

Bayer Material Science LLC

Health and Safety Plan

May 2009



A handwritten signature in black ink, appearing to read "Dave R. Kingsley".

Dave Kingsley
Project/Task Manager

A handwritten signature in black ink, appearing to read "Greg Ertel".

Greg Ertel, CIH
Health and Safety Manager

Health and Safety Plan

Hicksville, New York

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Our Ref.:
B0032305.0002

Date:
May 2009

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Approvals and Acknowledgments	viii
1. Introduction	1
1.1 Objective	1
1.2 Site and Facility Description	1
1.3 Relevant Site History	2
1.4 Policy Statement	3
1.5 References	4
1.6 Definitions	4
1.7 Acronyms	5
2. Roles and Responsibilities	8
2.1 All Personnel	8
2.2 ARCADIS Personnel	8
2.2.1 Project Officer (PO)	8
2.2.2 Health and Safety Officer (HSO)	8
2.2.3 Project Manager (PM)	8
2.2.4 Health and Safety Supervisor	9
2.2.5 Site Supervisor	10
2.3 Subcontractors	10
2.4 All On-Site Personnel	11
2.5 Visitors	12
2.6 Stop Work Authority	12
2.7 Short Service Employee (SSE) Program	12
2.8 Near-Miss Reporting Hotline	13
3. Project Hazards and Control Measures	15
3.1 Scope of Work	15
3.2 Field Activities, Hazards and Control Procedures	15

3.2.1	Mobilization	15
3.2.2	Construction Observation	16
3.2.2.1	Excavation Hazards and Control Procedures	17
3.2.2.2	Inspections by a Competent Person	19
3.2.2.3	Soil Classification	19
3.2.2.4	Overhead Electrical Clearances	21
3.2.2.5	Excavation Entry Procedure	21
3.2.2.6	Heavy Equipment Materials Handling	23
3.2.3	Air Monitoring	29
3.2.3.1	Hazards	29
3.2.4	Soil Sampling	30
3.2.4.1	Hazards	30
3.2.4.2	Control	31
3.2.5	Demobilization	31
3.3	Chemical Hazards	32
4.	General Safety Practices	34
4.1	General Safety Rules	34
4.2	Loss Prevention System (LPS)	35
4.2.1	Safe Performance Self-Assessment / TRACK Process	36
4.2.2	Incident Investigation	37
4.2.3	Loss Prevention Observation	37
4.2.4	Near Miss Reporting	38
4.2.5	Job Safety Analysis	39
4.3	Buddy System	39
4.4	Heat Stress	40
4.4.1	Heat Rashes	40
4.4.2	Heat Cramps	41

4.4.3	Heat Exhaustion	41
4.4.4	Heat Stroke	42
4.4.5	Heat Stress Safety Precautions	43
4.5	Cold Stress	45
4.6	Biological Hazards	48
4.6.1	Ticks	48
4.6.2	Mosquitoes	49
4.6.3	Poisonous Plants	50
4.6.4	Snakes	52
4.6.5	Spiders	52
4.7	Noise	53
4.8	Spill Control	53
4.9	Sanitation	54
4.9.1	Break Area	54
4.9.2	Potable Water	54
4.9.3	Sanitary Facilities	55
4.9.4	Lavatory	55
4.10	Emergency Equipment	55
4.11	Lockout/Tagout Procedures	55
4.12	Electrical Safety	56
4.13	Lifting Safety	57
4.14	Elevated Work Safety	58
4.14.1.1	Fall Protection	58
4.14.1.2	Ladders	59
4.15	Heavy Equipment Materials Handling	61
4.15.1	Audible Alarms	62
4.15.2	Equipment Inspection and Maintenance	62

4.15.3	Equipment Parking and Loading	63
4.15.4	Equipment Fueling	64
4.15.5	Flaggers	64
4.15.6	Additional Safety Requirements	65
4.16	Hot Work Safety Program	67
4.16.1.1	Designated Hot Work Areas	67
4.16.1.2	Conditions Prohibiting Hot Work	67
4.16.1.3	Hot Work Permits	68
4.16.1.4	Fire Watch Procedures	70
4.17	Confined Space Entry	70
4.17.1	Duties of Personnel	71
4.17.1.1	Duties of Entrants	71
4.17.1.2	Duties of Attendants	72
4.17.1.3	Duties of Entry Supervisors	73
4.17.2	Procedures for Permit Space Entry	74
4.17.3	Training	77
4.18	Crane Hazards and Control Procedures	78
4.19	Traffic Safety	82
5.	Personal Protective Equipment	83
5.1	Levels of Protection	83
5.1.1	Level D Protection	83
5.1.2	Modified Level D Protection	84
5.1.3	Level C Protection	84
5.2	Selection of PPE	85
5.3	Site Respiratory Protection Program	85
5.4	Using PPE	86
5.4.1	Donning Procedures	86

5.4.2	Doffing Procedures	87
5.5	Selection Matrix	88
6.	Air Monitoring	89
6.1	Air Monitoring	89
6.2	Noise Monitoring	90
6.3	Monitoring Equipment Maintenance and Calibration	90
6.4	Action Levels	91
6.5	On-Site Monitoring Plan and Response Activities	91
6.6	Odor Control	91
7.	Work Zones and Decontamination	93
7.1	Work Zones	93
7.1.1	Authorization to Enter	93
7.1.2	Site Orientation and Hazard Briefing	93
7.1.3	Certification Documents	93
7.1.4	Entry Log	93
7.1.5	Entry Requirements	94
7.1.6	Emergency Entry and Exit	94
7.1.7	Contamination Control Zones	94
7.1.7.1	Exclusion Zone	94
7.1.7.2	Contamination Reduction Zone	94
7.1.7.3	Support Zone	95
7.1.8	Posting	95
7.1.9	Site Inspections	95
7.2	Decontamination	95
7.2.1	Personnel Decontamination	95
7.2.2	Equipment Decontamination	96
7.2.3	Personal Protective Equipment Decontamination	96

8. Training and Medical Surveillance	97
8.1 Training	97
8.1.1 General	97
8.1.2 Basic 40-Hour Course	97
8.1.3 Supervisor Course	98
8.1.4 Site-Specific Training	98
8.1.5 Daily Safety Meetings	99
8.1.6 First Aid and CPR	99
8.2 Medical Surveillance	99
8.2.1 Medical Examination	99
8.2.2 Pre-placement Medical Examination	99
8.2.3 Other Medical Examinations	100
8.2.4 Periodic Exam	101
8.2.5 Medical Restriction	101
9. Emergency Procedures	102
9.1 General	102
9.2 Emergency Response	102
9.2.1 Fire	102
9.2.2 Contaminant Release	102
9.3 Medical Emergency	103
9.3.1 Emergency Care Steps	103
9.4 First Aid – General	104
9.4.1 First Aid – Inhalation	104
9.4.2 First Aid – Ingestion	104
9.4.3 First Aid – Skin Contact	104
9.4.4 First Aid – Eye Contact	105
9.5 Reporting Injuries, Illnesses and Near Miss Incidents	105

9.6	Emergency Information	105
9.6.1	Directions to North Shore University Hospital	106

Tables

1	Key Personnel
2	Maximum Allowable Slopes (29 CFR 1926 Subpart P, Appendix B)
3	Minimum Overhead Electrical Clearances (All Equipment)
4	Screening Criteria for Heat Stress Exposure
5	Examples of Activities within Metabolic Rate Categories
6	Chill Temperature Chart
7	Minimum Overhead Electrical Clearances (Aerial Lifts)
8	Acceptable Entry Conditions for Confined Spaces
9	Minimum Overhead Electrical Clearances (Cranes)
10	PPE Selection Matrix
11	Airborne Contaminant Action Levels
12	Emergency Contacts

Attachments

A	Addendum Page
B	Visitor Acknowledgement and Acceptance of HASP
C	Utility Location Policy and Procedure
D	Material Safety Data Sheets
E	Incident/Near-Miss Investigation Report
F	Loss Prevention Observation Form
G	Real Time Air Monitoring Data Collection Form
H	Site Activities Tailgate Safety Briefing Sign-in Log

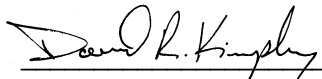
Approvals and Acknowledgments

Approvals

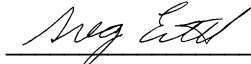
I have read and approved this Health and Safety Plan with respect to project hazards, regulatory requirements, and ARCADIS procedures.

Project Name: Bayer Material Science Facility, Hicksville, New York

Project Number: B0032305.0002

 5.20.09

Project/Task Manager/Date

 5.20.09

Health and Safety Manager/Date

Health and Safety Supervisor/Date

Acknowledgments

The final approved version of this *Health and Safety Plan* (HASP) has been provided to the Site Supervisor (SS). I acknowledge my responsibility to provide the SS with the equipment, materials and qualified personnel to implement the safety requirements in this HASP. I will formally review this plan with the Health and Safety Staff every six months until project completion.

Project/Task Manager/Date

I acknowledge receipt of this HASP from the Project Manager (PM), and that it is my responsibility to explain its contents to all site personnel and cause these requirements to be fully implemented. Any change in conditions, scope of work or other change that might affect worker safety requires me to notify the PM and/or the Health and Safety Officer.

Site Supervisor/Date

1. Introduction

1.1 Objective

This Health and Safety Plan (HASP) has been prepared in support of Interim Corrective Measure Additional PCB Soil Removal Work Plan (ICM) removal activities to be performed at the Bayer Material Science LLC (Bayer) facility located at 125 New South Road in Hicksville, New York (Site). ICM activities conducted by ARCADIS for this project will consist of construction observation during the soil removal, being completed by the client's contractor, from the Plant 1 and Pilot Plant footprint and other areas at the site that contains polychlorinated biphenyls (PCBs) at concentrations greater than 50 parts per million (ppm) and removal of certain soil that exhibits volatile and semivolatile organic compounds at concentrations exceeding New York State Department of Environmental Conservation (NYSDEC) soil guidelines. Activities to be conducted by ARCADIS are expected to consist of the following general tasks:

- Mobilization;
- Construction oversight;
- Air Monitoring;
- Soil Sampling, and
- Demobilization.

The objective of this HASP is to provide a mechanism for establishing safe working conditions at the site. The safety organization, procedures and protective equipment have been established based on an analysis of potential physical, chemical and biological hazards. Specific hazard control methodologies have been evaluated and selected to minimize the potential of injury, illness or other hazardous incident.

1.2 Site and Facility Description

The Site consists of a 14-acre triangular-shaped parcel located just southeast of the intersection of New South Road and Commerce Road in the City of Hicksville, New York. The Site is bordered to the north by industrial properties, to the south and west by the Long Island Railroad and commercial/industrial properties, and to the east by warehouses and the Northrop Grumman Corporation (Northrop Grumman) complex.

Aside from the Administration Building located in the northern portion of the Site, all other buildings and aboveground structures formerly used in connection with Site operations were demolished down to their floor slabs in 2003. Access to the Site is limited by a chain-link fence and locking gates. Access to the site is controlled and security is not expected to be an issue. All personnel will communicate with the designated site contact prior to entry.

Non-masonry building materials generated by the demolition activities were transported for off site reclamation/ disposal. Brick and mortar wall materials generated by demolition activities were crushed and remain stockpiled onsite for future use as hard fill material. Varying amounts of construction and demolition debris are scattered on the ground surface at the site. Remaining areas of the Site are covered with crushed stone/gravel or vegetation (grass or brush).

1.3 Relevant Site History

The Site was formerly used as a production facility for polyester resin, polyurethane dispersions and polyvinyl chloride (PVC). The facility was originally constructed in 1945 and operations were expanded in subsequent years. The facility was previously owned/operated by the Hooker Chemical and Plastic Corporation/Occidental Chemical Corporation (HCPC/OCC) from 1966 to 1982. The facility was designated as a Superfund site and placed on the National Priorities List (NPL) established under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) in the early 1980s. Various soil and groundwater investigation/ remedial activities have been implemented since that time.

Ruco Polymer Corporation (Ruco) purchased the facility from HCPC/OCC in 1982. The purchase agreement indemnified Ruco for environmental liabilities associated with facility operations conducted prior to the sale. Ruco operated an onsite Resource Conservation and Recovery Act (RCRA) interim status drum storage facility in the early 1980s, which formed the basis for RCRA Facility Investigation (RFI) and ICM activities. Ruco was acquired by Sybron Chemical Corporation (Sybron) in 1988. Sybron was, in turn, acquired by Bayer Corporation in 2000. Facility ownership was transferred from Bayer Corporation to Bayer Polymers LLC in 2003 as part of a corporate restructuring. As part of further restructuring, Bayer Polymers LLC became Bayer Material Science LLC in 2004. As the successor to Ruco, Bayer received the HCPC/OCC indemnification for environmental liabilities associated with former facility operations.

Based on economic evaluation, manufacturing operations were discontinued during 2002 and transferred to existing Bayer facilities in Georgia and West Virginia. In an effort to prepare the Site for future sale and economic redevelopment, all raw materials, products and hazardous chemicals were removed from the Site. In addition, facility equipment was decommissioned and tanks/piping were closed pursuant to applicable regulations. Asbestos-containing materials were removed and the on-site buildings and aboveground structures were demolished in 2003.

1.4 Policy Statement

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

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

The provisions of this plan are mandatory for all ARCADIS personnel and ARCADIS subcontractors. All visitors to ARCADIS work areas of the site must also abide by the requirements of this plan. This HASP does not cover activities conducted by employees of other businesses or other contracted organizations at the site.

In addition to the requirements of this HASP, all on-site personnel must abide by any Bayer facility safety rules or procedures. An acknowledgement form is located at the front of this HASP and must be signed by all on-site personnel following review of this HASP and the attached documentation. A visitor sign in and HASP acknowledgement form is included as Attachment B.

1.5 References

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

- *Standard Operating Safety Guides*, USEPA (Publication 9285.1-03, June 1992).
- *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, NIOSH, OSHA, USCG, USEPA (86116, October 1985).
- *Title 29 of the Code of Federal Regulations (CFR)*, Part 1910.
- *Title 29 of the Code of Federal Regulations (CFR)*, Part 1926.
- *Pocket Guide to Chemical Hazards*, DHHS, PHS, CDC, NIOSH (2009).
- *Threshold Limit Values*, ACGIH (2009).
- *Guide to Occupational Exposure Values*, ACGIH (2009).
- *Quick Selection Guide to Chemical Protective Clothing*, Forsberg, K. and S.Z. Mansdorf, 2nd Ed. (1993).
- *Health and Safety Policies and Procedures, and Employee Field Health & Safety Handbook*, ARCADIS

1.6 Definitions

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

- *Contamination Reduction Zone (CRZ)* – Area between the exclusion zone and support zone that provides a transition between contaminated and clean areas. Decontamination stations are located in this zone.
- *Exclusion Zone (EZ)* – Any portions of the site where hazardous substances are, or are reasonably suspected to be present, and pose an exposure hazard to on-site personnel.

- *Incident* – All losses, including first aid cases, injuries, illnesses, near misses, spills/leaks, equipment and property damage, motor vehicle accidents, regulatory violations, fires and business interruptions.
- *Near Miss* – An incident in which no injury, illness, motor vehicle accident, equipment or property damage, etc., occurred, but under slightly different circumstances, could have occurred.
- *On-Site Personnel* – All ARCADIS and subcontractor personnel involved with the project.
- *Project* – All on-site work performed under the scope of work.
- *Site* – The area described in Section 1.2.1, Site Description, where the work is to be performed by ARCADIS personnel.
- *Support Zone (SZ)* – All areas of the site, except the EZ and CRZ. The SZ surrounds the CRZ and EZ. Support equipment and break areas are located in this zone.
- *Visitor* – All other personnel, except the on-site personnel.
- *Work Area* – The portion of the site where work activities are actively being performed. This area may change daily as work progresses and includes the SZ, CRZ, and EZ. If the work area is located in an area on the site that is not contaminated, or suspected of being contaminated, the entire work area may be a SZ.

1.7 Acronyms

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

- *ACGIH* – American Conference of Governmental Industrial Hygienists
- *COC* – Constituent(s) of Concern
- *CRZ* – Contamination Reduction Zone
- *EZ* – Exclusion Zone

- *GFCI* – Ground Fault Circuit Interrupter
- *HASP* – Health and Safety Plan
- *HSO* – Health and Safety Officer
- *HSS* – Health and Safety Supervisor
- *II* – Incident Investigation
- *JSA* – Job Safety Analysis
- *LEL* – Lower Explosive Limit
- *LPO* – Loss Prevention Observation
- *MSDS* – Material Safety Data Sheet
- *OSHA* – Occupational Safety and Health Administration
- *PCBs* – Polychlorinated Biphenyls
- *PID* – Photoionization Detector
- *PM* – Project Manager
- *PO* – Project Officer
- *PPE* – Personal Protective Equipment
- *SPSA/TRACK* – Safe Performance Self-Assessment/TRACK Process
- *SS* – Site Supervisor
- *SZ* – Support Zone
- *TLV* – Threshold Limit Value
- *USCG* – United States Coast Guard

- *USEPA* – United States Environmental Protection Agency

2. Roles and Responsibilities

2.1 All Personnel

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

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

The roles of ARCADIS personnel are outlined in the following sections. Key project personnel and contacts are summarized in Table 1.

2.2 ARCADIS Personnel

2.2.1 Project Officer (PO)

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

2.2.2 Health and Safety Officer (HSO)

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

2.2.3 Project Manager (PM)

The PM is responsible for verifying that project activities are completed in accordance with the requirements of this HASP. The PM is responsible for confirming that the Site Supervisor (SS) has the equipment, materials and qualified personnel to fully

implement the safety requirements of this HASP. It is also the responsibility of the PM to perform the following duties:

- Consult with the HSO on site health and safety issues.
- Review Loss Prevention Observation (LPO) forms.
- Verify that all incidents are thoroughly investigated.
- Approve, in writing, addenda or modifications to this HASP.
- Suspend work or modify work practices, as necessary, for personal safety, protection of property and regulatory compliance.

2.2.4 Health and Safety Supervisor

The Health and Safety Supervisor (HSS) is responsible for field health and safety issues, including the execution of this HASP. Questions in the field regarding health and safety procedures, project procedures, and other technical or regulatory issues should be addressed to this individual. The HSS will advise the PM on health and safety issues, and will establish and coordinate the project air monitoring program if one is deemed necessary (see Section 6.1, Air Monitoring). The HSS is the primary site contact on health and safety matters. It is the responsibility of the HSS to perform the following duties:

- Provide on-site technical assistance, if necessary.
- Participate in all incident investigations (IIs), and confirm that they are reported to the Principal-in-Charge (PIC), PO, HSM/HSO, Client and PM by end of shift.
- Coordinate site and personal air monitoring, as required, including equipment maintenance and calibration.
- Conduct site safety orientation training and safety meetings.
- Verify that ARCADIS personnel have received the required physical examinations and medical certifications.
- Review site activities with respect to compliance with this HASP.

- Maintain required health and safety documents and records.
- Assist the SS in instructing field personnel on project hazards and protective procedures.
- Review LPO forms.

2.2.5 Site Supervisor

The SS is responsible for implementing this HASP, including communicating requirements to onsite personnel. The SS will be responsible for informing the PM of changes in the work plan, procedures or site conditions so that those changes may be addressed in this HASP. Other responsibilities are to perform the following duties:

- Consult with the HSS on site health and safety issues.
- Conduct LPOs at the site and complete the LPO forms.
- Verify via questioning, the conduct of Safe Performance Self-Assessments (SPSAs).
- Stop work, as necessary, for personal safety, protection of property and regulatory compliance.
- Observe on-site project personnel for signs of ill-health effects.
- Investigate and report any incidents to the PIC, PO, HSO and PM.
- Verify that on-site personnel are informed of the physical, chemical and biological hazards associated with the site activities and the procedures and protective equipment necessary to control the hazards.

2.3 Subcontractors

ARCADIS subcontractors and their personnel must understand and comply with applicable regulations and site requirements established in this HASP.

All ARCADIS subcontractor personnel will receive training in accordance with applicable regulations, and be familiar with the requirements and procedures contained

in this HASP prior to initiating site activities. All ARCADIS subcontractor personnel will attend an initial hazard briefing prior to beginning work at the site. Additionally, on-site ARCADIS subcontractor personnel must attend and participate in the daily site safety meetings.

ARCADIS subcontractors must designate individuals to function as the PM, HSO, HSS and SS. In some firms, it is not uncommon for the duties of the HSO to be carried out by the PM. This is acceptable provided the PM has the required knowledge, training and experience to properly address all hazards associated with the work, and to prepare, approve and oversee the execution of the site-specific HASP. A subcontractor may designate the same person to perform the duties of both the HSS and the SS. However, depending on the level of complexity of a contractor's scope of work, it may be infeasible for one person to perform both functions satisfactorily.

2.4 All On-Site Personnel

All on-site ARCADIS personnel, subcontractors and visitors, collectively referred to as "personnel", must read and acknowledge their understanding of this HASP before commencing work, and abide by the requirements of the plan. All on-site personnel shall sign the HASP Acknowledgement Form following their review of this HASP.

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

All on-site personnel must perform a SPSA prior to beginning each work activity. The SPSA process is presented in Section 4.2.1. This process must be performed prior to beginning each activity, and must be performed after any near miss or other incident in order to determine if it is safe to proceed. On-site personnel will immediately report the following to the SS or HSS:

- Personal injuries and illnesses no matter how minor.
- Unexpected or uncontrolled release of chemical substances.
- Symptoms of chemical exposure.
- Unsafe or hazardous situations.

- Unsafe or malfunctioning equipment.
- Changes in site conditions that may affect the health and safety of project personnel.
- Damage to equipment or property.
- Situations or activities for which they are not properly trained.
- Near misses.

2.5 Visitors

All visitors to ARCADIS work areas must check in with the SS. Visitors will be cautioned to avoid skin contact with surfaces, soils, groundwater or other materials that may impacted or be suspected to be impacted by constituents of concern (COCs).

