06-2 |
| 86 | 2,4,6-TRICHLOROPHENOL | 863.71 | 86 | 000088-06-2 |
| 87 | 2,4-DINITROPHENOL | 860.45 | 87 | 000051-28-5 |
| 88 | BIS(2-CHLOROETHYL) ETHER | 859.88 | 88 | 000111-44-4 |
| 89 | THIOCYANATE | 849.21 | 89 | 000302-04-5 |
| 90 | ASBESTOS | 841.54 | 90 | 001332-21-4 |
| 91 | CHLORINE | 840.37 | 92 | 007782-50-5 |
| 92 | CYCLOTRIMETHYLENETRINITRAMINE (RDX) | 840.28 | 91 | 000121-82-4 |
| 93 | HEXACHLOROBENZENE | 838.34 | 93 | 000118-74-1 |

| | | | | |
|---|---|---|---|---|
| 94 | 2,4-DINITROTOLUENE | 837.88 | 96 | 000121-14-2 |
| 95 | RADIUM-226 | 835.93 | 94 | 013982-63-3 |
| 96 | ETHION | 834.03 | 97 | 000563-12-2 |
| 97 | 1,1,1-TRICHLOROETHANE | 833.81 | 95 | 000071-55-6 |
| 98 | URANIUM | 833.41 | 98 | 007440-61-1 |
| 99 | ETHYLBENZENE | 832.13 | 99 | 000100-41-4 |
| 100 | RADIUM | 828.07 | 100 | 007440-14-4 |
| 101 | THORIUM | 825.17 | 101 | 007440-29-1 |
| 102 | 4,6-DINITRO-O-CRESOL | 822.78 | 102 | 000534-52-1 |
| 103 | 1,3,5-TRINITROBENZENE | 820.17 | 103 | 000099-35-4 |
| 104 | CHLOROBENZENE | 819.69 | 105 | 000108-90-7 |
| 105 | RADON | 817.89 | 104 | 010043-92-2 |
| 106 | RADIUM-228 | 816.76 | 106 | 015262-20-1 |
| 107 | THORIUM-230 | 814.72 | 107 | 014269-63-7 |
| 107 | URANIUM-235 | 814.72 | 107 | 015117-96-1 |
| 109 | BARIUM | 813.46 | 109 | 007440-39-3 |
| 110 | FLUORANTHENE | 812.40 | 113 | 000206-44-0 |
| 111 | URANIUM-234 | 812.11 | 110 | 013966-29-5 |
| 112 | N-NITROSODI-N-PROPYLAMINE | 811.05 | 111 | 000621-64-7 |
| 113 | THORIUM-228 | 810.36 | 112 | 014274-82-9 |
| 114 | RADON-222 | 809.78 | 114 | 014859-67-7 |
| 115 | HEXACHLOROCYCLOHEXANE, ALPHA- | 809.56 | 116 | 000319-84-6 |
| 116 | 1,2,3-TRICHLOROBENZENE | 808.41 | 143 | 000087-61-6 |
| 117 | MANGANESE | 807.90 | 115 | 007439-96-5 |
| 118 | COAL TARS | 807.07 | 117 | 008007-45-2 |
| 119 | CHRYSOTILE ASBESTOS | 806.68 | 119 | 012001-29-5 |
| 119 | STRONTIUM-90 | 806.68 | 119 | 010098-97-2 |
| 121 | PLUTONIUM-239 | 806.67 | 118 | 015117-48-3 |
| 122 | POLONIUM-210 | 806.39 | 122 | 013981-52-7 |
| 123 | METHYLMERCURY | 806.39 | 121 | 022967-92-6 |
| 124 | PLUTONIUM-238 | 806.01 | 123 | 013981-16-3 |
| 125 | LEAD-210 | 805.90 | 124 | 014255-04-0 |
| 126 | PLUTONIUM | 805.23 | 125 | 007440-07-5 |
| 127 | CHLORPYRIFOS | 804.93 | 125 | 002921-88-2 |
| 128 | COPPER | 804.86 | 133 | 007440-50-8 |
| 129 | AMERICIUM-241 | 804.55 | 128 | 086954-36-1 |
| 130 | RADON-220 | 804.54 | 127 | 022481-48-7 |
| 131 | AMOSITE ASBESTOS | 804.07 | 129 | 012172-73-5 |
| 132 | IODINE-131 | 803.48 | 130 | 010043-66-0 |
| 133 | HYDROGEN CYANIDE | 803.08 | 132 | 000074-90-8 |
| 134 | TRIBUTYLTIN | 802.61 | 131 | 000688-73-3 |
| 135 | GUTHION | 802.32 | 134 | 000086-50-0 |
| 136 | NEPTUNIUM-237 | 802.13 | 135 | 013994-20-2 |
| 137 | CHRYSENE | 802.10 | 139 | 000218-01-9 |
| 138 | CHLORDECONE | 801.64 | 136 | 000143-50-0 |
| 138 | IODINE-129 | 801.64 | 136 | 015046-84-1 |
| 138 | PLUTONIUM-240 | 801.64 | 136 | 014119-33-6 |
| 141 | S,S,S-TRIBUTYL PHOSPHOROTRITHIOATE | 797.88 | 140 | 000078-48-8 |
| 142 | BROMINE | 789.15 | 142 | 007726-95-6 |
| 143 | POLYBROMINATED BIPHENYLS | 789.11 | 141 | 067774-32-7 |
| 144 | DICOFOL | 787.56 | 144 | 000115-32-2 |
| 145 | PARATHION | 784.14 | 145 | 000056-38-2 |
| 146 | 1,1,2,2-TETRACHLOROETHANE | 782.15 | 146 | 000079-34-5 |