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

2.6 Stop Work Authority

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

2.7 Short Service Employee (SSE) Program

Recognizing that employees who are new to ARCADIS are at a greater risk for incidents, the following guidelines are established to identify those employees and ease their transition. Short Service Employees (SSEs) will have an assigned field mentor to assist them in adjusting to the project requirements and procedures. SSEs will be identified in the field by wearing an orange hardhat or baseball-type cap. The following procedures apply to SSEs:

- ARCADIS employees new to the industry and new to ARCADIS will be designated SSEs for 6 months.
- ARCADIS employees experienced in the industry but new to ARCADIS will be designated SSEs for 3 months.

Additionally, the following apply:

- A crew of 2 to 3 may have 1 SSE on site.
- A crew of 5 may have 2 SSEs on site.
- A crew of 10 or more may have no more than 3 SSEs on site.

2.8 Near-Miss Reporting Hotline

In an effort to streamline near-miss reporting, especially for employees conducting field work who do not have real-time access to the web, ARCADIS has established a toll-free Near-Miss Reporting Hotline. The hotline will be checked daily and data will be entered into the ARCADIS LPS Database with the caller listed as the primary contact for the event. All entries will be saved as initial and can be accessed by the caller when they return to their computers. Entry into the database does not relieve the caller from the responsibility of following through with the near-miss investigation or of notifying other employees in the office or project team of the occurrence.

THE NEAR-MISS REPORTING NUMBER IS 1.866.242.4304

Callers will be prompted to provide the following information:

- Name and phone number.
- Date of near-miss.
- Location.
- Project number (if applicable).
- A brief description of what happened.

- Name of division or office VP.
- What they think could have happened if this situation had resulted in an injury or damage.
- Any other information they think may be important.

The intent of this service is to enable employees to phone in near-misses immediately and have the events entered into the ARCADIS LPS Database. Following all near-misses employees are expected to immediately conduct an SPSA in accordance with Section 4.2.1 to ensure that it is safe to continue with the task.

**TABLE 1
KEY PERSONNEL**

Bayer Personnel		
Role	Name	Address/Telephone No.
Bayer Project Manager	Ramon J. Simon	Bayer Material Science LLC 8500 West Bay Road Baytown, TX 77520-9730 (281) 383-6149
Bayer Assistant Project Manager	To Be Determined	
Hicksville Administration Building	Not Staffed	125 New South Road Hicksville, NY 11801 Tel: (516) 931-8104 Fax: (516) 931-8104
ARCADIS Personnel		
Role	Name	Address/Telephone No.
Project Officer	Joseph Molina, III, P.E.	295 Woodcliff Drive Third Floor, Suite 301 Fairport, NY 14450 (585) 385-0090, ext. 12
Project/Task Manager	David Kingsley	295 Woodcliff Drive Third Floor, Suite 301 Fairport, NY 14450 (585) 385-0090, ext. 12
Design Engineer	John Brussel, P.E.	6723 Towpath Road P.O. Box 66 Syracuse, NY 13214-0066 (315) 446-9120, ext. 441
Health and Safety Officer	Jay D. Keough, CIH	8 South River Road Cranbury, NJ 08512 (609) 860-0590, ext. 101
Health and Safety Manager	Greg Ertel, CIH	6723 Towpath Road P.O. Box 66 Syracuse, NY 13214-0066 (315) 446-9120, ext. 297
Site Supervisor/Health and Safety Supervisor	Dan Talbot	6723 Towpath Road P.O. Box 66 Syracuse, NY 13214-0066 (315) 446-9120, ext. 483

3. Project Hazards and Control Measures

3.1 Scope of Work

Activities to be conducted are expected to consist of the following general tasks:

- Mobilization.
- Construction oversight.
- Air Monitoring.
- Soil Sampling.
- Demobilization.

3.2 Field Activities, Hazards and Control Procedures

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

3.2.1 Mobilization

Site mobilization will include travel to the job site and establishing work areas. Mobilization also includes setting up air monitoring equipment and establishing a temporary site office (i.e., within the Administration Building). A break area will be set up outside of regulated work areas. During this initial phase, project personnel will walk the site to confirm the existence of anticipated hazards, and identify safety and health issues that may have arisen since the writing of this plan. The client's contractor performing the field work will also be mobilizing to the site at this time, which will be observed and documented by ARCADIS and which also presents additional hazards.

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

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

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

Control procedures for these hazards are discussed in Section 4, General Safety Practices.

3.2.2 Construction Observation

ARCADIS personnel will observe construction activities to be performed by the client's contractor such as mobilization, soil excavation and off-site transportation, shoring/bracing installation, backfilling, site restoration and decontamination procedures for the duration of this project. Construction observation activities may involve a potential for exposure to physical and health hazards. Hazards may be associated with the site, the equipment used and environmental conditions.

Hazards – There exists a potential for incidents involving personnel being struck by or struck against heavy equipment, train cars, or objects resulting in fractures, lacerations, punctures, or abrasions. Walking and working surfaces during activities may involve slip, trip, or fall hazards. Slippery walking/working surfaces can increase the possibility of back injuries, overexertion injuries and slips and falls. Materials handling operations may result in “caught between” situation when a load is being handled and a body part gets caught between two objects. Material handling also exposes employees to

sprains/strains if proper lifting techniques are not used. Noise may also present a hazard. Heavy equipment and train operation frequently results in high noise levels.

Environmental hazards include plants, such as poison ivy, poison sumac and poison oak; biting/stinging insects such as ticks, fleas, mosquitoes, wasps, spiders and snakes; weather, such as sunburn, lightning, rain and heat-related illnesses; and pathogens, such as rabies, Lyme disease and blood-borne pathogens.

Control – Prior to initiating any field activity, the site conditions will be discussed with all employees. Hazards will be identified and protective measures will be explained. Control procedures for these hazards are discussed in Section 4, General Safety Practices and in task specific sections of this HASP. Decisions regarding PPE will be based on the potential chemical and physical hazards on the site, and measurements and observations made prior to and during work activities. A minimum of Level D protection will be worn by personnel conducting observation activities. See Section 5, Personal Protective Equipment, for a description of PPE requirements. Personnel conducting observation activities will do so from a safe distance. The following sections describe excavation hazards and control procedures, hazards and control procedures associated with general construction activities. The information in the following sections is provided for the use of ARCADIS personnel only. They are not meant for use by others conducting activities at the site.

3.2.2.1 Excavation Hazards and Control Procedures

During field activities, ARCADIS personnel may be working in areas of active excavation. This task involves the client's contractor excavating at specified locations creating a man-made cut, trench, or depression in the earth's surface. ARCADIS will verify that excavation activities will be conducted in accordance with this section, and appropriate federal and state regulations. In the event that the client's contractor is not conducting excavation activities in a safe manner, then ARCADIS will exercise its stop work authority and resolve this issue to the satisfaction of ARCADIS and the client.

The physical hazards involved with excavating soils are related to the excavation itself and the operation of heavy equipment. The presence of overhead utilities, such as power lines, requires careful positioning of the excavating equipment to maintain a safe distance between the lines and the closest part of the equipment. The presence of underground utilities (such as gas lines, power lines, water lines and sewer pipes), must be determined prior to beginning the excavation.

Excavations pose significant hazards to employees if they are not carefully controlled. There exists a chance for the excavation to collapse if it is not dug properly, sloped, benched, or shored as required by 29 Code of Federal Regulations (CFR) 1926 Subpart P. Protective systems, as required by 29 CFR 1926 Subpart P, must be used if the potential for hazardous cave-ins exists. The excavation also is a fall hazard and employees must pay careful attention to what they are doing or they risk a fall into the excavation. Fall protection, as required by 29 CFR 1926 Subpart M, will be required.

The following control procedures are required during soil sampling activities:

- Activities must be done remotely whenever feasible.
- At the end of each workday, equipment will be moved to a location away from high-voltage electrical equipment and away from routes necessary to access high-voltage electrical equipment.
- Airborne concentrations of COCs in the site soil and the dust from the excavation procedure pose the potential for inhalation exposure. PPE for this phase is described in Section 5, Personal Protective Equipment. Airborne particulate generation will be controlled during site excavations. Dry, dusty soil will be wetted with a water spray from a potable water source to control the generation of dust. Soil will not be wetted to a degree that will cause runoff or erosion.
- Before intrusive activities commence, the existence and location of any and all underground utilities must be determined and clearly marked out. ARCADIS will implement the Utility Location Policy and Procedure (Attachment C) to verify that the client's contractor has adequate controls in place to address the hazards of underground utilities during intrusive activities. The Long Island One-Call Center must be contacted at least 1 week, but no more than 2 weeks, prior to subsurface activities. The contractor will meet with electrical and natural gas locators on site prior to marking out the underground utilities. During this meeting, the contractor will provide the electric and natural gas locators with a site figure that shows the locations where excavation and drilling activities will be completed. The contractor will conduct a site walkover with utility locators to visually identify each location where excavation activities are to be completed during site operations. A *Utilities and Structures Checklist* (Exhibit 3 of Attachment C) must be used to document that utilities have been marked on the ground, and that the intrusive work areas have been cleared. The completed checklist will be in the possession of the SS prior to commencing any intrusive work.

If intrusive activities are located near underground installations, the exact location of the installations must be determined by safe and acceptable means. Subsurface work conducted near expected utility locations will be conducted with a hand auger or shovel until utilities can be located. While the excavation is open, underground installations must be protected, supported, or removed as necessary to safeguard employees.

3.2.2.2 *Inspections by a Competent Person*

Daily inspections of excavations, the adjacent areas, and protective systems must be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection must be conducted by the competent person from the firm that is installing the excavation prior to starting work and as needed throughout the shift. **ARCADIS competent person inspections should be conducted prior to entry to verify that conditions are acceptable for ARCADIS employees. Entry into any excavation should be avoided if at all possible.** All inspections conducted by ARCADIS are for the sole use of ARCADIS and their employees, and are not intended to meet the requirements for excavation contractors to document compliance with the 29 CFR 1926 Subpart P.

Inspections must also be made after every rainstorm or other hazard-increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated. Where the competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees must be removed from the hazardous area until the necessary precautions have been taken to maintain their safety.

Walkways must be provided where employees or equipment are required or permitted to cross over excavations. Guardrails that comply with 1926.502(b) must be provided. Adequate barrier protection must be provided at all remotely located excavations. All wells, pits, shafts, etc., must be barricaded or covered. Upon completing exploration and other similar operations, temporary wells, pits, shafts, etc., must be backfilled.

3.2.2.3 *Soil Classification*

29 CFR 1926 Subpart P, Appendix A describes methods for classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth

requirements, and describes acceptable visual and manual tests for use in classifying soils. This appendix applies during the following conditions:

- Sloping or benching system is designed in accordance with the requirements set forth in 1926.652(b) (2) as a method of protection for employees from cave-ins.
- Timber shoring for excavations is designed as a method of protection from cave-ins in accordance with Appendix C to Subpart P of Part 1926, and when aluminum hydraulic shoring is designed in accordance with 29 CFR Subpart P, Appendix D.
- If other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in 1926.652(c), and the use of the data are predicated on the use of the soil classification system set forth in Appendix A of 29 CFR 1926.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V). Short-term exposure means a period of time less than or equal to 24 hours that an excavation is open. Soil and rock deposits must be classified in accordance with Appendix A to Subpart P of Part 1926. The maximum allowable slope for a soil or rock deposit must be determined from Table 2, below. The actual slope must not be steeper than the maximum allowable slope. The actual slope must be less steep than the maximum allowable slope when there are signs of distress. If that situation occurs, the slope must be cut back to an actual slope that is at least one-half horizontal to one vertical ($\frac{1}{2}$ H:1V) less steep than the maximum allowable slope. When surcharge loads from stored material or equipment, operating equipment or traffic are present, a competent person must determine the degree to which the actual slope must be reduced below the maximum allowable slope and confirm that such reduction is achieved. Surcharge loads from adjacent structures must be evaluated in accordance with 1926.651(I). Configurations of sloping and benching systems must be in accordance with 29 CFR 1926 Subpart P, Appendix B.

Table 2
Maximum Allowable Slopes
(29 CFR 1926 Subpart P Appendix B)

Soil or Rock Type	Maximum Allowable Slopes (H:V) ¹ for Excavations Less Than 20 Feet Deep ²
Stable Rock	Vertical (90°)
Type A ³	¾:1 (53°)
Type B	1:1 (45°)
Type C	1½:1 (34°)

Notes:

- ¹ Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
- ² Sloping or benching for excavations greater than 20 feet deep must be designed by a registered professional engineer.
- ³ A short-term maximum allowable slope of ½H:1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth must be ¾H:1V (53°).
(Source: Table B-1, 29 CFR 1926 Subpart P Appendix B, Maximum Allowable Slopes.)

3.2.2.4 Overhead Electrical Clearances

If excavation activities are conducted in the vicinity of overhead power lines, the power to the lines must be de-energized, tested de-energized, marked up and guaranteed, or the equipment must be positioned such that no part, including the excavation boom, can come within the minimum clearances outlined in Table 3.

Table 3
Minimum Overhead Electrical Clearances (All Equipment)

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

When excavation equipment is in transit, the equipment clearance must be at least 4 feet for voltages less than 50kV, 10 feet for voltages of 50kV to 345kV and 16 feet for voltages above 345kV.

3.2.2.5 Excavation Entry Procedure

Persons entering an excavation must do so under controlled conditions. The excavation must be properly sloped, benched, or shored, and ladders or ramps must

be available every 25 feet laterally in the excavation. Each entry must have an attendant who observes the entrant(s) and is prepared to render assistance.

Duties of Workers Entering an Excavation

Workers entering an excavation are responsible for the following information and actions:

- Know the hazards that may be faced during entry, including information on the mode, signs or symptoms and consequences of exposure to site contaminants.
- Communicate with the attendant as necessary to enable the attendant to monitor entrant status and alert entrants of the need to evacuate the space.
- Alert the attendant whenever:
 - The entrant recognizes any warning sign or symptom of exposure to a dangerous situation.
 - The entrant detects a prohibited condition.
- Exit from the excavation as quickly as possible whenever:
 - An order to evacuate is given by the attendant or the supervisor.
 - The entrant recognizes any warning sign or symptom of exposure to a dangerous situation.
 - The entrant detects a prohibited condition.

Duties of Attendants

Attendants at an excavation have the following responsibilities:

- Know the hazards that may be faced during entry, including information on the mode, signs or symptoms and consequences of exposure to site contaminants.
- Continuously maintain a count of entrants in the excavation.
- Remain outside the excavation during entry operations until relieved by another attendant.

- Communicate with authorized entrants, as necessary, to monitor entrant status and to alert entrants to evacuate the excavation if the attendant detects any of the following situations:
 - A prohibited condition.
 - Behavioral effects of hazard exposure in an entrant.
 - A situation outside the excavation that could endanger the entrants.
 - If the attendant cannot effectively and safely perform his duties.
- Summon rescue and other emergency services if the entrants need assistance to evacuate the excavation.

3.2.2.6 Heavy Equipment Materials Handling

Excavation activities involve using heavy equipment to remove and transport excavated material to train cars. During field activities, ARCADIS personnel may be working in areas where heavy equipment is in operation. Heavy equipment operation will be conducted in accordance with this section and appropriate federal and state regulations.

The physical hazards involved with heavy equipment materials handling activities relate to the work done with heavy equipment and the site environment itself. There exists a potential for incidents involving personnel being struck by or against heavy equipment, train cars, or materials, resulting in fractures, cuts, punctures, or abrasions. Heavy equipment and train operation may present noise and vibration hazards, and a potential for contact with moving parts or hot surfaces to equipment operators. Walking and working surfaces may involve slip, trip and fall hazards. Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries and slips and falls. Noise may also present a hazard. Heavy equipment and train operation frequently results in high noise levels.

Audible Alarms

Every vehicle used to haul dirt, rock, concrete, or other construction material must be equipped with a warning device that operates automatically while the vehicle is backing. The warning sound must be of such magnitude that it will normally be audible from a distance of 200 feet and will sound immediately on backing. In congested areas or areas with high ambient noise that obscures the audible alarm, a signaler, in clear view of the operator, must direct the backing operation. Other vehicles, if operating in areas where their backward movement would constitute a hazard to employees

working in the area on foot and where the operator's vision is obstructed to the rear of the vehicle, must be equipped with an effective device or method to safeguard employees such as:

- An automatic backup audible alarm that would sound immediately on backing.
- An automatic braking device at the rear of the vehicle that will apply the service brake immediately on contact with any obstruction to the rear.
- In lieu of the above requirements, administrative controls must be established such as.
 - A spotter or flagger in clear view of the operator who must direct the backing operation.
 - Other procedures that will require the operator to dismount and circle the vehicle immediately prior to starting a backup operation.
 - Prohibiting all foot traffic in the work area.
 - Other means must be provided that will provide safety equivalent to the foregoing for personnel working in the area.

The operator of all vehicles must not leave the controls of the vehicle while it is moving under its own engine power. Hauling or earth-moving operations must be controlled in such a manner as to confirm that equipment or vehicle operators know of the presence of other personnel in the areas of their operations.

Equipment Inspection and Maintenance

All vehicles in use must be checked at the beginning of each shift to confirm that the following parts, equipment and accessories are in safe operating condition and free of apparent damage that could cause failure while in use:

- Service brakes, including trailer brake connections.
- Parking system (hand brake).
- Emergency stopping system (brake).
- Tires.
- Horn.

- Steering mechanism.
- Coupling devices.
- Seat belts.
- Operating controls.
- Safety devices.

All defects affecting safe operation must be corrected before the vehicle is placed in service. These requirements also apply to equipment such as lights, reflectors, windshield wipers, defrosters, fire extinguishers, etc., where such equipment is necessary.

Vehicle engines must not be allowed to run in closed garages or other enclosed places unless vents are provided that effectively remove the exhaust gases from the building.

Except for emergency field repairs, a safety tire rack, cage, or equivalent protection must be used when inflating truck or equipment tires after mounting on a rim, if such tires depend on a locking ring or similar device to hold them on the rim.

No repairs must be attempted on power equipment until arrangements are made to eliminate the possibility of injury caused by sudden movements or operation of the equipment or its parts. When the equipment being repaired is a bulldozer, carryall, ripper, or other machine having sharp or heavy moving parts such as blades, beds, or gates, such parts must be lowered to the ground or securely and positively blocked in an inoperative position.

All controls must be in a neutral position, with the engine(s) stopped and brakes set, unless work being performed requires otherwise. Trucks with dump bodies must be equipped with positive means of support, permanently attached and capable of being locked in position to prevent accidental lowering of the body while maintenance or inspection work is being done. In all cases where the body is raised for any work, the locking device must be used.

Equipment Parking and Loading

Whenever equipment is parked, the parking brake must be set. Equipment parked on inclines must have the wheels chocked and parking brake set, or be otherwise prevented from moving by effective mechanical means.

Scissor points on all front-end loaders, which constitute a hazard to the operator, must be adequately guarded. A loader must not travel without adequate visibility for the driver and stability of the equipment. No loading device must be left unattended until the load or bucket is lowered to the ground, unless proper precautions such as blocking are taken to prevent accidental lowering.

Equipment Fueling

No internal combustion engine fuel tank must be refilled with a flammable liquid while the engine is running. Fueling must be done in such a manner that the likelihood of spillage is minimal. If a spill occurs, it must be contained and cleaned, or equivalent action taken to control vapors before restarting the engine. Fuel tank caps must be replaced before starting the engine.

Good metal to metal contact must be kept between fuel supply tank or nozzle of supply hose and the fuel tank. No open lights, welding, or sparking equipment must be used near internal combustion equipment being fueled or near storage tanks. Smoking is not permitted at or near the gasoline storage area or on equipment being fueled. A conspicuous sign must be posted in each fuel storage and fueling area stating: **"No Smoking Within 50 Feet"** Class I liquids must not be dispensed by pressure from drums, barrels and similar containers. Approved pumps taking suction through the top of the container or approved self-closing faucets must be used. No repairs must be made to equipment while it is being fueled.

Each fuel storage tank or drum must have the word "flammable" conspicuously marked thereon, and should also have a similarly sized word indicating the contents of the container. A fire extinguisher rated 20:BC or larger must be in a location accessible to the fueling area. All fuel storage tanks, drums, or safety cans must be properly marked and of the proper type.

Flaggers

Flaggers must be used at locations on a construction site where barricades and warning signs cannot control the moving traffic. When flaggers are required, they must be placed in relation to the equipment or operation so as to give effective warning. Placement of warning signs must be according to the state Department of Transportation (DOT).

Flaggers must wear orange warning garments such as vests, jackets, or shirts. Rainwear, when worn, must be orange or other color provided an orange outer warning garment is worn. While working in darkness, flaggers' stations must be illuminated such that the flagger will be clearly visible to approaching traffic, and flaggers must be outfitted with reflective garments. The retro-reflective material must be orange, white (including silver-coated reflecting coatings or elements that reflect white light), yellow, fluorescent red-orange or fluorescent yellow-orange.

Flaggers must be trained in the proper fundamentals of flagging moving traffic before being assigned as flaggers. Signaling directions used by flaggers must conform to the DOT standards.

Additional Safety Requirements

To protect on-site personnel against hazards associated with materials handling, and to prevent injury due to unsafe heavy equipment operation, only properly trained and authorized personnel will be allowed to operate heavy equipment. All materials handling equipment will be maintained in a safe operating condition and inspected daily prior to use.

Additional heavy equipment safety requirements include, but are not limited to:

- Prior to operating any heavy equipment, the authorized operator must conduct a pre-operation inspection to determine if the heavy equipment is in safe operating condition prior to each work shift.
- All mobile equipment must be equipped with an audible back-up alarm.
- Personnel will not be allowed to stand or pass under the elevated portion of any heavy equipment, whether loaded or empty.

- Personnel will not place arms and legs between pinch or scissor points of the equipment, or outside the operator enclosure.
- A safe distance must be maintained from the edge of excavations, ditches, ramps, or platforms.
- Operators will maintain sufficient clearance under overhead utilities, installations, lights, pipes, etc.
- Heavy equipment must never be used for lifting or transporting personnel.
- The operator is required to look in the direction of, and maintain a clear view of the path of travel.
- Heavy equipment must not be operated without an overhead guard and roll-over protection to protect the operator against falling objects and equipment roll-over.
- Heavy equipment must not be driven up to anyone standing in front of any object.
- Stunt driving and horseplay are strictly prohibited.
- Operators will yield the right-of-way to other site vehicles.
- Other heavy equipment traveling in the same direction at intersections, blind spots, or other dangerous locations, must not be passed.
- A safe distance must be maintained from other heavy equipment, and the equipment must be kept under control at all times.
- The heavy equipment operator must slow down for wet and slippery conditions. Under all travel conditions, the equipment will be operated at a speed that will permit it to be brought to a stop safely.
- Operators will avoid running over loose objects on operating surfaces.
- Grades and ramps must be ascended and descended slowly.
- On all grades, the load will be tilted back and raised only as far as necessary to clear the operating surface.

- The operator will slow down and sound the horn at intersections, when entering buildings and other locations where vision may be obstructed.
- If the load being carried obstructs forward view, the operator will travel with the load trailing.
- While negotiating turns, speed will be reduced to a safe rate, and turning will be in done a smooth, sweeping motion to avoid abrupt turns and potential equipment or load upset.
- Authorized operators will only handle stable or safely arranged loads that are within the rated capacity of the heavy equipment and will not affect the stability of the heavy equipment.
- When a piece of heavy equipment is left unattended, hydraulics will be fully lowered, controls will be neutralized, power will be shut off, and brakes set. Wheels will be blocked or chocked if the heavy equipment is parked on an incline. When internal combustion-engine-powered heavy equipment is used indoors, near confined spaces, or near excavations, carbon monoxide levels must be monitored to prevent personnel exposure.

3.2.3 Air Monitoring

Air Monitoring will include establishing monitoring stations upwind and downwind of the work areas and roaming monitoring units within the work area. The physical hazards of these operations are primarily associated with working in or near excavations, heavy equipment, and trains and exposure to airborne contaminants. In addition, personnel may be exposed to hazards associated with slips, trips and falls and environmental hazards.

3.2.3.1 Hazards

Hazards – There exists a potential for incidents involving personnel being struck by or struck against heavy equipment, train cars, or objects resulting in fractures, lacerations, punctures, or abrasions. Walking and working surfaces during activities may involve slip, trip, or fall hazards. Slippery walking/working surfaces can increase the possibility of back injuries, overexertion injuries and slips and falls. Materials handling operations may result in “caught between” situation when a load is being handled and a body part gets caught between two objects. Material handling also exposes employees to

sprains/strains if proper lifting techniques are not used. Noise may also present a hazard. Heavy equipment and train operation frequently results in high noise levels.

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

Control – Prior to initiating any field activity, the site conditions will be discussed with all employees. Hazards will be identified and protective measures will be explained. Control procedures for these hazards are discussed in Section 4, General Safety Practices and in task specific sections of this HASP. Decisions regarding PPE will be based on the potential chemical and physical hazards on the site, and measurements and observations made prior to and during work activities. A minimum of Level D protection will be worn by personnel conducting observation activities. See Section 5, Personal Protective Equipment, for a description of PPE requirements. Personnel conducting observation activities will do so from a safe distance. The following sections describe excavation hazards and control procedures, hazards and control procedures associated with general construction activities.

3.2.4 Soil Sampling

This task involves collecting soil samples for subsequent analysis and evaluation of potential impact by COCs. The physical hazards of these operations are primarily associated with the sample collection methods and procedures used and exposure to contaminants. In addition, personnel may be exposed to hazards associated with working in or near excavations and heavy equipment.

3.2.4.1 Hazards

Inhalation and absorption of COCs are the primary routes of entry associated with soil sampling due to the manipulation of sample media and equipment, manual transfer of media into sample containers, and proximity of operations to the breathing zone. During this project, several different soil sampling methodologies may be used based on equipment accessibility and the types of materials to be sampled. These sampling methods may include the use of hand-auger/sampling probes, sampling spoons, or trowels. The primary hazards associated with these specific sampling procedures are not potentially serious; however, other operations in the area, or the conditions under which samples must be collected may present chemical and physical hazards. The

hazards directly associated with soil sampling procedures are generally limited to strains or sprains, and potential eye hazards. Exposure to soil containing COCs is also possible. In addition to the safety hazards specific to sampling operations, hazards associated with the operation of vehicles (especially large vehicles with limited operator visibility), is a concern. Of particular concern will be the backing up of trucks, excavation equipment and other support vehicles.

The flora and fauna of the site may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders and snakes. The work area presents slip, trip and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces and unstable soil. Freezing weather hazards include frozen, slick and irregular walking surfaces.

3.2.4.2 Control

To control dermal exposure during soil sampling activities, a minimum of Modified Level D protection will be worn. If necessary, based on field observations and site conditions, air monitoring may be conducted during soil sampling activities to assess the potential for exposure to airborne COCs. If the results of air monitoring indicate the presence of organic vapors in a concentration causing concern, personnel will upgrade to Level C protection. Each level of personal protection is described in Section 5, Personal Protective Equipment. Control procedures for environmental and general hazards are discussed in Section 4, General Safety Practices. Collecting subsurface soil samples may involve advancing test pit excavations with excavation equipment. The equipment poses a hazard if it is not properly operated. The presence of overhead utilities and underground obstacles poses a hazard if the excavator contacts them. Safety hazards and procedures associated with activities conducted around excavations are presented in the following subsections.

3.2.5 Demobilization

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

Manual materials handling may cause blisters, sore muscles and joint and skeletal injuries; and may present eye, contusion and laceration hazards. Heavy equipment operation presents noise and vibration hazards and hot surfaces, to operators. Personnel in the vicinity of heavy equipment operation may be exposed to physical

hazards resulting in fractures, contusions and lacerations and may be exposed to high noise levels. The work area presents slip, trip and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces and unstable soil.

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

Control procedures for these hazards are discussed in Section 4, General Safety Practices.

3.3 Chemical Hazards

The chemical hazards associated with site operations are related to inhalation, ingestion and skin exposure to COCs and any construction materials brought to the site.

Based on previous investigation activities on the site, it is anticipated that the primary COCs may potentially include polychlorinated biphenyls (PCBs), benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, phenol, pyrene, naphthalene, glycols, barium, cadmium, chromium, copper, lead, mercury, nickel and zinc. The primary exposure concern is potential skin contact and generation of airborne particulate. Based on the COCs at the site, levels of PPE to be used with each work activity were selected by ARCADIS and are discussed in Section 5, Personal Protective Equipment. Engineering controls including positioning personnel upwind and wetting of soil will also be implemented. As analytical data becomes available, this HASP may be amended to address the specific constituents detected and MSDSs for the specific chemicals will be attached to this HASP.

A MSDS must accompany all materials brought to the site. No material shall be used or installed by any subcontractor prior to review of the MSDS by the SS or HSS. Following review of MSDS' by the SS or HSS, copies shall be made and placed in this HASP. The location of the HASP shall be communicated to all on-site employees. All provisions of the 29 CFR 1910.1200 are to be followed with regard to materials that are to be used during construction activities.

If airborne concentrations of hazardous vapors or fumes may become measurable during certain tasks, air monitoring of potentially hazardous atmospheres will be conducted during such operations.

The MSDS for the COCs and the materials brought to the site are included in Attachment D.

4. General Safety Practices

4.1 General Safety Rules

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

- At least one copy of this HASP must be in a location at the site that is readily available to personnel, and all project personnel shall review the plan prior to starting work.
- Consume or use food, beverages, chewing gum and tobacco products only in the SZ or other designated area outside the EZ and CRZ. Cosmetics shall not be applied in the EZ or CRZ.
- Wash hands before eating, drinking, smoking, or using toilet facilities.
- Wear all PPE as required, and stop work and replace damaged PPE immediately.
- Secure disposable coveralls, boots, and gloves at the wrists and legs and ensure closure of the suit around the neck.
- Upon skin contact with materials that may be impacted by COC, remove contaminated clothing and wash the affected area immediately. Contaminated clothing must be changed. Any skin contact with materials potentially impacted by COC must be reported to the SS or HSS immediately. If needed, medical attention should be sought.
- Practice contamination avoidance. Avoid contact with surfaces either suspected or known to be impacted by COC, such as standing water, mud, or discolored soil. Equipment must be stored on elevated or protected surfaces to reduce the potential for incidental contamination.
- Remove PPE as required in the CRZ to limit the spread of COC-containing materials.
- At the end of each shift or as required, dispose of all single-use coveralls, soiled gloves and respirator cartridges in designated receptacles designated for this purpose.

- Removing soil containing site COC from protective clothing or equipment with compressed air, shaking, or any other means that disperses contaminants into the air is prohibited.
- Inspect all non-disposable PPE for contamination in the CRZ. Any PPE found to be contaminated must be decontaminated or disposed of appropriately.
- Recognize emergency signals used for evacuation, injury, fire, etc.
- Report all injuries, illnesses, near misses and unsafe conditions or work practices to the SS or HSS.
- Use the “buddy system” during all operations requiring Level C PPE, and when appropriate, during Modified Level D operations.
- Obey all warning signs, tags and barriers. Do not remove any warnings unless authorized to do so.
- Use, adjust, alter and repair equipment only if trained and authorized to do so, and in accordance with the manufacturer’s directions.
- Personnel are to perform only tasks for which they have been properly trained and will advise their supervisor if they have been assigned a task for which they are not trained.
- The presence or consumption of alcoholic beverages or illicit drugs during the workday, including breaks, is strictly prohibited. Do not take prescription or over-the-counter drugs when assigned to tasks with the potential for absorption, inhalation, or ingestion of hazardous substances, unless given written approval by an appropriate health care professional.
- Remain upwind during site activities whenever possible.

4.2 Loss Prevention System (LPS)

LPS is a behavior based safety system meant to prevent or reduce the occurrence of injury, illness, or other incident. This program seeks the prevention or reduction of losses by:

- Emphasizing proactive activities.
- Capitalizing on the on-the-job expertise of field employees.
- Maximizing the use of positive reinforcement.
- Integrating with daily field operations.
- Solving problems from the bottom up while providing direction from the top down.

Prior to assignment on a in the field, ARCADIS personnel that will be performing or overseeing work on this project must attend a LPS training session. This training session explains the objectives, elements and requirements of LPS. Personnel will not be allowed to perform work prior to attending an LPS training session. Elements of the LPS program are briefly outlined below in sections 4.2.1-4.2.4.

4.2.1 Safe Performance Self-Assessment / TRACK Process

All on-site personnel are required to perform an SPSA prior to beginning any activity. Each individual must perform the following three-step process:

- Assess the risk of the task to be performed. Ask the following questions:
 - What could go wrong?
 - What is the worst thing that could happen if something does go wrong?
- Analyze the ways the risk can be reduced. Ask the following questions:
 - Do I have all the necessary training and knowledge to do this task safely?
 - Do I have all the proper tools and PPE?
- Act to control the risk and perform the task safely:
 - Take the necessary action to perform the job safely.
 - Follow written procedures and ask for assistance if necessary.

This process must be performed prior to beginning any activity and after any near miss or other incident to determine if it is safe to proceed.

4.2.2 Incident Investigation

An incident includes any of the following events:

- First-aid cases.
- Injuries.
- Illnesses.
- Near misses.
- Spills or leaks.
- Equipment and property damage.
- Motor vehicle accidents.
- Regulatory violations.
- Fires.
- Business interruptions.

All incidents must be investigated within 24 hours, and reported to the PIC, PO, PM and the HSO.

IIs are conducted to prevent the recurrence of a similar hazardous event. IIs review all incidents in the same manner. Using the information gathered during an II, appropriate measures are to protect personnel from the hazard in question. The Incident/Near-Miss Investigation Report is included in Attachment E.

4.2.3 Loss Prevention Observation

The SS or the HSS will perform the LPO (see Attachment F for the LPO Form). LPOs are conducted to identify and correct potential hazards, and to positively reinforce behaviors and practices that are correct. The SS or HSS must identify potential deviations from safe work practices that could possibly result in an incident, and take prompt corrective action. The LPO process includes the following steps:

- Identify tasks that have the greatest potential for hazardous incidents.
- Review the standard procedure for completing the task.
- Discuss with the observed employee the task and the SS/HSS role in observing the task.
- Observe the employee completing the task.
- Reference the LPO form for criteria. Complete the form, documenting positive actions, as well as areas in need of improvement.
- Discuss the results of the LPO with the employee. Discuss corrective action necessary.
- Implement corrective action.
- Communicate the results of the LPO and corrective action to the PM and the HSO.

4.2.4 Near Miss Reporting

As a part of the philosophy that work-related accidents and losses are preventable, we believe that the practices and standards used to conduct work could sometimes lead to an incident and that changing these practices and standards will reduce the potential for an incident. To achieve this end, we use the practice of “near-miss” reporting. Near-misses are situations where no injury or property damage occurred; however, under slightly different circumstances an injury or property damage could have occurred. The near miss report should identify the work that was conducted, what actually happened, discuss the “what could have happened” had the circumstances been slightly different, and recommend a change to procedures to prevent an incident from occurring from similar work in the future. Near miss reporting is encouraged for all workers at any level in the work force. The worker may feel comfortable completing the report themselves or may seek assistance from their HSS or supervisor. Near miss reporting and job safety assessments can be particularly useful after any changes to work practices are implemented, including changes to personnel, equipment, or means and methods.

4.2.5 Job Safety Analysis

A JSA is a tool used of identifying potential hazards and developing corrective or protective systems to eliminate the hazard. A JSA lists all the potential hazards associated with an activity. Hazards may be physical, such as lifting hazards or eye hazards, or environmental, such as weather or biological (stinging insects, snakes). Following the identification of the hazards associated with an activity, control measures are evaluated and protective measures or procedures are then instituted. JSAs are reviewed periodically to ensure that the procedures and protective equipment specified for each activity are current and technically correct. Any changes in site conditions and/or the scope of work may require a review and modification to the JSA in question. During this review process, comments on the JSA and its procedures should be obtained from personnel associated with the activity being analyzed.

4.3 Buddy System

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

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

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

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

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

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

4.4 Heat Stress

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

4.4.1 Heat Rashes

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

4.4.2 Heat Cramps

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

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

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

4.4.3 Heat Exhaustion

Heat exhaustion occurs from increased stress on various body organs due to inadequate blood circulation, cardiovascular insufficiency, or dehydration. Signs and symptoms include:

- Pale, cool, moist skin.
- Heavy sweating.
- Dizziness.
- Nausea.
- Headache.
- Vertigo.
- Weakness.
- Thirst.

- Giddiness.

Fortunately, this condition responds readily to prompt treatment.

Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended; moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, which is a medical emergency.

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

4.4.4 Heat Stroke

Heat stroke is the most serious form of heat stress. Heat stroke occurs when the body's system of temperature regulation fails, and the body's temperature rises to critical levels. This condition is caused by a combination of highly variable factors and its occurrence is difficult to predict.

Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are:

- Confusion.
- Irrational behavior.
- Loss of consciousness.
- Convulsions.
- A lack of sweating (usually).
- Hot, dry skin.
- An abnormally high body temperature (e.g., a rectal temperature of 41°C [105.8°F]).

If body temperature is too high, it causes death. The elevated metabolic temperatures caused by a combination of workload and environmental heat load, both of which contribute to heat stroke, are also highly variable and difficult to predict.

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

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

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

4.4.5 Heat Stress Safety Precautions

Heat stress monitoring and work rest cycle implementation should commence when the ambient adjusted temperature exceeds 72°F. Screening criteria for heat stress exposure are described in Table 4 and examples of activities within metabolic rate categories are provided in Table 5.

**TABLE 4
SCREENING CRITERIA FOR HEAT STRESS EXPOSURE
FOR 8 HOUR WORK DAY FIVE DAYS PER WEEK WITH CONVENTIONAL BREAKS**

Work Demands	Acclimatized				Unacclimatized			
	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy
100% Work	85.1°F (29.5°C)	81.5°F (27.5°C)	78.8°F (26°C)		81.5°F (27.5°C)	77°F (25°C)	72.5°F (22.5°C)	
75% Work; 25% Rest	86.9°F (30.5°C)	83.3°F (28.5°C)	81.5°F (27.5°C)		84.2°F (29°C)	79.7°F (26.5°C)	76.1°F (24.5°C)	
50% Work; 50% Rest	88.7°F (31.5°C)	85.1°F (29.5°C)	83.3°F (28.5°C)	81.5°F (27.5°C)	86°F (30°C)	82.4°F (28°C)	79.7°F (26.5°C)	77°F (25°C)
25% Work; 75% Rest	90.5°F (32.5°C)	87.8°F (31°C)	86°F (30°C)	85.1°F (29.5°C)	87.8°F (31°C)	84.2°F (29°C)	82.4°F (28°C)	79.7°F (26.5°C)

Source: 2004 TLVs and BEIs - Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati: American Conference of Governmental Industrial Hygienists (ACGIH), 2004 - page 171.

TABLE 5
EXAMPLES OF ACTIVITIES WITHIN METABOLIC RATE CATEGORIES

Categories	Example Activities
Resting	Sitting quietly
	Sitting with moderate arm movements
Light	Sitting with moderate arm and leg movements
	Standing with light work at machine or bench while using mostly arms
	Using a table saw
	Standing with light or moderate work at machine or bench and some walking about
Moderate	Scrubbing in a standing position
	Walking about with moderate lifting or pushing
	Walking on a level at 6 Km/hr while carrying 3 Kg weight load
Heavy	Carpenter sawing by hand
	Shoveling dry sand
	Heavy assembly work on a noncontinuous basis
	Intermittent heavy lifting with pushing or pulling (e.g., pick-and-shovel work)
Very Heavy	Shoveling wet sand

Source: 2004 TLVs and BEIs - Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati: American Conference of Governmental Industrial Hygienists (ACGIH), 2004 - page 172

Acclimatization is a set of physiological adaptations, which allows the body to react to heat stress conditions. Full-heat acclimatization requires up to 3 weeks of continued physical activity under heat-stress conditions similar to those anticipated for the work. Its loss begins when the activity under those heat-stress conditions is discontinued, and a noticeable loss occurs after 4 days. With a recent history of heat stress exposures (e.g., 5 of the last 7 days), a worker can be considered acclimatized for the purpose of using the table Screening Criteria for Heat Stress Exposure (Table 4).

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

- Site workers will be encouraged to drink plenty of water and electrolyte replacement fluids throughout the day.
- On-site drinking water will be kept cool (50 to 60°F).

- A work regimen that will provide adequate rest periods for cooling down will be established, as required.
- All personnel will be advised of the dangers and symptoms of heat stroke, heat exhaustion and heat cramps.
- Cooling devices, such as vortex tubes or cooling vests, should be used when personnel must wear impermeable clothing in conditions of extreme heat.
- Employees should be instructed to monitor themselves and co-workers for signs of heat stress and to take additional breaks as necessary.
- A shaded rest area must be provided. All breaks should take place in the shaded rest area.
- Employees must not be assigned to other tasks during breaks.
- Employees must remove impermeable garments during rest periods. This includes white Tyvek™-type garments.

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

4.5 Cold Stress

Cold stress normally occurs in temperatures at or below freezing, or under certain circumstances, in temperatures of 40°F. Extreme cold for a short time may cause severe injury to exposed body surfaces or result in profound generalized cooling, causing death. Areas of the body that have high surface area-to-volume ratio, such as fingers, toes, and ears, are the most susceptible. Two factors influence the development of a cold weather injury: ambient temperature and the velocity of the wind. For instance, 10°F with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at 18°F. An equivalent chill temperature chart relating the actual dry bulb temperature and wind velocity is presented in Table 6.

**TABLE 6
CHILL TEMPERATURE CHART**

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

[This chart was developed by the U.S. Army Research Institute of Environmental Medicine, Natick, MA

(Source: ACGIH Threshold Limit Values for Chemical Substances and Physical Agents)].

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

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

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

level of cold and physical activity. In addition to protective clothing, preventive safe work practices, additional training and warming regimens may be utilized to prevent cold stress.

Safety Precautions for Cold Stress Prevention

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

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

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

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

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

Safe Work Practices

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

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

Field personnel should be provided the opportunity to become accustomed to cold-weather working conditions and required protective clothing.

Work should be arranged in such a way that sitting or standing still for long periods is minimized.

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

4.6 Biological Hazards

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

4.6.1 Ticks

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

Symptoms of Lyme disease include a rash or a peculiar red spot, like a bull’s eye, which expands outward in a circular manner. The victim may have headache, weakness, fever, a stiff neck, and swelling and pain in the joints, and eventually, arthritis.

Erlchiosis – This disease also commonly occurs in summer and is transmitted by the bite of infected ticks. “Hot spots” in the United States include New York, Massachusetts, Connecticut, Rhode Island, Minnesota and Wisconsin. Symptoms of erlichiosis include muscle and joint aches and flu-like symptoms, but there is typically no skin rash.

Rocky Mountain Spotted Fever (RMSF) – This disease is transmitted via the bite of an infected tick. The tick must be attached for 4 to 6 hours before the disease-causing organism (*Rickettsia rickettsii*) becomes reactivated and can infect humans.

The primary symptom of RMSF is the sudden appearance of a moderate-to-high fever. The fever may persist for 2 to 3 weeks. The victim may also have a headache, deep muscle pain, and chills. A rash appears on the hands and feet on about the third day and eventually spreads to all parts of the body. For this reason, RMSF may be confused with measles or meningitis. The disease may cause death, if untreated, but if identified and treated promptly, death is uncommon.

Control – These diseases are transmitted primarily by the deer tick, which is smaller and redder than the common wood tick. The diseases may be transmitted by immature ticks, which are small and hard to see. The tick may be as small as a period on this page. Tick repellent containing diethyltoluamide (DEET) should be used when working in tick-infested areas, and pant legs should be tucked into boots. In addition, workers should search the entire body every 3 or 4 hours for attached ticks. Ticks should be removed promptly and carefully without crushing, since crushing can squeeze the disease-causing organism into the skin. A gentle and steady pulling action should be used to avoid leaving the head or mouth parts in the skin. Hands should be protected with surgical gloves when removing ticks.