| | | | | | |
|---|---|---|---|---|---|
| 147 | SELENIUM | 778.98 | 147 | 007782-49-2 | |
| 148 | HEXACHLOROCYCLOHEXANE, TECHNICAL GRADE | 774.91 | 148 | 000608-73-1 | |
| 149 | TRICHLOROFLUOROETHANE | 770.74 | 149 | 027154-33-2 | |
| 150 | TRIFLURALIN | 770.12 | 150 | 001582-09-8 | |
| 151 | DDD, O,P'- | 768.73 | 151 | 000053-19-0 | |
| 152 | 4,4'-METHYLENEBIS(2-CHLOROANILINE) | 766.66 | 152 | 000101-14-4 | |
| 153 | HEXACHLORODIBENZO-P-DIOXIN | 760.42 | 153 | 034465-46-8 | |
| 154 | HEPTACHLORODIBENZO-P-DIOXIN | 754.47 | 154 | 037871-00-4 | |
| 155 | PENTACHLOROBENZENE | 753.58 | 155 | 000608-93-5 | |
| 156 | 1,3-BUTADIENE | 747.31 | 201 | 000106-99-0 | |
| 157 | AMMONIA | 745.55 | 156 | 007664-41-7 | |
| 158 | 2-METHYLNAPHTHALENE | 743.24 | 157 | 000091-57-6 | |
| 159 | 1,4-DICHLOROBENZENE | 737.32 | 159 | 000106-46-7 | |
| 160 | 1,1-DICHLOROETHANE | 736.23 | 158 | 000075-34-3 | |
| 161 | ACENAPHTHENE | 731.25 | 160 | 000083-32-9 | |
| 162 | 1,2,3,4,6,7,8,9-OCTACHLORODIBENZOFURAN | 726.14 | 161 | 039001-02-0 | |
| 163 | 1,1,2-TRICHLOROETHANE | 724.96 | 162 | 000079-00-5 | |
| 164 | TRICHLOROETHANE | 723.32 | 163 | 025323-89-1 | |
| 165 | HEXACHLOROCYCLOPENTADIENE | 719.01 | 164 | 000077-47-4 | |
| 166 | HEPTACHLORODIBENZOFURAN | 718.58 | 165 | 038998-75-3 | |
| 167 | 1,2-DIPHENYLHYDRAZINE | 713.90 | 166 | 000122-66-7 | |
| 168 | 2,3,4,7,8-PENTACHLORODIBENZOFURAN | 710.71 | 167 | 057117-31-4 | |
| 169 | TETRACHLOROBIPHENYL | 709.21 | 168 | 026914-33-0 | |
| 170 | CRESOL, PARA- | 707.83 | 169 | 000106-44-5 | |
| 171 | OXYCHLORDANE | 706.32 | 170 | 027304-13-8 | |
| 172 | 1,2-DICHLOROBENZENE | 704.91 | 171 | 000095-50-1 | |
| 173 | 1,2-DICHLOROETHENE, TRANS- | 704.04 | 178 | 000156-60-5 | |
| 174 | INDENO(1,2,3-CD)PYRENE | 703.30 | 180 | 000193-39-5 | |
| 175 | GAMMA-CHLORDENE | 702.59 | 172 | 056641-38-4 | |
| 176 | CARBON DISULFIDE | 702.55 | 174 | 000075-15-0 | |
| 177 | TETRACHLOROPHENOL | 702.54 | 173 | 025167-83-3 | |
| 178 | AMERICIUM | 701.62 | 175 | 007440-35-9 | |
| 178 | URANIUM-233 | 701.62 | 175 | 013968-55-3 | |
| 180 | PALLADIUM | 700.66 | 177 | 007440-05-3 | |
| 181 | HEXACHLORODIBENZOFURAN | 700.56 | 179 | 055684-94-1 | |
| 182 | PHENOL | 696.96 | 183 | 000108-95-2 | |
| 183 | CHLOROETHANE | 693.90 | 182 | 000075-00-3 | |
| 184 | ACETONE | 693.31 | 181 | 000067-64-1 | |
| 185 | P-XYLENE | 690.20 | 185 | 000106-42-3 | |
| 186 | DIBENZOFURAN | 689.19 | 187 | 000132-64-9 | |
| 187 | ALUMINUM | 688.13 | 186 | 007429-90-5 | |
| 188 | 2,4-DIMETHYLPHENOL | 685.76 | 189 | 000105-67-9 | |
| 189 | CARBON MONOXIDE | 684.49 | 188 | 000630-08-0 | |
| 190 | TETRACHLOROETHANE | 677.97 | 190 | 025322-20-7 | |
| 191 | HYDROGEN SULFIDE | 676.51 | 193 | 007783-06-4 | |
| 192 | PENTACHLORODIBENZOFURAN | 673.21 | 192 | 030402-15-4 | |
| 193 | CHLOROMETHANE | 670.19 | 191 | 000074-87-3 | |
| 194 | BIS(2-METHOXYETHYL) PHTHALATE | 666.08 | 194 | 034006-76-3 | |
| 195 | BUTYL BENZYL PHTHALATE | 659.38 | 195 | 000085-68-7 | |
| 196 | CRESOL, ORTHO- | 658.66 | 196 | 000095-48-7 | |
| 197 | HEXACHLOROETHANE | 653.10 | 199 | 000067-72-1 | |
| 198 | VANADIUM | 651.70 | 198 | 007440-62-2 | |