4.6.2 Mosquitoes

Personnel may be exposed to mosquitoes during work activities.

West Nile Virus – Typical exposure to mosquitoes does not present a significant hazard. However, if West Nile virus is prevalent in the area exposure to this virus is increased. West Nile virus results in flu-like symptoms and can be serious if not treated or in immune compromised individuals.

Control – To minimize the threat of mosquito bites all personnel working outside must be aware of the potential for encountering mosquitoes and implement the basic precautions listed below:

- Avoid working at dawn or dusk when mosquitoes are most active.
- Prevent accumulation of standing water at the work-site.
- Apply an insect repellent that contains DEET to exposed skin.
- Wear light colored clothes, preferably with long-sleeves and full-length pants.

- Do not touch any dead birds or animals that you encounter.

If dead birds are detected near the site, report to the local County Health Department. If flu-like symptoms are present, contact your doctor or the HSO for more information.

4.6.3 Poisonous Plants

Poisonous plants may be present in the work area. Personnel should be alerted to their presence and instructed on methods to prevent exposure. Poison sumac grows as a shrub or small tree with large alternate, compound leaves having 7 to 13 leaflets without teeth. All plant parts are poisonous. The lack of 1) leaflet glands, 2) "wings" between the leaflets, and 3) teeth on the leaves, in addition to this species' red stems supporting the leaflets and leaves, help to distinguish this plant from similar-looking nonpoisonous species such as other sumacs and tree-of-heaven. Flowers are shades of green, white and yellow and appear in late spring. Fruits are small white berries that mature in late summer and may last through winter. Occasionally found in moist or wet soils.

Poison ivy is a woody shrub or vine with hairy looking aerial roots. It grows to 10 feet or more, climbing high on trees, walls and fences or trails along the ground. All parts of poison ivy, including the roots, are poisonous at all times of the year.



Poison Sumac



Poison Ivy

The main control for both poison ivy and poison sumac is to avoid contact with the plant, cover arms and hands and frequently wash potentially exposed skin. Particular attention must be given to avoiding skin contact with objects or protective clothing that have touched the plants. Treat every surface that may have touched the plant as contaminated, and practice contamination avoidance.

Poison ivy and sumac are very easy to treat if you identified your contact with the irritating plant within a few hours of the incident. The urushiol oil present in both plants chemically bonds with the proteins in your skin about 30 minutes after contact. 75 percent of the population is effected by contact with urushiol, although immunity to urushiol today does not assure immunity tomorrow, and vice versa. Rash symptoms can appear within a few hours but can take two to five days to appear. The rash starts as a red, annoyingly itchy area that starts to swell. The area then gets inflamed and will get covered in clusters of tiny pimples, the pimple eventually merge and turn into blisters. The fluid in the blisters turns yellow, dries up, and becomes crusty. Left completely untreated, this cycle can last as short as five days and in severe cases as long as five to six weeks.

If you come in contact with poison ivy, oak or sumac, or a animal exposed to any of these, or tools, gear, or clothing exposed to any of these, you should wash off with hot water (not so hot that it burns) and strong soap as soon as possible. If you can get washed up in the first six hours, before the first symptoms appear, you have a good chance of avoiding an out break, and an even better chance of minimizing the effects if you do have one.

4.6.4 Snakes

Hazards – The possibility of encountering snakes exists, specifically for personnel working in wooded or vegetated areas. Snake venoms are complex and include proteins, some of which have enzymatic activity. The effects produced by venoms include:

- Neurotoxic effects with sensory, motor, cardiac and respiratory difficulties.
- Cytotoxic effects on red blood cells, blood vessels, heart muscle, kidneys and lungs.
- Defects in coagulation.
- Effects from local release of substances by enzymatic actions.

Other noticeable effects of venomous snakebites include swelling, edema and pain around the bite, and the development of ecchymosis (the escape of blood into tissues from ruptured blood vessels).

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

4.6.5 Spiders

Hazards – Personnel may encounter spiders during work activities. Two spiders of concern are the black widow and the brown recluse. Both prefer dark sheltered areas such as basements, equipment sheds and enclosures and around woodpiles or other scattered debris. The black widow is shiny black, approximately 1-inch long, and found throughout the United States. There is a distinctive red hourglass marking on the underside of the black widow's body. The bite of a black widow is seldom fatal to healthy adults, but effects include respiratory distress, nausea, vomiting and muscle spasms. The brown recluse is smaller than the black widow and gets its name from its brown coloring and behavior. The brown recluse is more prevalent in the Southern

United States. The brown recluse has a distinctive violin shape on the top of its body. The bite of the brown recluse is painful, and the bite site ulcerates and takes many weeks to heal completely.

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

4.7 Noise

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

Control – All personnel must wear hearing protection, with a Noise Reduction Rating (NRR) of at least 20, when noise levels exceed 85 dBA. When it is difficult to hear a co-worker at normal conversation distance, the noise level is approaching or exceeding 85 dBA, and hearing protection is necessary. All site personnel who may be exposed to noise must also receive baseline and annual audiograms and training as to the causes and prevention of hearing loss. Noise monitoring is discussed in Section 6.2, Noise Monitoring.

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

4.8 Spill Control

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

Spill control equipment and materials will be located on the site at locations that present the potential for discharge. All sorbent materials used for the cleanup of spills will be containerized and labeled appropriately. In the event of a spill, the SS will follow the provisions in Section 9, Emergency Procedures, to contain and control released materials and to prevent their spread to off-site areas.

4.9 Sanitation

Site sanitation will be maintained according to OSHA requirements as described in the following sections.

4.9.1 Break Area

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

4.9.2 Potable Water

The following rules apply to all field operations:

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

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

4.9.3 Sanitary Facilities

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

4.9.4 Lavatory

If permanent toilet facilities are not available, an appropriate number of portable chemical toilets will be provided.

This requirement does not apply to mobile crews or to normally unattended site locations so long as employees at these locations have transportation immediately available to nearby toilet facilities.

4.10 Emergency Equipment

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

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

4.11 Lockout/Tagout Procedures

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

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

device indicating that the equipment controls may not be operated until the tag is removed by the personnel who attached the tag.

4.12 Electrical Safety

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

General electrical safety requirements include:

- All electrical wiring and equipment must be a type listed by Underwriters Laboratories (UL), Factory Mutual Engineering Corporation (FM), or other recognized testing or listing agency.
- All installations must comply with the National Electrical Safety Code (NESC), the National Electrical Code (NEC), or USCG regulations.
- Portable and semi-portable tools and equipment must be grounded by a multi-conductor cord having an identified grounding conductor and a multi-contact polarized plug-in receptacle.
- Tools protected by an approved system of double insulation, or its equivalent, need not be grounded. Double insulated tools must be distinctly marked and listed by UL or FM.
- Live parts of wiring or equipment must be guarded to prevent persons or objects from touching them.
- Electric wire or flexible cord passing through work areas must be covered or elevated to protect it from damage by foot traffic, vehicles, sharp corners, projections, or pinching.
- All circuits must be protected from overload;
- Temporary power lines, switchboxes, receptacle boxes, metal cabinets and enclosures around equipment must be marked to indicate the maximum operating voltage.

- Plugs and receptacles must be kept out of water unless of an approved submersible construction.
- All extension cord outlets must be equipped with ground fault circuit interrupters (GFCI).
- Attachment plugs or other connectors must be equipped with a cord grip and be constructed to endure rough treatment.
- Extension cords or cables must be inspected prior to each use, and replaced if worn or damaged. Cords and cables must not be fastened with staples, hung from nails, or suspended by bare wire.
- Flexible cords must be used only in continuous lengths without splice, with the exception of molded or vulcanized splices made by a qualified electrician.

4.13 Lifting Safety

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

- Consider the size, shape, and weight of the object to be lifted. A mechanical lifting device or additional persons must be used to lift an object if it cannot be lifted safely alone.
- The hands and the object should be free of dirt or grease that could prevent a firm grip.
- Gloves must be used, and the object inspected for metal slivers, jagged edges, burrs, or rough or slippery surfaces.
- Fingers must be kept away from points that could crush or pinch them, especially when putting an object down.
- Feet must be placed far enough apart for balance. The footing should be solid and the intended pathway should be clear.
- The load should be kept as low as possible, close to the body with the knees bent.

- To lift the load, grip firmly and lift with the legs, keeping the back as straight as possible.
- A worker should not carry a load that he or she cannot see around or over.
- When putting an object down, the stance and position are identical to that for lifting; the legs are bent at the knees, and the back is straight as the object is lowered.

4.14 Elevated Work Safety

During the course of this project personnel may be exposed to the hazards of working at heights (ladders, scaffolding, roofing work). The following sections of 29 CFR 1926 are applicable to the elevated work on this project:

- Subpart M, Fall Protection.
- Subpart X Ladders.

All elevated work will be performed in a safe manner and in compliance with all regulations governing such work, and the requirements of this HASP. All personnel exposed to fall hazards shall be trained regarding the nature of the hazards of elevated work prior to assignment.

4.14.1.1 Fall Protection

All personnel exposed to fall hazards greater than 6 feet shall be protected from the hazard by a fall protection system.

Fall protection systems shall comply with the guidelines established in 29 CFR 1926 Subpart M, Fall Protection.

All personnel exposed to fall hazards shall be trained by a competent person in the following areas:

- The nature of fall hazards in the work area.
- The correct procedures for erecting, maintaining, disassembling and inspecting the fall protection systems to be used and the employees roles and responsibilities associated with the systems.

- The use and operation of the fall protection systems to be used.
- The correct procedures for the handling and storage of materials and equipment and the erection of overhead protection.
- The fall protection standards contained in 29 CFR 1926 Subpart M, Fall Protection.

Written certification of fall protection training for personnel exposed to fall hazards shall be maintained by each contractor, and must be made available to the SS upon request.

4.14.1.2 Ladders

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

Ladders shall be maintained free of oil, grease and other slipping hazards.

Ladders shall not be loaded beyond the maximum intended load for which they were built, nor beyond their manufacturer's rated capacity.

Ladders shall be used only for the purpose for which they were designed.

Non-self-supporting ladders shall be used at an angle such that the horizontal distance from the top support to the foot of the ladder is approximately one-quarter of the working length of the ladder (the distance along the ladder between the foot and the top support).

Wood job-made ladders with spliced side rails shall be used at an angle such that the horizontal distance is one-eighth the working length of the ladder.

Fixed ladders shall be used at a pitch no greater than 90 degrees from the horizontal, as measured to the back side of the ladder.

Ladders shall be used only on stable and level surfaces unless secured to prevent accidental displacement.

Ladders shall not be used on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental displacement. Slip-resistant feet shall not be used as a substitute for care in placing, lashing, or holding a ladder that is used upon slippery surfaces, including, but not limited to, flat metal or concrete surfaces that are constructed so they cannot be prevented from becoming slippery.

Ladders placed in any location where they can be displaced by workplace activities or traffic, such as in passageways, doorways, or driveways, shall be secured to prevent accidental displacement, or a barricade shall be used to keep the activities or traffic away from the ladder.

The area around the top and bottom of ladders shall be kept clear.

The top of a non-self-supporting ladder shall be placed with the two rails supported equally unless it is equipped with a single support attachment.

Ladders shall not be moved, shifted, or extended while occupied.

Ladders shall have non-conductive siderails if they are used where the employee or the ladder could contact exposed energized electrical equipment.

Personnel using a stepladder shall not stand or sit on the top, top step, or any step labeled that it or any step above it not be used as a step.

Cross-bracing on the rear section of stepladders shall not be used for climbing unless the ladders are designed and provided with steps for climbing on both front and rear sections.

Ladders shall be inspected by the HSS for visible defects on a daily basis and after any occurrence that could affect their safe use.

Portable ladders with structural defects, such as, but not limited to, broken or missing rungs, cleats, or steps; broken or split rails; corroded components; or other faulty or defective components shall either be immediately marked in a manner that readily identifies them as defective, or be tagged with "Do Not Use" or similar language, and shall be withdrawn from service.

Fixed ladders with structural defects, such as, but not limited to, broken or missing rungs, cleats, or steps; broken or split rails; or corroded components; shall be withdrawn from service.

Ladder repairs shall restore the ladder to a condition meeting its original design criteria, before the ladder is returned to use.

Single-rail ladders shall not be used.

When ascending or descending a ladder, the user shall face the ladder.

Each employee shall use at least one hand to grasp the ladder when progressing up and/or down the ladder.

An employee shall not carry any object or load that could cause the employee to lose balance and fall.

4.15 Heavy Equipment Materials Handling

To protect on-site personnel against hazards associated with materials handling and site restoration activities, and to prevent injury due to unsafe heavy equipment operation, only properly trained and authorized personnel will be allowed to operate heavy equipment. All materials handling equipment will be maintained in a safe operating condition and inspected daily prior to use. Personnel operating forklifts shall be trained and certified in accordance with 29 CFR 1910.178(l). Certification shall be made available to the SS upon request.

Hazards - The physical hazards involved with heavy equipment materials handling activities relate to the work done with heavy equipment and the site environment itself. There exists a potential for incidents involving personnel being struck by or struck against heavy equipment or materials, resulting in fractures, cuts, punctures, or abrasions. Heavy equipment operation may present noise hazards, vibration hazards, and a potential for contact with moving parts or hot surfaces to equipment operators. Walking and working surfaces may involve slip, trip and fall hazards. Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, and slips and falls. Noise may also present a hazard. Heavy equipment operation frequently results in high noise levels.

4.15.1 Audible Alarms

Every vehicle used to haul dirt, rock, concrete, or other construction material shall be equipped with a warning device that operates automatically while the vehicle is backing. The warning sound shall be of such magnitude that it will normally be audible from a distance of 200 feet and will sound immediately on backing. In congested areas or areas with high ambient noise that obscures the audible alarm, a signaler, in clear view of the operator, shall direct the backing operation. Other vehicles, if operating in areas where their backward movement would constitute a hazard to employees working in the area on foot, and where the operator's vision is obstructed to the rear of the vehicle shall be equipped with an effective device or method to safeguard employees such as:

- An automatic backup audible alarm which would sound immediately on backing.
- An automatic braking device at the rear of the vehicle that will apply the service brake immediately on contact with any obstruction to the rear.
- In lieu of the above requirements, administrative controls shall be established such as:
 - A spotter or flagger in clear view of the operator who shall direct the backing operation.
 - Other procedures which will require the operator to dismount and circle the vehicle immediately prior to starting a backup operation.
 - Prohibiting all foot traffic in the work area.
 - Other means shall be provided that will furnish safety equivalent to the foregoing for personnel working in the area.

The operator of all vehicles shall not leave the controls of the vehicle while it is moving under its own engine power. Hauling or earth moving operations shall be controlled in such a manner as to ensure that equipment or vehicle operators know of the presence of other personnel in the areas of their operations.

4.15.2 Equipment Inspection and Maintenance

All vehicles in use shall be checked at the beginning of each shift to assure that the following parts, equipment and accessories are in safe operating condition and free of apparent damage that could cause failure while in use: service brakes, including trailer brake connections; parking system (hand brake); emergency stopping system (brake); tires; horn; steering mechanism; coupling devices; seat belts; operating controls and

safety devices. All defects affecting safe operation shall be corrected before the vehicle is placed in service. These requirements also apply to equipment such as lights, reflectors, windshield wipers, defrosters, fire extinguishers, etc., where such equipment is necessary.

Vehicle engines shall not be allowed to run in closed garages or other enclosed places, unless vents are provided which effectively remove the exhaust gases from the building.

No repairs shall be attempted on power equipment until arrangements are made to eliminate possibility of injury, caused by sudden movements or operation of the equipment or its parts. When the equipment being repaired is a bulldozer, carryall, ripper, or other machine having sharp or heavy moving parts such as blades, beds, or gates, such parts shall be lowered to the ground or securely and positively blocked in an inoperative position.

All controls shall be in a neutral position, with the engine(s) stopped and brakes set, unless work being performed requires otherwise. Trucks with dump bodies shall be equipped with positive means of support, permanently attached, and capable of being locked in position to prevent accidental lowering of the body while maintenance or inspection work is being done. In all cases where the body is raised for any work, the locking device shall be used. Except for emergency field repairs, a safety tire rack, cage, or equivalent protection shall be used when inflating truck or equipment tires after mounting on a rim, if such tires depend upon a locking ring or similar device to hold them on the rim.

4.15.3 Equipment Parking and Loading

Whenever the equipment is parked, the parking brake shall be set. Equipment parked on inclines shall have the wheels chocked and the parking brake set or be otherwise prevented from moving by effective mechanical means.

Scissor points on all front end loaders, which constitute a hazard to the operator, shall be adequately guarded. A loader shall not travel without adequate visibility for the driver and stability of the equipment. No loading device shall be left unattended until the load or bucket is lowered to the ground, unless proper precautions such as blocking are taken to prevent accidental lowering.

4.15.4 Equipment Fueling

No internal combustion engine fuel tank shall be refilled with a flammable liquid while the engine is running. Fueling shall be done in such a manner that the likelihood of spillage is minimal. If a spill occurs it shall be contained and cleaned, or equivalent action taken to control vapors before restarting the engine. Fuel tank caps shall be replaced before starting the engine.

A good metal to metal contact shall be kept between fuel supply tank or nozzle of supply hose and the fuel tank. No open lights, welding, or sparking equipment shall be used near internal combustion equipment being fueled or near storage tanks. No smoking shall be permitted at or near the gasoline storage area or on equipment being fueled. Post a conspicuous sign in each fuel storage and fueling area stating: "NO SMOKING WITHIN 50 FEET." Class I liquids shall not be dispensed by pressure from drums, barrels and similar containers. Approved pumps taking suction through the top of the container or approved self-closing faucets shall be used. No repairs shall be made to equipment while it is being fueled.

Each fuel storage tank or drum shall have the word "Flammable" conspicuously marked thereon and should also have a similarly sized word indicating the contents of the container. A fire extinguisher rated 20:BC or larger shall be in a location accessible to the fueling area. All fuel storage tanks, drums or safety cans shall be properly marked and of the proper type.

4.15.5 Flaggers

Flaggers shall be utilized at locations on a construction site where barricades and warning signs cannot control the moving traffic. When flaggers are required, they shall be placed in relation to the equipment or operation so as to give effective warning. Placement of warning signs shall be according to the State Department of Transportation (DOT).

Flaggers shall wear orange warning garments such as vests, jackets, or shirts. Rainwear, when worn, shall be orange, or other color provided an orange outer warning garment is worn. During the hours of darkness, flaggers' stations shall be illuminated such that the flagger will be clearly visible to approaching traffic and flaggers shall be outfitted with reflective garments. The retro reflective material shall be either orange, white (including silver-coated reflecting coatings or elements that reflect white light), yellow, fluorescent red-orange, or fluorescent yellow-orange.

Flaggers shall be trained in the proper fundamentals of flagging moving traffic before being assigned as flaggers. Signaling directions used by flaggers shall conform to the DOT standards.

4.15.6 Additional Safety Requirements

To protect on-site personnel against hazards associated with materials handling, and to prevent injury due to unsafe heavy equipment operation, only properly trained and authorized personnel will be allowed to operate heavy equipment. All materials handling equipment will be maintained in a safe operating condition and inspected daily prior to use.

Additional heavy equipment safety requirements include, but are not limited to:

- Prior to operating any heavy equipment, the authorized operator must conduct a pre-operation inspection to determine if the heavy equipment is in safe operating condition prior to each work shift.
- All mobile equipment shall be equipped with an audible back-up alarm.
- Personnel will not be allowed to stand or pass under the elevated portion of any heavy equipment, whether loaded or empty.
- Personnel will not place arms and legs between pinch or scissor points of the equipment or outside the operator enclosure.
- A safe distance shall be maintained from the edge of excavations, ditches, ramps, or platforms.
- Operators will maintain sufficient clearance under overhead utilities, installations, lights, pipes, etc.
- Heavy equipment must never be used for lifting or transporting personnel.
- The operator is required to look in the direction of, and maintain a clear view of the path of travel.
- Heavy equipment shall not be operated without an overhead guard and roll-over protection to protect the operator against falling objects and equipment roll-over.

- Heavy equipment must not be driven up to anyone standing in front of any object.
- Stunt driving and horseplay are strictly prohibited.
- Operators will yield the right-of-way to other site vehicles.
- Other heavy equipment traveling in the same direction, at intersections, blind spots, or other dangerous locations must not be passed.
- A safe distance must be maintained from other heavy equipment, and the equipment must be kept under control at all times.
- The heavy equipment operator must slow down for wet and slippery conditions. Under all travel conditions the equipment will be operated at a speed that will permit it to be brought to a stop in a safe manner.
- Operators will avoid running over loose objects on operating surfaces.
- Grades and ramps must be ascended and descended slowly.
- On all grades, the load will be tilted back, and raised only as far as necessary to clear the operating surface.
- The operator will slow down and sound the horn at intersections, when entering buildings, and other locations where vision may be obstructed.
- If the load being carried obstructs forward view, the operator will travel with the load trailing.
- While negotiating turns, speed will be reduced to a safe rate, and turning will be in a smooth, sweeping motion to avoid abrupt turns and potential equipment or load upset.
- Authorized operators will only handle stable or safely arranged loads that are within the rated capacity of the heavy equipment and will not affect the stability of the heavy equipment.

When a piece of heavy equipment is left unattended, hydraulics will be fully lowered, controls will be neutralized, power will be shut off, and brakes set. Wheels will be

blocked or chocked if the heavy equipment is parked on an incline. When internal combustion engine-powered heavy equipment is utilized indoors, near confined spaces, or near excavations, carbon monoxide levels shall be monitored to prevent personnel exposure.

4.16 Hot Work Safety Program

The purpose of the Hot Work Safety Program is to protect all personnel from hazards associated with activities producing sparks, flames, or other ignition sources, and to prevent the loss of property due to fire. To effectively comply with the provisions of the OSHA standards governing fire prevention and hot work activities, the Hot Work Safety Program establishes procedures to ensure that physical and chemical fire hazards present in the workplace are isolated from hot work activities. The Hot Work Safety Program is applicable to all welding, cutting, burning, grinding and other spark producing work activities. Contractors may utilize their own hot work safety procedures as long as the requirements of this section are met.