| | | | | |
|---|---|---|---|---|
| 199 | N-NITROSODIMETHYLAMINE | 650.71 | 200 | 000062-75-9 |
| 200 | 1,2,4-TRICHLOROBENZENE | 647.30 | 203 | 000120-82-1 |
| 201 | BROMOFORM | 643.53 | 202 | 000075-25-2 |
| 202 | TETRACHLORODIBENZO-P-DIOXIN | 635.74 | 204 | 041903-57-5 |
| 203 | 1,3-DICHLOROBENZENE | 631.41 | 205 | 000541-73-1 |
| 204 | PENTACHLORODIBENZO-P-DIOXIN | 625.12 | 207 | 036088-22-9 |
| 205 | N-NITROSODIPHENYLAMINE | 624.79 | 208 | 000086-30-6 |
| 206 | 1,2-DICHLOROETHYLENE | 622.49 | 206 | 000540-59-0 |
| 207 | 2,3,7,8-TETRACHLORODIBENZOFURAN | 622.15 | 210 | 051207-31-9 |
| 208 | 2-BUTANONE | 620.01 | 209 | 000078-93-3 |
| 209 | 2,4-DICHLOROPHENOL | 616.45 | 212 | 000120-83-2 |
| 210 | 1,4-DIOXANE | 616.29 | 215 | 000123-91-1 |
| 211 | FLUORINE | 613.28 | 214 | 007782-41-4 |
| 212 | NITRITE | 612.64 | 216 | 014797-65-0 |
| 213 | CESIUM-137 | 612.50 | 217 | 010045-97-3 |
| 214 | SILVER | 612.19 | 213 | 007440-22-4 |
| 215 | CHROMIUM TRIOXIDE | 610.85 | 218 | 007738-94-5 |
| 216 | NITRATE | 610.66 | 219 | 014797-55-8 |
| 217 | POTASSIUM-40 | 608.91 | 220 | 013966-00-2 |
| 218 | DINITROTOLUENE | 607.65 | 221 | 025321-14-6 |
| 219 | ANTIMONY | 605.37 | 222 | 007440-36-0 |
| 220 | COAL TAR PITCH | 605.33 | 224 | 065996-93-2 |
| 221 | THORIUM-227 | 605.32 | 223 | 015623-47-9 |
| 222 | 2,4,5-TRICHLOROPHENOL | 604.83 | 225 | 000095-95-4 |
| 223 | ARSENIC ACID | 604.45 | 226 | 007778-39-4 |
| 224 | ARSENIC TRIOXIDE | 604.36 | 227 | 001327-53-3 |
| 225 | PHORATE | 603.10 | 228 | 000298-02-2 |
| 226 | BENZOPYRENE | 603.00 | 230 | 073467-76-2 |
| 227 | CRESOLS | 602.74 | 229 | 001319-77-3 |
| 228 | CHLORDANE, TECHNICAL | 602.62 | 231 | 012789-03-6 |
| 229 | DIMETHOATE | 602.61 | 232 | 000060-51-5 |
| 230 | ACTINIUM-227 | 602.57 | 233 | 014952-40-0 |
| 230 | STROBANE | 602.57 | 233 | 008001-50-1 |
| 232 | 4-AMINOBIPHENYL | 602.51 | 235 | 000092-67-1 |
| 232 | PYRETHRUM | 602.51 | 235 | 008003-34-7 |
| 234 | ARSINE | 602.42 | 237 | 007784-42-1 |
| 235 | NALED | 602.32 | 238 | 000300-76-5 |
| 236 | DIBENZOFURANS, CHLORINATED | 602.13 | 239 | 042934-53-2 |
| 236 | ETHOPROP | 602.13 | 239 | 013194-48-4 |
| 238 | ALPHA-CHLORDENE | 601.94 | 241 | 056534-02-2 |
| 238 | CARBOPHENOTHION | 601.94 | 241 | 000786-19-6 |
| 240 | DICHLORVOS | 601.64 | 243 | 000062-73-7 |
| 241 | CALCIUM ARSENATE | 601.45 | 244 | 007778-44-1 |
| 241 | MERCURIC CHLORIDE | 601.45 | 244 | 007487-94-7 |
| 241 | SODIUM ARSENITE | 601.45 | 244 | 007784-46-5 |
| 244 | FORMALDEHYDE | 599.64 | 247 | 000050-00-0 |
| 245 | 2-CHLOROPHENOL | 599.62 | 248 | 000095-57-8 |
| 246 | PHENANTHRENE | 597.68 | 249 | 000085-01-8 |
| 247 | HYDROGEN FLUORIDE | 588.03 | 250 | 007664-39-3 |
| 248 | 2,4-D ACID | 584.47 | 251 | 000094-75-7 |
| 249 | DIBROMOCHLOROMETHANE | 580.59 | 252 | 000124-48-1 |
| 250 | DIURON | 579.16 | 253 | 000330-54-1 |
| 251 | BUTYLATE | 578.43 | 254 | 002008-41-5 |