4.16.1.1 Designated Hot Work Areas

Contractors may establish designated hot work areas at the project site. Hot work conducted within a designated hot work area does not require a work permit. Designated hot work areas must be delineated, and all project site personnel informed of their location.

All project site personnel are responsible for keeping flammable and combustible materials out of designated hot work areas. All hot work conducted outside of designated hot work areas requires a hot work permit.

4.16.1.2 Conditions Prohibiting Hot Work

Hot work activities are prohibited in any area of the project site where the following conditions exist:

- If the requirements of the hot work permit cannot be met, then the hot work is prohibited and alternative methods shall be employed.
- If areas potentially containing explosive atmospheres due to the presence of flammable gases, vapors, liquids, or dusts.

- Within 50 feet of an area where flammable or combustible liquids or gases are used or stored.

Hot work activities shall not be conducted within the areas outlined above. All on-site personnel are responsible for preventing hot work activities within prohibited areas. Additionally, no hot work will be conducted on any surface covered with a protective coating whose flammability is not known. Employees conducting hot work activities on toxic preservative coatings shall wear appropriate respiratory protection and the preservative coatings shall be removed a sufficient distance from the area to be heated.

4.16.1.3 Hot Work Permits

A hot work permit is required for welding, cutting, burning, grinding, or spark producing work conducted outside of designated hot work areas. This section outlines the preparation, issuance, use, and tracking of hot work permits. Contractors may utilize their own hot work permits if they meet the requirements of this section. This procedure has been developed to ensure basic precautions for fire prevention and employee safety are implemented prior to and during hot work activities outside of designated hot work areas. No hot work will be conducted by ARCADIS or its subcontractors while completing this project. Therefore ARCADIS will not require a hot work permit. In the event that ARCADIS observes the client's contractor conducting hot work, ARCADIS will communicate to that contractor the safety procedures detailed in this section, as applicable, and exercise its stop work authority in the event that hot work is proceeding in an unsafe manner.

If possible, the object or equipment on which the hot work is to be conducted shall be moved to a designated hot work area.

If an object or equipment on which hot work is to be conducted cannot be moved, all moveable fire hazards shall be moved at least 50 feet from the hot work operation.

If an object or equipment on which hot work is to be conducted cannot be moved, or all fire hazards cannot be removed, then guards, barriers, or screens shall be used to confine any heat, sparks and slag, and to protect the immovable fire hazards.

All floor, wall, and window openings or cracks within a 35-foot radius shall be protected to prevent exposure of combustible material to heat, sparks, or slag.

Suitable fire fighting equipment shall be on-hand for immediate use.

If hot work takes place in an area where flying sparks and slag may injure personnel working near, above, or below the hot work operation, then additional precautions shall be implemented to prevent injury to the personnel (i.e., screens, barriers, caution tape, PPE).

A fire watch will begin before hot work is initiated and will continue during and for a minimum of 30 minutes after the hot work concludes to ensure that there are no smoldering fires. A fire watch is required whenever hot work is performed outside of designated hot work areas.

Verify that flammable and combustible materials adjacent to the opposite side of metal partitions, walls, ceilings, or roofs which are likely to be ignited by conduction or radiation are protected by guards, barriers, screens, or are moved 50 feet away from the metal partitions, walls, ceilings, or roofs.

If hot work is to be conducted in a confined space, the requirements for the confined space entry must be reviewed and followed.

Hot work will not be performed in areas where other workers may be affected unless adequate engineering or administrative controls are used to prevent personnel exposure.

Welding, cutting and other hot work will not be undertaken unless adequate ventilation, PPE and well maintained equipment are used by trained and authorized personnel.

After welding and cutting has been completed, the area will be thoroughly cleaned, and equipment returned to its proper location.

All personnel involved in hot work activities shall use appropriate PPE.

If any of the basic requirements for fire prevention cannot be implemented prior to or during hot work which is conducted outside a designated hot work area, then the hot work activities will not be conducted. At the conclusion of the hot work activities, the hot work permit will be provided to the contractor's HSS for recordkeeping.

4.16.1.4 Fire Watch Procedures

A fire watch is required whenever hot work is performed outside designated hot work areas. Fire watch personnel are required to meet the following requirements.

Fire watch personnel must have fire-extinguishing equipment readily available and ready for immediate use.

Fire watch personnel must be trained in the use of the fire fighting equipment provided.

Fire watch personnel must be familiar with the procedure to sound the fire alarm in the event of a fire and know the location of the nearest telephone.

All fire watch personnel shall use appropriate PPE.

Fire watch personnel must watch for fires, try to extinguish them if safe to do so, or otherwise activate the fire alarm system.

If a fire cannot be extinguished with one fire extinguisher, the area shall be evacuated, the fire alarm system shall be activated and the appropriate professional fire fighting organization contacted.

Fire watch personnel must maintain a fire watch for at least 30 minutes after the hot work operations are completed.

If any of the above requirements cannot be met, hot work shall not be conducted.

4.17 Confined Space Entry

A confined space is defined as a space large enough and so configured that an employee can bodily enter and perform assigned work, has limited means for entry or exit, and is not designed for continuous employee occupancy. Some confined space work may pose additional hazards such as air contamination, flammable or explosive atmosphere, and oxygen deficiency. Confined space entry may pose the possibility of engulfment. Personnel must be properly trained in order to supervise and participate in confined space entry procedures or serve as standby attendants.

All confined spaces are initially considered permit-required confined spaces (permit spaces). No confined space entry will be conducted by ARCADIS or its subcontractors

while completing this project. Therefore ARCADIS will not require a confined space entry permit. In the event that ARCADIS observes the client's contractor conducting confined space entry activities, ARCADIS will communicate to that contractor the safety procedures detailed in this section, as applicable, and exercise its stop work authority in the event that confined space entry activities appear to be occurring in an unsafe manner.

Identification - The ARCADIS SS/HSS is responsible to identify all confined spaces into which ARCADIS employees will enter. Entry is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space. The client is responsible to identify and provide information as to contents, expected atmosphere, and rescue procedures for all confined spaces on his/her property. If a space is not considered permit required by the client but meets the criteria of this procedure, it shall be considered permit required for ARCADIS-managed entry. If a space does not meet the criteria in this procedure but is considered permit-required by the client, it will be considered a permit-required confined space by ARCADIS. Confined Space entry will be conducted in accordance with 29 CFR 1910.146 Permit Required Confined Spaces.

The permit spaces to be entered on this project may include but are not limited to: sewer system manholes, catch basins, troughs, sumps, enclosures/pits, outfalls, drains, vessels and tanks.

4.17.1 Duties of Personnel

Each confined space being entered shall have a minimum of one dedicated attendant and one other support person (who may have other duties) within sight or call.

4.17.1.1 Duties of Entrants

Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure.

Communicate with the attendant as necessary to enable the attendant to monitor entrant status and to enable the attendant to alert entrants of the need to evacuate the space.

Alert the attendant whenever:

- The entrant recognizes any warning sign or symptom of exposure to a dangerous situation.
- The entrant detects a prohibited condition.

Exit from the permit space as quickly as possible whenever:

- An order to evacuate is given by the attendant or the entry supervisor.
- The entrant recognizes any warning sign or symptom of exposure to a dangerous situation.
- The entrant detects a prohibited condition.
- An evacuation alarm is activated.

4.17.1.2 Duties of Attendants

Knows the hazards that may be faced during entry, including information on the mode, signs or symptoms and consequences of the exposure.

Is aware of possible behavioral effects of hazard exposure in authorized entrants.

Continuously maintains an accurate count of authorized entrants in the permit space and accurately identifies who is in the permit space by tagging the lifelines with the entrant's name, and recording the names of the entrants.

Remains outside the permit space during entry operations until relieved by another attendant.

Communicates with authorized entrants as necessary to monitor entrant status and to alert entrants of the need to evacuate the space.

Monitors activities inside and outside the space to determine if it is safe for entrants to remain in the space and orders the authorized entrants to evacuate the permit space immediately under any of the following conditions:

- If the attendant detects a prohibited condition.
- If the attendant detects the behavioral effects of hazard exposure in an authorized entrant.
- If the attendant detects a situation outside the space that could endanger the authorized entrants.
- If the attendant cannot effectively and safely perform all his duties.

Summon rescue and other emergency services as soon as the attendant determines that authorized entrants may need assistance to escape from permit space hazards.

Takes the following actions when unauthorized persons approach or enter a permit space while entry is underway:

- Warn the unauthorized persons that they must stay away from the permit space.
- Advise the unauthorized persons that they must exit immediately if they have entered the permit space.
- Inform the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space.

Performs non-entry rescues.

Performs no duties that might interfere with the attendant's primary duty to monitor and protect the authorized entrants.

4.17.1.3 Duties of Entry Supervisors

Knows the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure.

Verifies, by checking that the appropriate entries have been made on the permit, that all tests specified by the permit have been conducted and that all procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin.

Terminates the entry and cancels the permit as required.

Removes unauthorized individuals who enter or who attempt to enter the permit space during entry operations.

Determines that entry operations remain consistent with terms of the entry permit and that acceptable entry conditions are maintained.

Documents on the entry permit any incidents or circumstances requiring review of the confined space entry program. Such incidents include:

- Unauthorized entry.
- The detection of a condition/hazard not authorized by the permit.
- The occurrence of an injury or near-miss during entry.
- A change in use or configuration of the space.
- Employee complaints about the program.

Prescribes procedures for coordination of entry when personnel from multiple employers will work simultaneously. Subcontractors shall follow all confined space entry procedures.

4.17.2 Procedures for Permit Space Entry

Acceptable Entry Conditions - The acceptable entry conditions for entry into each space are outlined in the following table.

Isolation Requirements - The confined space must be isolated to prevent the introduction of contaminants during entry. If complete isolation is not practical or possible, entry conditions must be continuously monitored. Procedures for isolating

hazardous energy sources will comply with 29 CFR 1910.147, Control of Hazardous Energy (Lockout/Tagout).

Atmospheric Hazard Control - Atmospheric hazards must be eliminated or controlled to meet the requirements specified in the following table. If necessary, the space shall be purged or made inert, then ventilated. Ventilation equipment may be needed to maintain these conditions.

Table 8
Acceptable Entry Conditions for Confined Spaces

Airborne Contaminant Entry Conditions and Action Levels		
Parameter	Reading	Action/Level of Protection
Total Organic Vapors	< 5 parts per million (ppm)	Acceptable Normal operations;
	≥ 5 ppm	Stop work; evacuate confined space and investigate cause of reading
Total Particulate	0 to 0.10 mg/m ³	Normal operations
Total Particulate	> 0.10-0.15 mg/m ³	Stop work; investigate source of particulate, reduce generation rate
Total Particulate	> 0.15 mg/m ³	Stop work, institute control techniques to maintain levels below action level
Within CRZ or SZ Lead and Cadmium monitoring will be implemented if action levels in the EZ are exceeded		
Flammable Vapors (LEL)	< 10% LEL	Normal operations, acceptable entry condition
	≥ 10% LEL	Stop work; evacuate confined space; ventilate area; investigate source of vapors
Hydrogen Sulfide	< 5 ppm	Normal operations, acceptable entry condition
	≥ 5 ppm	Stop work; evacuate confined space; ventilate area; investigate source of vapors
Carbon Monoxide	< 25 ppm	Normal operations, acceptable entry condition
	≥ 25 ppm	Stop work; evacuate confined space; ventilate area; investigate source of vapors
Oxygen	> 19.5%, < 23.5%	Acceptable Entry Condition, Normal Operations
	< 19.5%, > 23.5%	Stop work; evacuate confined space; ventilate; re-sample

Inspecting and Testing Procedures – The following equipment shall be available for testing each confined space:

- Multi RAE instrument (our equivalent) with PID, Oxygen, LEL, CO and Hydrogen sulfide sensors.

All equipment shall be maintained in such quantity and condition, per manufacturer recommendations, to adequately monitor and assess all confined space entries.

Testing Procedures – Procedures for inspecting, monitoring and testing the confined space to verify that acceptable conditions exist prior to and throughout the entry operation are as follows:

Permit required confined spaces shall be tested continuously to detect changes in atmospheric conditions. Priority for atmospheric hazard testing shall be oxygen, combustible gases and then toxic gases.

Communications – Provisions for continuous communication between entrants and attendants shall consist of powered communication equipment (i.e. radio). Powered communication equipment with the appropriate NEC rating shall be provided. If this is not practical or possible, portable air horns must be provided to all entrants and attendants. The code for air horn blasts is as follows:

- 1 Horn Blast = Are you OK?
- 2 Horn Blasts = Yes, I am OK.
- 3 Horn Blasts = Exit the confined space immediately.

Personal Protective Equipment - (see Section 5, *Personal Protective Equipment, for additional PPE requirements*):

- Protective suits, boots, and gloves.
- Face, head, and foot protection.
- A chest or parachute harness with approved lifelines at least ½ inch in diameter and 2,000 pounds test. (NOTE: Wristlets may be used only when a harness presents a greater hazard to the employee and wristlets are the safest, most

effective alternative). All lifelines shall be secured to a mechanical device or fixed point outside the confined space. Mechanical devices shall be used for all vertical entry permit spaces greater than five feet deep.

Other Required Equipment – Lighting and electrical shall be of the appropriate National Electrical Code (NEC) rating. Rating should be Class I, Division I unless the space specifically meets other rating requirements.

Ingress and Egress Equipment – Protective barriers to be used to protect entrants from external pedestrian, vehicle or equipment hazards. Ladders shall meet the requirements of 29 CFR 1926 Subpart X, Ladders.

Rescue Equipment – All lifelines must be attached to a mechanical device outside the space such that a rescue can begin as soon as the rescuer becomes aware that a rescue is necessary. A mechanical device must be attached to entrant in order to retrieve personnel from vertical type permit spaces more than 5 feet deep.

Permit System – Before entry is authorized, the contractor's Entry Supervisor shall complete and sign the contractor's entry permit according to their written confined space program and document that all pre-entry requirements have been met and that acceptable entry conditions exist. The complete permit shall be posted at the primary entrance to the permit space.

All Entry Permits are valid for a maximum of one work shift, and shall be canceled by the Entry Supervisor when the shift ends, confined space operations are complete, or whenever a prohibited condition arises in or near the space. All confined spaces shall be securely closed or barricaded whenever the entry permit is canceled. Each contractor's Entry Permit must be completely executed and include all required information.

Emergency Procedures – The SS/HSS or client shall arrange for outside rescue services. The rescue personnel must be offered an opportunity to inspect the space, and practice a rescue if necessary. The means for summoning rescue services must be clearly communicated and documented on the contractor's entry permit.

4.17.3 Training

General – Prior to assignment to confined space entry work, all employees shall receive training in the hazards of confined spaces, work practices to control these

hazards and duties to be performed. Employee proficiency shall be established by testing and/or practical demonstration.

Requirements for Entrants, Attendants, and Supervisors – Basic training requirements for entrants and attendants shall include Confined Space Entry Entrant/Attendant training, and 40-hour HAZWOPER training or equivalent if required.

Basic training for entry supervisors and personnel conducting atmospheric testing shall include 8-hour supervisor training and Confined Space Entry Training.

Personnel assigned to attendant duties shall be trained in non-entry rescue procedures.

Requirements for Emergency Rescue Personnel – The HSS or client must coordinate rescue services by identifying a rescue entity, and contacting them to inform them that an entry will take place. Personnel assigned to provide emergency entry and rescue services shall be trained annually in the proper use of personal protective and rescue equipment. Such training shall include a simulated rescue exercise at least once every 12 months. In addition, rescue personnel shall be trained in the hazards and proper work practices for handling blood or other potentially infectious materials.

4.18 Crane Hazards and Control Procedures

Hazards – The primary physical hazards for this activity are associated with the use of the crane and associated rigging equipment. There exists a potential for incidents involving personnel being struck by or struck against the crane or materials, resulting in fractures, cuts, punctures, or abrasions. Crane operation may present noise hazards, vibration hazards, and a potential for contact with moving parts or hot surfaces to crane operators. Crane accidents can occur as a result of improperly placing the rig on uneven or unstable terrain, or failing to adequately secure the load prior to the start of lifting operations. Overhead utility lines can create hazardous conditions if contacted by the crane or any part of the load being lifted. Rigging equipment such as slings, chokers, wire rope and hooks have the potential for striking personnel, resulting in fractures, lacerations, punctures, or abrasions.

Control – Only trained and authorized personnel shall operate cranes or provide hand signals to the crane operator. All crane operators must possess any required state or local licenses to perform such work. All members of the lifting crew including the signaler, shall receive site-specific training prior to beginning work.

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

All manufacturer's instructions, specifications, and limitations applicable to the operation of the crane must be followed. Deviations from manufacturer's guidance documentation must be approved in writing by the manufacturer.

Any attachments used with the crane shall not exceed the capacity, rating, or scope recommended by the manufacturer.

Rated load capacities, recommended operating speeds, special hazard warnings or instruction, shall be conspicuously posted on all equipment. Instructions or warnings shall be visible to operators while they are at their control stations.

Hand signals to the crane operator shall be those prescribed by the applicable American National Standards Institute (ANSI) standard for the type of crane in use. An illustration of the signals must be posted at the job site.

A competent person, designated by the crane/rigging contractor, must inspect all machinery and equipment prior to each use, and during use, to make sure it is in safe operating condition. Any deficiencies must be repaired, or defective parts replaced, before continued use.

A thorough, annual inspection of the hoisting machinery shall be made by a competent person. The crane/rigging contractor must maintain a record of the dates and results of inspections for each hoisting machine and piece of equipment.

Wire rope shall be taken out of service when any of the following conditions exist:

- In running ropes, six randomly distributed broken wires in one lay or three broken wires in one strand in one lay.
- Wear of one-third the original diameter of outside individual wires.

- Kinking, crushing, bird caging, or any other damage resulting in distortion of the rope structure.
- Evidence of any heat damage from any cause.
- Reductions from nominal diameter of more than one-sixty-fourth inch for diameters up to and including five-sixteenths inch, one-thirty-second inch for diameters three-eighths inch to and including one-half inch, three-sixty-fourths inch for diameters nine-sixteenths inch to and including three-fourths inch, one-sixteenth inch for diameters seven-eighths inch to 1 inch inclusive, three-thirty-seconds inch for diameters 1¼ to 1½ inches inclusive.
- In standing ropes, more than two broken wires in one lay in sections beyond end connections or more than one broken wire at an end connection.

Wire rope safety factors shall be in accordance with ANSI B30.5-1968 or SAE J959-1966.

Belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating, or other moving parts or equipment shall be guarded if such parts are exposed to contact by employees, or otherwise create a hazard. Guarding shall meet the requirements of the ANSI B15.1-1958 Rev., Safety Code for Mechanical Power Transmission Apparatus.

All windows in cabs shall be of safety glass, or equivalent, with no visible distortion that will interfere with the safe operation of the machine.

Where necessary for rigging or service requirements, a ladder, or steps, shall be provided to give access to a cab roof. Guardrails, handholds, and steps shall be provided on cranes for easy access to the car and cab, conforming to ANSI B30.5.

Platforms and walkways shall have anti-skid surfaces.

An accessible fire extinguisher of 5BC rating, or higher, shall be available at all operator stations or cabs of equipment.

If crane operation or lifting activities are conducted in the vicinity of overhead power lines, the power to the lines must be de-energized, tested de-energized, marked up/guaranteed, and grounded or the equipment must be positioned such that no part,

including the boom, wire rope, or load can come within the minimum clearances as follows:

Table 9
Minimum Overhead Electrical Clearance (Cranes)

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

In addition to the above clearance requirements, equipment in use near power lines must operated in accordance with the following requirements:

- A person shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means.
- Cage-type boom guards, insulating links, or proximity warning devices may be used on cranes, but the use of such devices shall not alter the requirements of any other regulation of this part even if such device is required by law or regulation.
- Any overhead wire shall be considered to be an energized line unless and until the person owning such line or the electrical utility authorities indicate that it is not an energized line and it has been visibly grounded.
- Prior to work near transmitter towers where an electrical charge can be induced in the equipment or materials being handled, the transmitter shall be de-energized or tests shall be made to determine if electrical charge is induced on the crane. The following precautions shall be taken when necessary to dissipate induced voltages:
 - The equipment shall be provided with an electrical ground directly to the upper rotating structure supporting the boom.
 - Ground jumper cables shall be attached to materials being handled by boom equipment when electrical charge is induced while working near energized transmitters. Crews shall be provided with nonconductive poles having large alligator clips or other similar protection to attach the ground cable to the load.
 - Combustible and flammable materials shall be removed from the immediate area prior to operations.

No modifications or additions that affect the capacity or safe operation of the equipment shall be made by the crane/rigging contractor without the manufacturer's written approval. If such modifications or changes are made, the capacity, operation, and maintenance instruction plates, tags, or decals, shall be changed accordingly. In no case shall the original safety factor of the equipment be reduced.

All employees shall be kept clear of loads about to be lifted and of suspended loads.

4.19 Traffic Safety

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

Cones must be placed along the shoulder of the roadway starting 100 feet from the work area to alert passing motorists to the presence of personnel and equipment. A "Slow" or "Men Working" sign must be placed at the first cone. Barricades with flashing lights should be placed between the roadway and the work area.

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

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

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

5. Personal Protective Equipment

5.1 Levels of Protection

PPE is required to safeguard site personnel from various hazards. Varying levels of protection may be required depending on the levels of COC and the degree of physical hazard. This section presents the various levels of protection and defines the conditions of use for each level. The levels of protection in this section do not apply to asbestos abatement activities. Asbestos abatement personnel shall wear PPE as prescribed in the abatement company's HASP. A summary of the levels of protection is presented in Table 10 in this section.

5.1.1 Level D Protection

The minimum level of protection that is required of ARCADIS personnel at the site is Level D, which is worn when activities do not involve potential dermal contact with contaminants and air monitoring indicates that no inhalation hazard exists. Level D protection includes the following equipment:

- Work clothing as prescribed by weather.
- Steel-toe work boots, meeting ANSI Z41 (puncture resistant soles or insoles based upon JSA).
- Safety glasses with side shields or goggles, meeting ANSI Z87.
- Hard hat, meeting ANSI Z89, when falling object hazards are present.
- Reflective vest.
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used).
- PFD if working on or near water.

5.1.2 Modified Level D Protection

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

- Nitrile outer gloves worn over nitrile surgical gloves.
- Latex or PVC overboots when contact with COC-impacted media is anticipated.
- Steel-toe work boots, meeting ANSI Z41.
- Safety glasses with side shields or goggles, meeting ANSI Z87.
- Face shield in addition to safety glasses or goggles when projectiles or splash hazards exist.
- Tyvek® or KleenGuard® coveralls when skin contact with COC-impacted media is anticipated.
- Hard hat, meeting ANSI Z89, when falling object hazards are present.
- Reflective vest.
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used).
- PFD if working on or near water.

5.1.3 Level C Protection

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

- Full-face, National Institute for Occupational Safety and Health- (NIOSH-) approved, air-purifying respirator with combination organic vapor cartridges.
- Polyethylene-coated Tyvek® suit with ankles and cuffs taped to boots and gloves.

- Nitrile outer gloves worn over nitrile surgical gloves.
- Steel-toe work boots, meeting ANSI Z41.
- Chemical-resistant boots with steel toes, or latex or PVC overboots over steel-toe boots.
- Hard hat, meeting ANSI Z89.
- Reflective vest.
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used).
- PFD if working on or near water.

5.2 Selection of PPE

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

5.3 Site Respiratory Protection Program

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

- All on-site personnel who may use respiratory protection will have an assigned respirator.
- All on-site personnel who may use respiratory protection will have been fit tested and trained in the use of a full-face air-purifying respirator within the past 12 months.
- All on-site personnel who may use respiratory protection must within the past year have been medically certified as being capable of wearing a respirator.

Documentation of the medical certification must be provided to the HSS, prior to commencement of site work.

- Only cleaned, maintained, NIOSH-approved respirators will be used.
- If respirators are used, the respirator cartridge is to be properly disposed of at the end of each work shift, or when load-up or breakthrough occurs.
- Contact lenses are not to be worn when a respirator is worn.
- All on-site personnel who may use respiratory protection must be clean-shaven. Mustaches and sideburns are permitted, but they must not touch the sealing surface of the respirator.
- Respirators will be inspected, and a negative pressure test performed prior to each use.
- After each use, the respirator will be wiped with a disinfectant, cleansing wipe. When used, the respirator will be thoroughly cleaned at the end of the work shift. The respirator will be stored in a clean plastic bag, away from direct sunlight in a clean, dry location, in a manner that will not distort the face piece.

5.4 Using PPE

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

5.4.1 Donning Procedures

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

- Remove bulky outerwear. Remove street clothes and store in clean location
- Put on work clothes or coveralls

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

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

5.4.2 Doffing Procedures

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

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

- Clean and disinfect respirator for next use.

All disposable equipment, garments and PPE must be bagged in plastic bags, labeled for disposal. See Section 7, Decontamination, for detailed information on decontamination stations.

5.5 Selection Matrix

The level of personal protection selected will be based on air monitoring of the work environment and an assessment by the SS and HSS of the potential for skin contact with COC. The PPE selection matrix is presented in Table 10. This matrix is based on information available at the time this plan was written. The Airborne Contaminant Action Levels in Table 11 should be used to verify that the PPE prescribed in these matrices is appropriate.

TABLE 10
PPE SELECTION MATRIX

Task	Anticipated Level of Protection
Mobilization	Level D
Construction Observation	Level D/Modified Level D
Air Monitoring	Level D/Modified Level D
Soil Sampling	Level D/Modified Level D
Demobilization	Level D

6. Air Monitoring

6.1 Air Monitoring

Airborne monitoring for particulate (dust) and volatile organic vapors will be conducted during the ICM removal activities in accordance with the New York State Department of Health's (NYSDOH's) Community Air Monitoring Program, dated June 2000.

Monitoring will be performed continuously at the upwind and downwind perimeters of the work area at temporary particulate monitoring stations, except during periods of precipitation or wet conditions. The airborne particulate monitoring will be conducted using a DustTrack aerosol monitor capable of measuring particulate matter less than 10 micrometers in size and capable of integrating over a period of 15 minutes for comparison to the airborne particulate action level. The monitoring equipment will be equipped with an alarm to indicate exceedance of the action level. The equipment will be calibrated at least once daily, prior to the start of work activities. The results of the airborne particulate monitoring will be continuously recorded by the instrument datalogger and recorded by the HSS (or designated alternate) at a minimum frequency of once per hour. A real-time air monitoring data collection form is included as Attachment G for use in recording air monitoring data in addition to the data logging, as necessary.

If particulate monitoring indicates that the downwind particulate level is 100 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) above background for the 15-minute period or if excessive visible dust is observed leaving the work area, then work activities will cease and dust suppression techniques will be employed. Potential dust generating work activities may continue provided that dust levels at the downwind work area perimeter do not exceed 150 $\mu\text{g}/\text{m}^3$ above the upwind level, and provided that no excessive visible dust is observed leaving the work area.

Dust control measures will be provided to mitigate dust generation during the project (as necessary) and may include one or more of the following techniques presented in the NYSDEC Technical and Administrative Guidance Memorandum (TAGM) 4031, entitled, "Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites," dated October 27, 1989:

- Applying water on haul roads.
- Limiting travel speed over the haul roads.

- Wetting equipment.
- Covering materials.

Adequate measures will also be taken to assure that total organic vapor (TOV) levels during the ICM removal activities do not exceed the levels presented in the project-specific health and safety plan (HASP). A PID will be used to monitor the worker breathing zone for TOV levels during the removal activities. PID monitoring will be performed continuously during the implementation of the work activities, and results will be recorded at a minimum frequency of once per hour. If the sustained level of TOV in the worker breathing zone exceeds 5 ppm above background, then the TOV levels will be manually recorded at the downwind perimeter of the work area (i.e., the exclusion zone) at 15 minute intervals. If the TOV levels at the downwind perimeter of the work area exceed 5 ppm above background, then work activities will be halted and additional downwind monitoring will be performed and additional measures will be employed to mitigate the source of the organic vapors.

6.2 Noise Monitoring

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

6.3 Monitoring Equipment Maintenance and Calibration

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

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

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

6.4 Action Levels

Table 11 presents airborne constituent action levels that will be used to determine the procedures and protective equipment necessary based on conditions as measured at the site.

6.5 On-Site Monitoring Plan and Response Activities

Soil will be disturbed as part of excavation activities. These activities have the potential to generate organic vapors and particulates. As mentioned above, air monitoring will be conducted in the worker breathing zone to determine the level of protection required for personnel observing intrusive work. If action levels in the worker breathing zone are exceeded for organic vapors or particulates, air monitoring will be required at various onsite/perimeter locations to determine appropriate response activities that are protective of personnel onsite who are not directly involved with the investigation, personnel at adjacent commercial sites, and the surrounding community. If action levels for the remaining monitoring parameters listed in Table 11 are exceeded, work will stop, the HSO will be contacted, and perimeter monitoring will be performed.

6.6 Odor Control

If any odor complaints are received from members of the surrounding community and are related to the field investigation activities described herein, then the potentially odor-causing activity will be suspended, subsurface openings will be covered, and onsite personnel (in consultation with Bayer and ARCADIS project managers) will evaluate an alternative course of action.

TABLE 11
AIRBORNE CONSTITUENT ACTION LEVELS

Parameter	Reading in Breathing Zone (BZ)	Action
Total Organic Vapors	0 ppm to < 1 ppm > 1 ppm to 5 ppm > 5 ppm to 25 ppm	Normal operations; record breathing zone monitoring measurements every hour Increase recording frequency to at least every 15 minutes Stop work; contact PM and HSO
Total Particulate (15 minute average readings taken in the breathing zone, above background) Lead and Cadmium sampling will be implemented if EZ action levels are exceeded	0 to 0.100 mg/m ³ above background > 0.100 mg/m ³ above background > 0.15 mg/m ³ in breathing zone or at downwind perimeter of work area	Normal operations Initiate dust suppression techniques, monitor downwind impacts. Stop work; investigate cause of reading; contact PM and HSO
Oxygen	< 19.5 % > 19.5% to < 23.5 % > 23.5 %	Stop work; evacuate confined spaces/work area, investigate cause of reading; ventilate area; contact HSO Normal operations Stop work; evacuate confined spaces/work area, investigate cause of reading; ventilate area; contact HSO
Carbon Monoxide	0 ppm to 20 ppm > 20 ppm	Normal operations Stop work; evacuate confined spaces/work area, investigate cause of reading; ventilate area; contact HSO
Hydrogen Sulfide	0 ppm to 5 ppm > 5 ppm	Normal operations Stop work; evacuate confined spaces/work area, investigate cause of reading; ventilate area; contact HSO
Flammable Vapors (LEL)	< 10% LEL > 10% LEL	Normal operations Stop work; ventilate area; investigate source of vapors

Note:

If action levels in the worker breathing zone are exceeded for organic vapors or particulates, air monitoring will be required at various onsite/perimeter locations to determine appropriate response activities that are protective of personnel onsite who are not directly involved with the investigation, personnel at adjacent commercial sites, and the surrounding community, as detailed in Section 6.1 of this HASP.

7. Work Zones and Decontamination

7.1 Work Zones

7.1.1 Authorization to Enter

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

7.1.2 Site Orientation and Hazard Briefing

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

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

7.1.3 Certification Documents

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

7.1.4 Entry Log

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

7.1.5 Entry Requirements

In addition to the authorization, hazard briefing, and certification requirements listed above, no person will be allowed in any ARCADIS work area unless they are wearing the minimum PPE as described in Section 5, Personal Protective Equipment.

7.1.6 Emergency Entry and Exit

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

7.1.7 Contamination Control Zones

Contamination control zones are maintained to prevent the spread of contamination and to prevent unauthorized people from entering hazardous areas. The following zones comply with 29 CFR 1910.120 HAZWOPER.

7.1.7.1 *Exclusion Zone*

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

7.1.7.2 *Contamination Reduction Zone*

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

7.1.7.3 Support Zone

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

7.1.8 Posting

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

7.1.9 Site Inspections

The SS will conduct a daily inspection of site activities, equipment, and procedures to verify that the required elements are in place. LPOs will be conducted per guidance from the PM and entered into the ARCADIS LPS Database.

7.2 Decontamination

7.2.1 Personnel Decontamination

The following decontamination requirements comply with 29 CFR 1910.120 HAZWOPER. All personnel wearing Modified Level D or Level C protective equipment in the EZ must undergo personal decontamination prior to entering the SZ. The personnel decontamination area will consist of the following stations at a minimum:

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

7.2.2 Equipment Decontamination

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

7.2.3 Personal Protective Equipment Decontamination

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

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

8. Training and Medical Surveillance

8.1 Training

8.1.1 General

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

8.1.2 Basic 40-Hour Course

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

- General safety procedures.
- Physical hazards (fall protection, noise, heat stress, cold stress).
- Names and job descriptions of key personnel responsible for site health and safety.
- Safety, health, and other hazards typically present at hazardous waste sites.
- Use, application, and limitations of PPE.
- Work practices by which employees can minimize risks from hazards.
- Safe use of engineering controls and equipment on site.
- Medical surveillance requirements.
- Recognition of symptoms and signs which might indicate overexposure to hazards.

- Worker right-to-know (Hazard Communication OSHA 1910.1200).
- Routes of exposure to contaminants.
- Engineering controls and safe work practices.
- Components of a health and safety program and a site-specific HASP.
- Decontamination practices for personnel and equipment.
- Confined-space entry procedures.
- General emergency response procedures.

8.1.3 Supervisor Course

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

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

8.1.4 Site-Specific Training

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

In addition to the initial hazard briefing, all ARCADIS personnel that will be performing work on site must attend a Bayer Safety Orientation. Personnel will not be allowed to perform work on the site prior to attending this training session.

8.1.5 Daily Safety Meetings

Twice daily safety meetings will be held to cover the work to be accomplished, the hazards anticipated, the PPE and procedures required to minimize site hazards, and emergency procedures. The SS or HSS should present these meetings prior to beginning the day's fieldwork and again in the afternoon. No work will be performed in an EZ before a safety meeting has been held. A safety meeting must also be held prior to new tasks, and repeated if new hazards are encountered. The Site Activities Tailgate Safety Briefing Sign-in Log is included in Attachment H.

8.1.6 First Aid and CPR

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

8.2 Medical Surveillance

8.2.1 Medical Examination

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

8.2.2 Pre-placement Medical Examination

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

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

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

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

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

8.2.3 Other Medical Examinations

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

- At employee request after known or suspected exposure to toxic or hazardous materials.
- At the discretion of the HSS, HSO, or occupational physician in anticipation of, or after known or suspected exposure to toxic or hazardous materials.

8.2.4 Periodic Exam

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

8.2.5 Medical Restriction

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

9. Emergency Procedures

9.1 General

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

The SS/HSS will establish evacuation routes and assembly areas for the site. All personnel entering the site will be informed of this route and the assembly area.

9.2 Emergency Response

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

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

9.2.1 Fire

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

9.2.2 Contaminant Release

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

- Notify SS/HSS immediately.
- Evacuate immediate area of release.

- Conduct air monitoring to determine needed level of PPE.
- Don required level of PPE and prepare to implement control procedures.

The SS/HSS has the authority to commit resources as needed to contain and control released material and to prevent its spread to off-site areas.

9.3 Medical Emergency

All employee injuries must be promptly reported to the HSS/SS, who will:

- Ensure that the injured employee receives prompt first aid and medical attention.
- In emergency situations, the worker is to be transported by appropriate means to the nearest urgent care facility (normally a hospital emergency room).
- If the injured person is an ARCADIS employee, notify ARCADIS Human Resources at 315-446-9120, ext. 336 as soon as possible after the injured employee has been safely evacuated from the scene.

9.3.1 Emergency Care Steps

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

- Do a primary survey of the victim. Check for airway obstruction, breathing, and pulse. Assess likely routes of chemical exposure by examining the eyes, mouth, nose, and skin of the victim for symptoms.
- Contact 911. Give the location, telephone number used, caller's name, what happened, number of victims, victim's condition, and help being given.
- Maintain airway and perform rescue breathing as necessary.
- Perform CPR as necessary.
- Do a secondary survey of the victim. Check vital signs and do a head-to-toe exam.

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

9.4 First Aid – General

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

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

9.4.1 First Aid – Inhalation

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

9.4.2 First Aid – Ingestion

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

9.4.3 First Aid – Skin Contact

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

9.4.4 First Aid – Eye Contact

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

9.5 Reporting Injuries, Illnesses and Near Miss Incidents

Injuries and illnesses, however minor, will be reported to the SS immediately. The SS will complete an injury report and submit it to the HSM/HSO, PIC, Client and the PM within 24 hours.

Near miss incidents are situations in which no injury or property damage occurred, but under slightly different circumstances an injury or property damage could have occurred. Near misses are caused by the same factors as injuries; therefore, they must be reported and investigated in the same manner. A SPSA/TRACK must be done immediately after an injury, illness, near miss, or other incident to determine if it is safe to proceed with the work.

ARCADIS employees are required to contact Work Care for all occupational related injuries and illnesses at 1-800-455-6155.

9.6 Emergency Information

The means to summon local public response agencies such as police, fire, and ambulance will be reviewed in the daily safety meeting. These agencies are identified in Table 12.

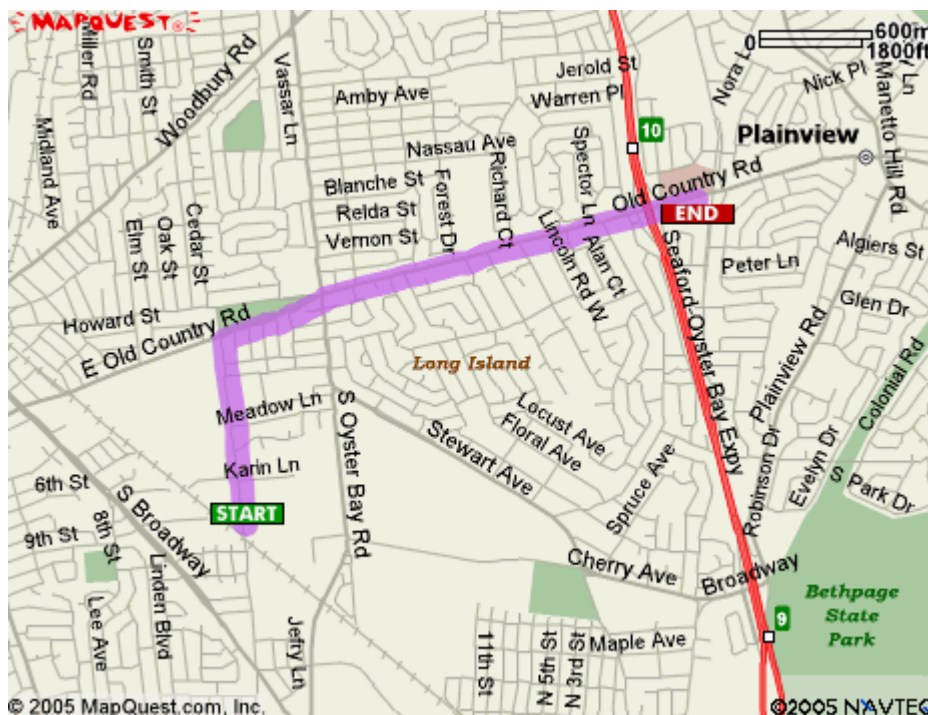
**TABLE 12
EMERGENCY CONTACTS**

Agency/Name	Telephone No.
Off-Site Emergencies	911
North Shore University Hospital:	(516) 719-3000
ARCADIS Project Manager – John Brussel	(315) 446-9120
Bayer Project Manager – Ramon J. Simon	(281) 383-6149
Work Care	1-800-455-6155

9.6.1 Directions to North Shore University Hospital

The estimated travel time is 0 hours, 6 minutes for 2.24 miles of travel, total of 3 steps.

Step	Directions	Elapsed Distance
1	Begin at 125 New South Road and travel North on New South Road for 0.6 miles	0.6
2	Turn right on E. Old Country Road and go 1.6 miles	2.2
3	Stop at 888 Old Country Road	2.2



ARCADIS

Attachment A

Addendum Page

HASP Addendum Page

This form should be completed for new tasks associated with the project. The project manager and/or task manager should revise the Project Hazard Analysis Worksheet with the new task information and attach to this addendum sheet. JSAs should be developed for any new tasks and attached as well.

Review the addendum with all site staff, including subcontractors, during the daily tailgate briefing, and complete the tailgate briefing form as required. Attach a copy of the addendum to all copies of the HASP including the site copy, and log in the Addendum Log Table A-1 on the next page.

Addendum Number: _____ Project Number: _____

Date of Changed Conditions: _____ Date of Addendum: _____

Description of Change that Results in Modifications to HASP:

Signed: _____
Project Manager

Signed: _____
Site Safety Officer

Signed: _____
H&S Plan Writer

Signed: _____
H&S Plan Reviewer

Attachment B

Visitor Acknowledgement and
Acceptance of HASP

Visitor Acknowledgement and Acceptance of HASP Signature Form

By signing below, I waive, release and discharge the Owner of the Site and ARCADIS G&M, Inc. and their employees from any future claims for bodily and personal injuries which may result from my presence at, entering, or leaving the Site and in any way arising from or related to any and all known and unknown conditions on the Site.

[illegible]

ARCADIS

Attachment C

Utility Location Policy and
Procedure

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page 1 of 10	<u>Approver</u> Mija Coppola

1. POLICY

It is the practice of ARCADIS and its affiliated companies to implement appropriate, reasonable and practical procedures within acceptable and customary industry practices to promote the health and safety of its employees, and avoid and mitigate exposure of risk in the performance of their work. In furtherance of this policy, ARCADIS promotes and encourages compliance by all employees with this policy and procedures relating to subsurface work and/or investigations (SWI) and working in the vicinity of above ground utilities.

- This procedure is followed by all responsible ARCADIS personnel. Such procedures are included in the project planning processes utilized by ARCADIS personnel.
- Project management procedural requirements are outlined in Section 5.2. All employees included in SWI and above ground utility work are familiar with these procedures.
- Contract Terms: In agreements for SWI with a client, prime contractor, or subcontractors, required terms (Exhibit 1) shall be included for the appropriate allocation of risk of damage to subsurface facilities. If such provisions cannot be agreed upon, the reasons are documented and other risk-management actions identified, such as limits of liability, additional physical investigations, additional lines of evidence of utility location, assignment of risk to subcontractors, etc.
- The policy of ARCADIS encourages and empowers all employees to take such action as they deem appropriate to assure compliance with this policy and procedures both in project planning and field site operations. Such authority is delegated to those on the project site to immediately stop any SWI work or work in the vicinity of above ground utilities where the employee believes that injury to persons or damage to property could occur. Such action is taken without regard to costs or schedule. Personnel should immediately notify their supervisor of any concerns they have when observing any SWI work or work in the vicinity of above ground utilities. In all agreements between ARCADIS and SWI subcontractors, (e.g., drilling subcontractors), provisions shall be included in the subcontract, work authorization or purchase order. These provisions (Exhibit 1) are found on the ARCADIS intranet at the Legal Department team site.

All ARCADIS personnel involved in SWI work or work in the vicinity of above ground utilities will be appropriately trained on this procedure and have the appropriate professional experience for oversight of or involvement in SWI work or work in the vicinity of above ground utilities. ARCADIS Corporate Health & Safety can answer further questions about this policy or the hazards associated with and the control procedure for work in the vicinity of subsurface or above ground utilities.