| | | | | |
|---|---|---|---|---|
| 252 | DIMETHYL FORMAMIDE | 578.23 | 255 | 000068-12-2 |
| 253 | PYRENE | 577.95 | 256 | 000129-00-0 |
| 254 | DICHLOROBENZENE | 577.70 | 211 | 025321-22-6 |
| 255 | ETHYL ETHER | 572.47 | 257 | 000060-29-7 |
| 256 | DICHLOROETHANE | 570.46 | 258 | 001300-21-6 |
| 257 | 4-NITROPHENOL | 567.79 | 259 | 000100-02-7 |
| 258 | 1,3-DICHLOROPROPENE, CIS- | 561.82 | 184 | 010061-01-5 |
| 259 | PHOSPHINE | 559.74 | 260 | 007803-51-2 |
| 260 | TRICHLOROBENZENE | 557.96 | 261 | 012002-48-1 |
| 261 | 2,6-DINITROTOLUENE | 555.20 | 262 | 000606-20-2 |
| 262 | FLUORIDE ION | 549.64 | 263 | 016984-48-8 |
| 263 | 1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN | 547.90 | 264 | 035822-46-9 |
| 264 | METHYL PARATHION | 545.83 | 265 | 000298-00-0 |
| 265 | PENTAERYTHRITOL TETRANITRATE | 545.59 | 266 | 000078-11-5 |
| 266 | 1,3-DICHLOROPROPENE, TRANS- | 543.37 | 267 | 010061-02-6 |
| 267 | BIS(2-ETHYLHEXYL)ADIPATE | 540.20 | 268 | 000103-23-1 |
| 268 | CARBAZOLE | 534.52 | 269 | 000086-74-8 |
| 269 | METHYL ISOBUTYL KETONE | 533.24 | 271 | 000108-10-1 |
| 270 | 1,2-DICHLOROETHENE, CIS- | 533.15 | 270 | 000156-59-2 |
| 271 | STYRENE | 532.70 | 272 | 000100-42-5 |
| 272 | CARBARYL | 530.98 | 273 | 000063-25-2 |
| 273 | 1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN | 529.45 | 274 | 067562-39-4 |
| 274 | ACRYLONITRILE | 528.28 | 275 | 000107-13-1 |
| 275 | 1-METHYLNAPHTHALENE | 526.51 | NEW | |

Substances were assigned the same rank when two (or more) substances received equivalent total point scores.

CAS #= Chemical Abstracts Service Registry Number

This page was updated on 01/10/2008