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page 2 of 10	<u>Approver</u> Mija Coppola

Again, to support the efforts of ensuring the health and safety of its employees and mitigating risk to ARCADIS, ARCADIS requires that these policies and procedures be followed and implemented at all levels of project management and field implementation.

2. PURPOSE AND SCOPE

2.1 Purpose

This procedure directs general safety procedures associated with the identification and management of above ground and subsurface utility locations on project sites.

2.2 Scope

- 2.2.1 **Management Requirements** - ARCADIS personnel managing or working on any project requiring SWI and requiring work in the vicinity of above ground utilities must incorporate this procedure into their project planning and field work activities to ensure that all reasonable means to identify utilities are implemented and that appropriate controls have been put in place to minimize or eliminate damage to these utilities and the hazards associated with these utilities. All applicable procedures described in this document must be completed prior to initiating intrusive field work or field work in the vicinity of above ground utilities, or the work cannot proceed.
- 2.2.2 **Project Management Requirements** - Where SWI are required to be performed by a subcontractor to ARCADIS under its subcontract, project management shall require the subcontractor to adequately incorporate SWI procedures described herein into the subcontractor's scope of work.

3. DEFINITIONS

Above Ground Utilities - For the purpose of this procedure, above ground utilities include, but are not limited to: any above ground line, system, or facility used for producing, storing, conveying, transmitting or distributing communication or telecommunications, electricity, gas, petroleum and petroleum products, coal slurry, hazardous liquids or gases, water under pressure, steam, or other hazardous materials.

Subsurface Utilities - For the purposes of this procedure, subsurface utilities include, but are not limited to: any underground line, system, or facility used for producing, storing, conveying, transmitting or distributing communication or telecommunications, electricity, gas, petroleum and petroleum products, coal slurry, hazardous liquids or gases, water under pressure, steam, or sanitary sewage; underground storage tanks; tunnels and cisterns; and septic tanks.

4. RESPONSIBILITIES

4.1 Project Manager Responsibilities

To prevent injury to employees, avoid disruption to utility services, and help eliminate damage to subsurface and above ground utilities, project managers have the responsibility for utility identification, location, and marking prior to initiating field activities. Most states, provinces, municipalities, and clients have rules, general statutes, or laws that specify the requirements of subsurface utility location prior to intrusive subsurface field activities (i.e., excavation, trenching,

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page 3 of 10	<u>Approver</u> Mija Coppola

boring, and all forms of drilling operations, etc.). The project manager ensures that these laws are followed, and that the directives outlined in this procedure are met for every project involving SWI and work in the vicinity of above ground utilities.

In addition, if field activities are completed in the vicinity of above ground utilities, the project manager is responsible for working with the client to identify the nature of the utilities, and to determine what control processes need to be implemented to prevent damage to these utilities and to minimize any injury in the event there is damage.

4.2 Field Personnel Responsibilities

Field personnel conducting SWI activities and activities where above ground utilities are in the vicinity of the work have the responsibility to read, understand, and follow this procedure and complete the appropriate checklists during the on-site utility locate process. ARCADIS personnel assisting in the identification of underground utilities need to have previous related experience of a minimum of 1 year. Those implementing remote sensing technologies must complete training in those techniques and have 6 months experience operating and interpreting results.

If utilities cannot be located to eliminate any reasonable concern, field personnel can use their Stop Work authority until utility locations can be identified. Field personnel must review this procedure onsite with ARCADIS subcontractors, and ensure they follow the procedures detailed in this document. Any ARCADIS subcontractor not following these procedures will be asked to stop work, and the project manager contacted. Any diversion from this procedure by ARCADIS field personnel must be approved by the project manager with input from Corporate Health & Safety as necessary.

5. PROCEDURE

A flow chart/decision tree of the procedure is presented in Exhibit 2 of this document.

5.1 Lines of Evidence

The following three actions (lines of evidence) are required for the utility location process:

- Contact the State One Call
- Obtain a detailed site utility plan drawn to scale, preferably an “as-built” plan
- Conduct a detailed visual site inspection

In the event that one or more of the above lines of evidence cannot be conducted, or if the accuracy of utility location is questionable, a minimum of one additional line of evidence must be utilized as appropriate or suitable to the conditions. Examples of additional lines of evidence include but are not limited to:

- Private utility locating service
- Research of state, county or municipal utility records and maps including computer-drawn maps or geographical information systems (GIS)
- Contact with the utility provider to obtain their utility location records

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page 4 of 10	<u>Approver</u> Mija Coppola

- Hand augering or digging
- Hydro-knife
- Air-knife
- Radio Frequency Detector (RFD)
- Ground Penetrating Radar (GPR)
- Any other method that may give ample evidence of the presence or location of subgrade utilities

5.2 Project Management Procedural Requirements

Field activities are planned and designed to avoid contact with and damage to, and minimize interference with subsurface and above ground utilities in the vicinity of ARCADIS work activities. During the planning phase of a project the project manager will insure the appropriate allocation of utility location responsibilities and verify their completion. The utility location activities will implement the lines of evidence as defined in Section 5.1.

5.2.1 Communication and Coordination

The PM or their designated Task Manager:

- Communicates verbally and in writing the responsibilities for utility location with each party
- Provides the list to the site safety officer for inclusion in the site-specific health and safety plan (HASP);
- Communicates potential hazards to field staff prior to mobilization;
- Instructs field staff to be aware of and implement the procedures in the Section 5.1 of this procedure and utilize the appropriate utility location checklists.
- When practical, schedules a joint meeting between the public/private utility locators and field staff to oversee the subsurface utility locating and marking in the field.
- Communicates with and provides utility location documentation to the subcontractors to verify with them the utility locations and discusses methods to be used to protect those utilities.
- Understands the subcontractor's methods for utility location and documenting the process with a clear delineation of responsibilities for utility location.

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page 5 of 10	<u>Approver</u> Mija Coppola

In general, subsurface utility locations marked by public utility locators are only good for 2 weeks (research your state-specific requirements). If SWI activities are not conducted during this time period, the site is remarked.

NOTE: At no time is SWI conducted based on old markings, hand-drawn maps/sketches, photographs, or by recollection/memory of field staff. If markings are smeared, removed, damaged, or impacted in any way, the site must be remarked before SWI begins. Flag markings are used in addition to paint markings wherever possible.

5.2.2 Utility Request Notifications for Public Property

Prior to intrusive work on public property (i.e., right-of-ways, easements, etc.), notification of a public one-call service center is completed a minimum of 48-72 hours (states/localities requirements vary, so the PM is responsible for verifying this) prior to initiating field activities (excluding Saturdays, Sundays, and legal holidays). Specific state or local laws related to utility location are evaluated with respect to notification and liability in the event of utility damage. During the call, the responsible party:

- Provides accurate description of the location of all areas of the SWI;
- Documents the utility locate request to record the time and date of the call, the area to be marked, the list of utility companies and municipalities that the one call service center will notify;
- Records the associated ticket (or dig) number provided by the one call service center;
- Cross references the notification list provided by the one-call service center with the list of known or suspected utilities for the property; and
- Provides accurate contact (responsible party name and phone numbers) information for the one call service center so they can subsequently communicate potential questions and/or delays related to the utility location and marking.

After receiving a request, the one-call service center sends requests to participating utility operators who have utilities in the area of the intrusive field activities. Each underground utility operator dispatches their own locators to mark their facilities with paint or flags. The project manager attempts to have field staff present during the marking of the utilities by the locator organization to ensure that the area of the SWI is included in the locating activities. It is important to note:

- Not all utility operators and municipalities participate in one call programs. In some instances, one-call programs provide a list of utility providers that participate, and a list of those that do not. The utility providers that do not participate are contacted individually so that they can

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page 6 of 10	<u>Approver</u> Mija Coppola

mark their own lines, and this call is documented (date of call, person receiving call, date lines will be marked, etc.);

- Public utility locators are usually only required to mark utilities within the public spaces (i.e., right of ways) or at most up to a meter on private property; and
- Knowledge of existing or suspected, but unmarked utilities are documented and communicated to the site safety officer, field staff, and the client prior to implementing field activities.

If a known or suspected subsurface utility does not participate in the state one-call program, and that provider has not been individually contacted prior to the start of SWI, then the field activities are postponed. If these utility providers are contacted and do not provide utility location services, then SWI are not performed until a private utility locating company is contracted and the locating tasks completed.

5.2.3 Nation-wide Utility Locate Call Number 811

State and local utility notification centers participate in a “Call before you Dig” number for public safety and to protect underground infrastructure. This national number is: **811**. The number is designed to help prevent professional excavators, drillers and homeowners from damaging underground utility lines, or causing an injury or service outage while digging/drilling. For more information about the 811 services, visit www.call811.com

The number 811 is an FCC designated national n-11 number. This quick and efficient one call service will notify the appropriate utilities, who participate in the one call program. **However**, callers must still verify who the one call service contacts, and then determine which utilities may need to be contacted directly (e.g. those utilities not participating in the one call service) by following the requirements outlined in this procedure.

5.3 Field Protocol

At no time do field activities that involve SWI or work in the vicinity of above ground utilities commence without the field staff having knowledge of the location of subsurface and above ground utilities. In addition, as stated above and in general, subsurface utility locations marked by public utility locators are only good for 2 weeks (research your state-specific requirements). If SWI activities are not conducted during this time period, all lines of evidence must be re-verified.

NOTE: At no time is SWI conducted based on old markings, hand-drawn maps/sketches, photographs, or by recollection/memory of field staff. If markings are smeared, removed, damaged, or impacted in any way, the site must be remarked before SWI begins. Flag markings are used in addition to paint markings wherever possible.

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page 7 of 10	<u>Approver</u> Mija Coppola

5.3.1 SWI and Subsurface Utilities

Prior to the start of intrusive activities, all utilities are located and measures instituted to avoid subsurface utility hazards. No SWI will be conducted within 30 inches of a line marking. If SWI must take place within 30 inches of the line marking, an additional line of evidence must be used that will ensure the avoidance of the line. An additional safety measure can include the use of lockout/tagout to render the utility controlled.

Prior to mobilizing to the site for SWI work, field staff reviews the task details with the project manager or their designated authorized TM. This may include but is not limited to review of boring logs, excavation permits, etc. Any special site or client requirements are also discussed. Prior to initiation of any intrusive activities, the utilities and structures checklist (Exhibit 3) is reviewed and completed. Generally, the following colors apply for different types of utilities/operations:

- Red – Electric;
- Yellow – Natural gas/oil;
- Orange – Communication/cable television;
- Blue – Water;
- Green – Sewer;
- Pink – Temporary survey marking;
- White – Proposed excavation; and
- Purple – Reclaimed water

In addition, the SWI subcontractor marks (i.e., paint, stakes, etc.) the location of their operations to ensure they fall within the area that has been investigated for utilities.

Once the checklist is completed and all utilities identified, any client/site specific utility location or other utility (subsurface or above ground utilities) protection procedures (i.e. such as hand digging to a specified depth, covering or shielding lines, etc.) is completed at each location where work will be completed. If a known or suspected public subsurface utility has not been marked or the markings are not clear, the state one-call number is contacted to determine if an “emergency” locate can be requested. If so, follow the procedures outlined by the locate service and contact the project manager. If it is a private utility that is not marked, the facility manager and/or the project manager should be contacted.

If unexpected conditions are encountered (refusal, debris, pea gravel, etc.) while completing the intrusive activity, all work is immediately halted. Note that subsurface utilities at many industrial facilities are often placed in conduits or concrete to prevent damage. If a utility or subsurface structure is compromised, the field staff initiates the Emergency Action Plan Guidelines (Exhibit 5); however, more detailed emergency action procedures should be reviewed with the client and documented in the site specific health and safety plan prior to initiating work.

5.3.2 Work in the Vicinity of Above Ground Utilities

If activities take place in the vicinity of an above ground utility, the utility line can be rendered controlled (i.e. through lockout/tagout procedures) or protected from damage (i.e. covering overhead power lines). The following table is used to develop acceptable work distances for work involving machinery with high extensions (backhoes, drilling rig masts, etc.) in the vicinity of overhead power lines:

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page 8 of 10	<u>Approver</u> Mija Coppola

Power Line Voltage Phase to phase (kV)	Minimum Safe Clearance (feet)
50 or below	10
Above 50 to 200	15
Above 200 to 350	20
Above 350 to 500	25
Above 500 to 750	35
Above 750 to 1,000	45

ANSI Standard B30.5-1994, 5-3.4.5

The distance may be lengthened if directed by the client or the electric company, and any specified distances are strictly followed. In addition, work involving machinery, vehicles or equipment that may come in contact with above ground utilities is not completed until those utilities are protected or control processes are in place to avoid damage to those utilities.

If an above ground utility is discovered that has not been previously identified prior to mobilizing to the field, the field staff notifies the project manager who requests the client to assist in the identification of the utility and the implementation of control procedures as appropriate. In addition, if a utility or subsurface structure is compromised, the field staff initiates the Emergency Action Plan Guidelines (Exhibit 5); however, more detailed emergency action procedures should be reviewed with the client and documented in the site specific health and safety plan prior to initiating work.

6. RECORDS

6.1 Utilities Location Records

All records (maps and documentation of communications) used to determine the location of utilities should be retained and kept in the project file.

7. APPROVALS AND HISTORY OF CHANGE

Approved By: Mija Coppola, Director H&S, Infrastructure and PM/CM Divisions

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page 9 of 10	<u>Approver</u> Mija Coppola



History of Change

Revision Date	Revision Number	Reason for change
13 December 2006	01	Original document
26 March 2007	02	Put in new company format
15 May 2007	03	Added nation-wide 811 number
6 September 2007	04	Changing over to new template format
22 February 2008	05	Changing over to new template format
13 January 2009	06	Define lines of evidence

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page E1 of E12	<u>Approver</u> Mija Coppola

Exhibit 1 - Contract Term Language

INSERT INTO ALL CLIENT CONTRACTS OR WORK ORDERS WHERE DRILLING, EXCAVATION, INTRUSIVE WORK IS TO BE PERFORMED.

Site Conditions: ARCADIS shall not be liable for: (i) damage or injury to any subterranean structures (including, but not limited to, utilities, mains, pipes, tanks, and telephone cables) or any existing subterranean conditions; or the consequences of such damage or injury, if (with respect to this clause (i)) such structures or conditions were unknown and were not identified or shown, or were incorrectly shown, in information or on plans furnished to or obtained by ARCADIS in connection with the Services; (ii) concealed conditions encountered in the performance of the Services; (iii) concealed or unknown conditions in an existing structure at variance with the conditions indicated by the Scope of Services or Work Authorization; or (iv) unknown physical conditions below the surface of the ground that differ materially from those ordinarily encountered and are generally recognized as inherent in work of the character provided under this Agreement.

Client shall provide to ARCADIS all plans, maps, drawing and other documents identifying the location of any subterranean structures on the Site. Prior to location of any drilling or excavation below the ground surface, ARCADIS shall obtain the concurrence of the Client as to the location for such drilling or excavation.

Should: (i) concealed conditions be encountered in the performance of the Services; (ii) concealed or unknown conditions in an existing structure be at variance with the conditions indicated by the Scope of Services or Work Authorization; or (iii) unknown physical conditions below the surface of the ground differ materially from those ordinarily encountered and generally recognized as inherent in work of the character provided under this Agreement; then the amount of this Agreement and/or time for performance shall be equitably adjusted by change order upon timely notice.

INSERT INTO ALL DRILLING, EXCAVATION, INTRUSIVE WORK SUBCONTRACTS.

Site Conditions: SUBCONTRACTOR acknowledges that time is of the essence with respect to the performance and completion of its work under this Contract. SUBCONTRACTOR shall adhere to, commence and complete its work in accordance with any schedule incorporated into this Contract, or any schedule submitted by SUBCONTRACTOR or attached hereto; and with respect to any Changes, out of scope or additional work, SUBCONTRACTOR shall expeditiously perform such work according to any schedule therefore agreed to by the parties. In the event any schedule is incorporated in this Contract or attached to this Contract, SUBCONTRACTOR acknowledges and agrees that such schedule has accounted for all inherent or reasonably anticipated delays, including but not limited to those inherent in obtaining site information, access sufficient labor, supplies, tools, equipment and utilities required for the project work, and SUBCONTRACTOR waives any claim of extra compensation or damages therefore.

Subcontractor represents and warrants that it has had an opportunity to review and/or has carefully examined all necessary drawings, maps, schematics, specifications, governmental restrictions, permits and license requirements, and all applicable laws, regulations and rules relating to the Work to be done and the Site, its surroundings and local conditions, and has made all investigations based on reasonably available information that are necessary to develop a full understanding of the hazards and difficulties which can be encountered and are likely to impact the cost or schedule to perform the Work. SUBCONTRACTOR is thus familiar with conditions at the Site as are pertinent to or which may affect the Work and has been granted the right to

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page E2 of E12	<u>Approver</u> Mija Coppola

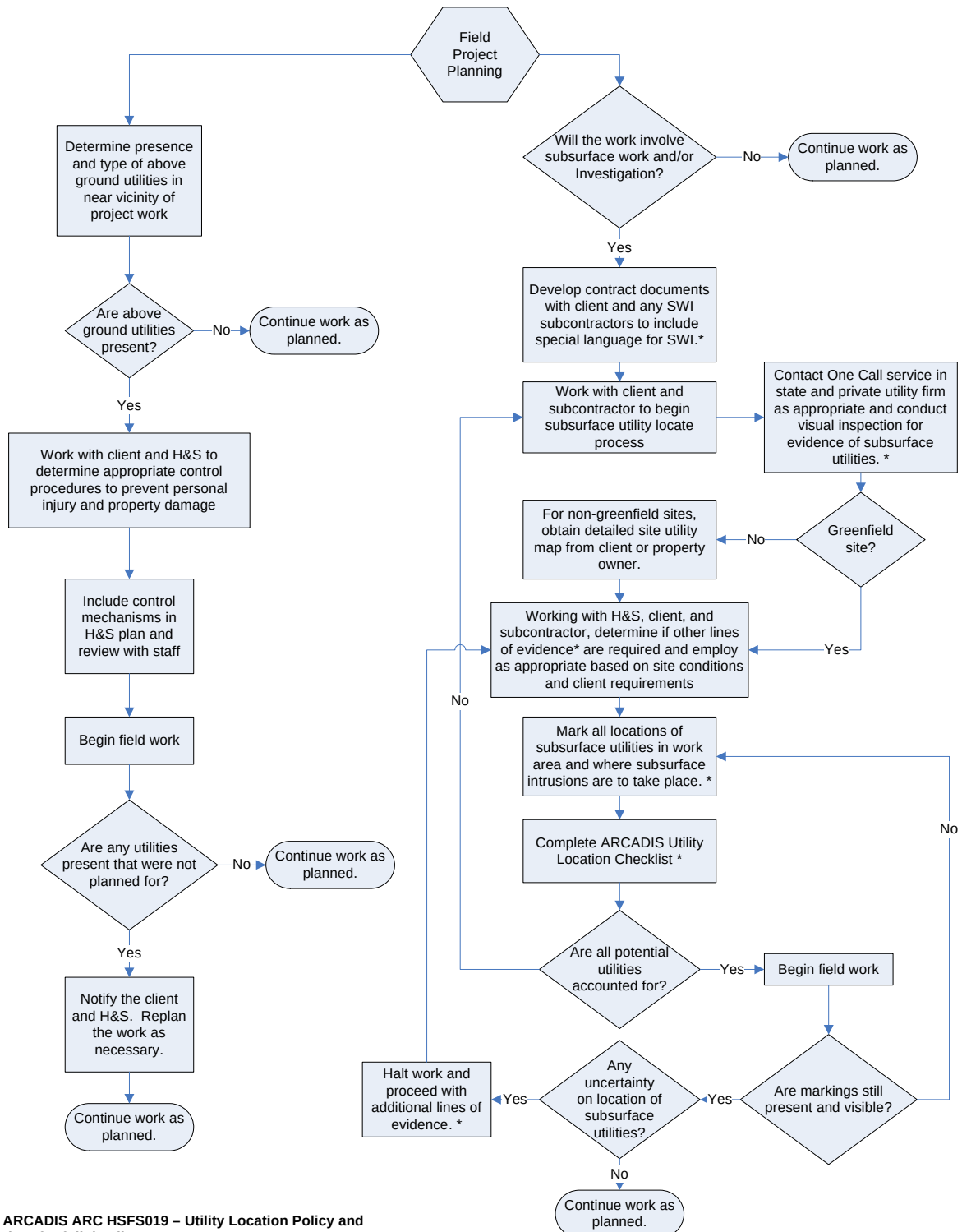
conduct, and has conducted, all investigations it deems appropriate to determine that it can fulfill the requirements of this Contract. Notwithstanding any other provision of this Contract, SUBCONTRACTOR assumes the risk of all conditions, as specified in this Contract, that may affect SUBCONTRACTOR'S ability to perform the Work and will, regardless of such conditions, or the expense or difficulty of performing the Work or the negligence, if any, of ARCADIS, with respect to same, fully complete the Work for the stated price without further recourse to ARCADIS. Information on the Site and local conditions at the Site furnished by ARCADIS are not guaranteed by ARCADIS to be accurate, and is furnished only for the convenience of SUBCONTRACTOR.

The discovery of concealed conditions which could not reasonably have been anticipated by the SUBCONTRACTOR from information available to SUBCONTRACTOR may constitute a changed condition, which, to the extent such condition materially affects the cost or schedule to perform the Work, would entitle the SUBCONTRACTOR to a change and an equitable adjustment of the Contract price or time. SUBCONTRACTOR warrants that it shall conduct appropriate investigations to determine, with reasonable certainty, the location of utility and service lines, underground storage systems, and other subsurface structures of any kind before commencement of any drilling, excavation, or other work that has the potential to disturb these structures. SUBCONTRACTOR further warrants that it shall conduct independent field investigations to confirm the location of subsurface structures before commencement of subsurface work and shall not rely exclusively on plot plans or other drawings provided to SUBCONTRACTOR in conducting these investigations.

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page E3 of E12	<u>Approver</u> Mija Coppola

Exhibit 2 – Utility Location Decision Tree

Exhibit B- Utility Location Decision Tree*
(PMs or TMs are required to follow both sides of flowchart)



	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page E4 of E12	<u>Approver</u> Mija Coppola

Exhibit 3 - Utilities and Structures Checklist

Project:	Project Number:
Site Location:	Date:

Instructions: This checklist will be used as a safety measure to insure that all underground utility lines, other underground structures as well as above ground utilities are clearly marked out and identified in the area selected for boring or excavation. **DRILLING, EXCAVATION, OR ANY TYPE OF GROUND INTRUSIVE WORK MAY NOT PROCEED UNTIL LINES ARE MARKED AND THIS CHECKLIST HAS BEEN COMPLETED.**

Pre-Field Work Requirements		
Was the state one-call notified with the required advanced notice (usually 48 to 72 hours) (or 811 Nation-wide number)	YES	NO
State one-call confirmation number		
List utility companies who do not participate in the state one call program. Were they contacted directly?		
What additional lines of evidence are used for utility clearance?		
Was a plot plan showing site features and subsurface utilities provided by the PM/TM?	YES	NO
Subgrade Utility Line Location		
Where is the gas line located?		
Where is the gas meter located on the site building(s)?		
Are the electric lines subsurface or overhead? Where are they located?		
Where is electric meter located on the site building(s)?		

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page E5 of E12	<u>Approver</u> Mija Coppola

Where are the telephone/cable lines located? Are there any overhead lines?	
Where do these lines enter the site building(s)?	
Where are the water lines located?	
Does the site occupant use water (bathrooms, industrial uses, fire suppression, etc.)? If so where do the water lines enter the building for these purposes?	
Are there small manholes/vault covers indicating water lines? If so, where?	
Was the local municipality contacted to mark sanitary lines?	
Where are the sanitary lines located?	
Where might the sanitary lines enter the building? (i.e. what side of the building are the bathrooms, kitchens, water treatment plant, etc?)	
Where are the storm sewer lines located?	
Are there storm sewer inlets located on the property? Check inlets for direction of subsurface lines.	
Are there any gutters directing storm water to the subsurface? Evaluate for direction of lines.	
Underground Storage Tank Sites	
Where are the USTs located? How many USTs are at the site (very number of USTs by counting fill ports and vent lines)?	
Where do the vent lines run?	
Where does the piping run? (Evaluate the path between USTs to dispenser islands).	
Where are the sub-surface electrical lines located which feed power to the UST system?	
General Underground Utility Location Signs	
Are there any cracks resembling straight lines that may indicate the settling of utility lines?	

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page E6 of E12	<u>Approver</u> Mija Coppola

Are there any patched areas where subsurface repairs may have been conducted?	
Are there any manhole covers or valve boxes that are not associated with marked lines?	
Above ground Utility Line Location	
Are there overhead power lines? If, so where are they located?	
What is the voltage of the overhead power lines?	
Are there any above ground structures (utilities, piping, etc.) that are used by the client? If so, are they located proximal to the work area?	
Do these lines need controlled (locked out) or protected prior to starting work?	
Interviews: Site Owners/Occupants MUST be interviewed for location of private utility lines at the site (if practicable) before start of work	
Name of Owner/Occupant.	
How is this person affiliated with the Site?	
Who interviewed Owner/Occupant?	
Date of Interview	
Specific comments that should be noted from the interview:	

NOTE: If any subsurface utilities listed above are not located, do not proceed with subsurface activities. Contact PM/TM immediately.

Name and signature of person who conducted utility line checklist

Name (print)

Signature

Date

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page E7 of E12	<u>Approver</u> Mija Coppola

Exhibit 4 - Use and Limitations of Utility Locating Methods

Ground Penetrating Radar (GPR)

The GPR system transmits high frequency electromagnetic waves into the ground and detects the energy reflected back to the surface. Energy is reflected along boundaries that possess different electrical properties. Reflections typically occur at lithologic contacts or where subsurface materials have high electrical contrasts, including metal objects such as underground storage tanks (USTs), drums, and utility pipes. These reflections are detected by the antenna and are processed into an electrical signal that can be used to image the subsurface feature. The GPR data will be reviewed in the field to assist in the delineation of potential piping or other subsurface structures.

The detection of subsurface structures located at the site depends on the electrical properties of the soil and the structure's depth, diameter, and composition. GPR is limited to the detection of smaller diameter pipes with depth. Generally, a pipe must increase in diameter by one 1 inch for each foot in depth to be seen using GPR. Also, plastic piping is more difficult to detect than metal piping using GPR, and caution should be used if plastic utility lines are suspected.

Radio Frequency Detection (RFD)

This instrument operates on the principle of radio frequency transmission and detection. The transmitter applies a known frequency to the pipe and the receiver is able to detect this frequency along the length of the structure. The success of RFD in tracing underground utilities is based on the composition of the structure (metal or plastic) and the ability to accurately position the transmitter unit so that it can be attached to, or placed directly over the structure. RFD should only be used to verify the location of utility mark-outs, and not as the primary method of utility identification.

Soil Vacuum Excavation

This method uses nondestructive vacuum excavation methods to create a visual test hole allowing the confirmation of buried utilities. This method is very accurate and relatively fast and can be performed prior to or during the drilling program. The limiting factors for this method are cost and availability. As with specialty drilling methods, a limited number of firms have the equipment to perform vacuum excavation.

The location of the structures to be cleared relative to the source and depth of impacted soil or groundwater is considered. If the zone to be cleared is known not to contain hazardous vapors or petroleum hydrocarbons via previous testing, continuous air monitoring is implemented using a lower explosive level (LEL)/O₂ meter and photoionization detector (PID) or flame ionization detector (FID) to the depth of the boring. Also consistent with the site health and safety plan (HASP), air monitoring should be conducted continuously with the LEL/O₂ meter during any activity if flammable or explosive vapors are suspected to be present. Prior to any subsurface investigation activities, air monitoring should be conducted to establish background levels for total organic vapors using a PID or FID. All work activity must STOP where tests indicate the concentration of flammable vapors exceeds 10% of the LEL, and the source of vapors must be investigated.

Vacuum-assisted soil excavation utility clearance will not be used in areas know to contain hazardous vapors or petroleum hydrocarbons unless the equipment to be used is suitable for flammable/explosive atmospheres. There is a significantly increased risk of explosion if these

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page E8 of E12	<u>Approver</u> Mija Coppola

materials are encountered while performing this type of utility clearance. Cautions will be performed, as identified below.

Cautions

Many vacuum systems that are commonly used for utility clearance are considered unsuitable for use for environmental investigation sites. Most vacuum units are "Not for use with Hydrocarbons, Explosives, Corrosive or Toxic Material," and are "Not Intrinsically Safe."

Given that many units and associated tanking are not explosion-proof, the following steps will be considered prior to using vacuum- assisted utility clearance units where soils could be impacted with petroleum hydrocarbons or flammable vapors.

1. Request from the manufacturer and/or the contractor doing the work to supply manufacturers' documentation and specifications for use of the unit at environmental sites.
2. Request documentation that the unit is intrinsically safe and may be used in areas where petroleum hydrocarbon may be present.
3. Obtain the procedures for grounding portable units to discharge potential static electricity during operation.
4. If none of the above are available, then hand auger instead and do not use vacuum-assisted methods.

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page E9 of E12	<u>Approver</u> Mija Coppola

Exhibit 5 - Emergency Action Plan Guidelines

When work activities result in the contact or compromise of a utility line, an appropriate response is critical to prevent injury, death or significant property damage. Although circumstances and response vary depending on site specific conditions, the following guidelines provide information that is factored into emergency action planning associated with utility damage. In any event, emergency planning is coordinated with the entity that owns the utility and the client prior to the start of work. This planning and the appropriate response actions are documented in the project health and safety plan and reviewed with all field staff.

Contact with Above or Underground Electric

Contact with above ground or underground electric lines may result in the equipment being energized. Field personnel do not assume rubber tires on equipment are insulating the equipment from the ground. For underground electric strikes, contact with the line may not be immediately noticeable but indications of a strike include: power outage, smoke, explosion, popping noises, or arching electricity. If contact with an electric line is made or is suspected, the following guidelines are followed:

- Under most circumstances, the equipment operator or any worker on a seat of the equipment should stay on the equipment. These workers should not touch anything, especially metal, on the equipment.
- If it is determined that the equipment should be vacated due to a life threatening circumstance, the worker(s) should jump clear as far as possible from the equipment. When jumping keep both feet together and hop away to a safe distance after landing on the ground. Do not use hand holds or touch any part of the equipment when preparing to jump off.
- Workers on the ground should move away from the equipment.
- Keep others away from the equipment and the area.
- If anyone is injured and in contact with the line or equipment, any attempted rescue should be performed with extreme caution. Only use long, dry, clean, unpainted pieces of wood or fiberglass pole or long dry, clean rope to retrieve the victim. Perform first aid/CPR only after the victim is sufficiently clear from the electrical hazard.
- Notify the electric utility or the client as appropriate for the site. Call 911 or the client's emergency response phone number, as appropriate, for any serious injury or any situation that may result in fire or other hazard that could produce injury or property damage.

Natural Gas

If a natural gas line of any size is compromised, immediately:

- Shut off the equipment and remove any other ignition sources.
- Evacuate the area as quickly as possible.

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page E10 of E12	<u>Approver</u> Mija Coppola

- DO NOT attempt to turn off any gas valves.
- Call 911 or the designated client emergency response number as appropriate.
- Call the gas utility, if site response is not controlled by the client.
- Do not return to the area until permitted by the utility or by the approved client emergency response personnel, as appropriate.

Water Lines (all types)

Compromised water lines may rapidly become a significant hazard especially if the line is under considerable pressure. Ruptured pressurized water lines may undermine and wash out unconsolidated materials beneath equipment or structures causing them to become unstable. If a pressurized water line is ruptured, the following guidelines should be followed:

- Promptly shut off all equipment.
- Lower masts or other high extension components of the equipment.
- Evacuate area and call the water utility or client emergency response number, as appropriate.
- Turn off the water if the valve location is known and on the site property.
- If potable water lines have been ruptured, attempt to divert any flow away from structures prone to being flooded. Use caution and keep a safe distance from the line break since the ground surface may be compromised.
- For raw process water or other water of unknown quality, do not attempt to divert or contain. Avoid skin contact or accidental ingestion of any water.
- When returning to the area of the break, survey the area for signs of compromised land surface (cracks in asphalt or concrete, depressions in ground, observations of undercutting, etc.) and avoid moving any equipment until these conditions are repaired or resolved.

Sewers (all types)

Use the same general guidelines for water lines when responding to compromised sewers. If a sanitary sewer is compromised additional guidelines should be followed to avoid contracting any bacterial illnesses. These include:

- Promptly evacuate the area.
- Avoid contact with any sewage material.
- If contaminated, promptly wash with soap (antimicrobial) and water and promptly change impacted clothing.

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page E11 of E12	<u>Approver</u> Mija Coppola

- If sewage is accidentally ingested or infiltrates any breach of the skin or enters the eyes, seek medical attention as a precautionary measure.
- Decontaminate equipment with commercially available disinfectant solutions or a 10% chlorine bleach solution.

Communication Lines

Contact and compromise of communication lines are generally considered more of a financial concern than a concern associated with injury. However, eye damage may occur if looking into the ends of a cut fiber optic line. Do not look into the ends of fiber optic lines or other communication lines of unknown type. Promptly contact the communication company owning the line.

Product Lines and Underground Storage Tanks (all types)

Compromise of a product line or underground storage tank (UST) requires immediate action to mitigate impact to the environment. For gasoline stations and similar facilities the following guidelines should be followed during a line or UST breach:

- Immediately shut down equipment and turn off the emergency shutoff switch for the facility dispensers.
- If there are no injuries, attempt to contain any flowing product using absorbent materials and/or by physically pumping or bailing product out of the breached area.
- If product is flowing on the surface away from the break area, attempt to protect downgradient storm drains, sewer drains, and surface water features from impact of the petroleum product using any readily available materials.
- If the bottom of a UST has been breached, immediately contact a pump truck to remove product from the affected UST.
- For releases involving diesel fuel, care will be taken to avoid any situation where diesel may be injected into the body from impalement by coated nails, wood splinters, etc. If diesel is injected into the body, seek prompt medical attention, even if no apparent symptoms of a problem exist.
- Clear area and arrange for prompt repair.

For industrial sites with lines or USTs containing multiple products with varying hazards, similar guidelines may be followed as above if the material encountered is known and workers have a fundamental understanding of the hazards associated with the material. Upon discovery of a line or UST breach due to work activities at these sites:

- Immediately stop work and notify the client representative or call the client designated emergency number. For abandoned sites call 911.

	<u>ARCADIS HS Procedure Name</u> Utility Location Policy and Procedure	<u>Revision Number</u> 06
<u>Implementation Date</u> 13 December 2006	<u>ARCADIS HS Procedure No.</u> ARCHSFS019	<u>Revision Date</u> 13 January 2009
<u>Author</u> Michael Thomas	Page E12 of E12	<u>Approver</u> Mija Coppola

- If the material is not known, promptly evacuate the area and let HAZMAT teams deal with the release.

ARCADIS

Attachment D

Material Safety Data Sheets

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: 1,2,4-Trichlorobenzene

CAS Number: 120-82-1

Chemical Formula: C₆H₃Cl₃

Structural Chemical Formula: C₆H₃Cl₃

EINECS Number: 204-428-0

ACX Number: X1001590-4

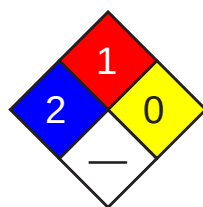
Synonyms: BENZENE,1,2,4-TRICHLORO-; HOSTETEX L-PEC; 1,2,4-TRICHLOROBENZENE; 1,2,5-TRICHLOROBENZENE; 1,3,4-TRICHLOROBENZENE; 1,2,4-TRICHLOROBENZOL; TROJCHLOROBENZEN; UNSYM-TRICHLOROBENZENE

General Use: Solvent in chemical manufacture, dyes and intermediates, dielectric fluid, synthetic transformer oils, lubricants, heat-transfer medium, insecticides.

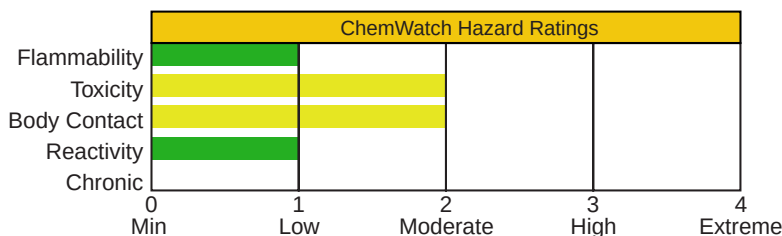
Section 2 - Composition / Information on Ingredients

Name	CAS	%
1,2,4-trichlorobenzene	120-82-1	>98
OSHA PEL	NIOSH REL	DFG (Germany) MAK
	Ceiling: 5 ppm (40 mg/m ³).	Skin.
ACGIH TLV		
Ceiling: 5 ppm.		
EU OEL		
TWA: 2 ppm; STEL: 5 ppm.		

Section 3 - Hazards Identification



Fire Diamond



HMIS	
2	Health
1	Flammability
0	Reactivity

ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless, liquid; aromatic odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: uncoordination, narcosis, tremors, headache, restlessness, increased heart rate/blood pressure. Chronic Effects: liver/kidney/lung damage (animal data).

Potential Health Effects

Target Organs: skin, eyes, mucous membranes

Primary Entry Routes: inhalation, skin contact

Acute Effects

Inhalation: The vapor is discomforting to the upper respiratory tract.

Inhalation hazard is increased at higher temperatures.

Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

Inhalation of vapor may aggravate a pre-existing respiratory condition.

Target organs from non-lethal exposures of cats, dogs, rats, rabbits and guinea pig include liver, kidney and ganglion cells of the brain. Local pulmonary irritation of the lungs and dyspnea were recorded in animals which later died after inhaling 1,2,4-TCB. Sublethal doses cause liver damage in guinea pigs and lethargy and weight gain in other animals.

Eye: The liquid is discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is highly discomforting to the eyes.

Skin: The liquid may produce skin discomfort following prolonged contact.

Defatting and/or drying of the skin may lead to dermatitis. Open cuts, abraded or irritated skin should not be exposed to this material.

The material may accentuate any pre-existing skin condition.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid is discomforting to the gastrointestinal tract and may be harmful if swallowed. Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: No human exposure data available. For this reason health effects described are based on experience with chemically-related materials.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center. Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: 105 °C Closed Cup

Autoignition Temperature: 571 °C

LEL: 2.5% v/v

UEL: 6.6% v/v

Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.

Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: Combustible. Slight fire hazard when exposed to heat or flame.

Heating may cause expansion or decomposition leading to violent rupture of containers.

On combustion, may emit toxic fumes of carbon monoxide (CO).

May emit acrid smoke.

Mists containing combustible materials may be explosive.

Combustion products include hydrogen chloride.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Use water delivered as a fine spray to control fire and cool adjacent area.

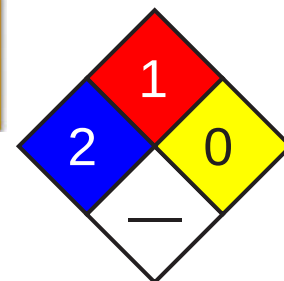
Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protected location.

If safe to do so, remove containers from path of fire.

Equipment should be thoroughly decontaminated after use.

See
DOT
ERG



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb spill with sand, earth, inert material or vermiculite.
Wipe up. Place in a suitable labeled container for waste disposal.

See
DOT
ERG

Large Spills: Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
Stop leak if safe to do so.
Contain spill with sand, earth or vermiculite.
Collect recoverable product into labeled containers for recycling.
Neutralize/decontaminate residue.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.
If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights or ignition sources.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.

Check all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in specific circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage areas.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses; safety glasses with side shields; chemical goggles.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Barrier cream with polyethylene gloves; Butyl rubber gloves or Neoprene gloves or PVC gloves.
Safety footwear.

Respiratory Protection:

Exposure Range >5 to 50 ppm: Air Purifying, Negative Pressure, Half Mask

Exposure Range >50 to 500 ppm: Air Purifying, Negative Pressure, Full Face

Exposure Range >500 to 5000 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face

Exposure Range >5000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Cartridge Color: black

Other: Overalls. Impervious protective clothing.

Eyewash unit.

Glove Selection Index:

NITRILE Best selection

TEFLON Best selection

VITON/NITRILE..... Best selection

PE Poor to dangerous choice for other than short-term immersion

SARANEX-23 Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless liquid with odor resembling that of o-dichlorobenzene. Miscible with ether, benzene, petroleum ether, carbon disulfide. Volatile with steam.

Physical State: Liquid

pH: Not applicable

Odor Threshold: 24.0 mg/m³

pH (1% Solution): Not applicable

Vapor Pressure (kPa): 0.1 at 40 °C

Boiling Point: 213.5 °C (416 °F) at 760 mm Hg

Vapor Density (Air=1): >6

Freezing/Melting Point: 17 °C (62.6 °F)

Formula Weight: 181.44

Water Solubility: 19 ppm at 22 °C in water

Specific Gravity (H₂O=1, at 4 °C): 1.46

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid reaction with oxidizing agents.

Section 11 - Toxicological Information

Toxicity

Oral (rat) TD_{Lo}: 1800 mg/kg

Oral (rat) LD₅₀: 756 mg/kg

Intraperitoneal (mouse) LD₅₀: 1223 mg/kg

Bacterial mutagen, altered sleep times, somnolence, convulsions, ataxia, maternal effects, effects on embryo, fetotoxicity, fetolethality recorded.

Irritation

Skin (rabbit): 1950 mg/13w - I

- moderate

See RTECS DC 2100000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If it is released to the soil it will probably adsorb to the soil and therefore will not leach appreciably through soil. However, it has been detected in some groundwater samples. It will not hydrolyze or biodegrade in groundwater, but it may biodegrade slowly in the soil based upon the data from one experiment. If released to water it will adsorb to the sediments and may bioconcentrate in aquatic organisms. It will not hydrolyze in surface waters but it may be subject to slow biodegradation. It is expected to evaporate from water with half-lives of 11-22 days for evaporation from a study of a physically mixed, 5.4 m deep seawater microcosm and a half-life of 4.2 hr predicted for evaporation from a model river 1 m deep, flowing at 1 m/sec with a wind velocity of 3 m/sec. Adsorption to sediments or absorption by microorganisms may minimize the rate of evaporation. A half-life of 450 years has been reported for sunlight photolysis in surface waters at 40 deg latitude in summer. If released to the atmosphere, it may react with photochemically produced hydroxyl radicals with a resulting estimated vapor phase half-life in the atmosphere of 18.5 days.

Ecotoxicity: LC₅₀ Cyprinodon variegatus (sheepshead minnow) > 46.8 mg/l/24 hr; > 46.8 mg/l/48 hr; 21.4 mg/l/96 hr /Conditions of bioassay not specified; LC₅₀ Poecilia reticulata (guppy) 2.4 ppm/14 days /Conditions of bioassay not specified; LC₅₀ Salmo gairdneri (rainbow trout) 1.95 mg/l/48 hr at 15 °C /Conditions of bioassay not specified

Henry's Law Constant: calculated at 3.9 x10⁻³

BCF: rainbow trout 980 to 1620

Biochemical Oxygen Demand (BOD): theoretical 78%, 20 days

Octanol/Water Partition Coefficient: log K_{ow} = 4.02

Soil Sorption Partition Coefficient: K_{oc} = 1441

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.

Follow applicable federal, state, and local regulations.

Incinerate residue at an approved site.

Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information**DOT Hazardous Materials Table Data (49 CFR 172.101):****Shipping Name and Description:** Trichlorobenzenes, liquid**ID:** UN2321**Hazard Class:** 6.1 - Poisonous materials**Packing Group:** III - Minor Danger**Symbols:****Label Codes:** 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B***Special Provisions:** IB3, T4, TP1**Packaging:** **Exceptions:** 153 **Non-bulk:** 203 **Bulk:** 241**Quantity Limitations:** **Passenger aircraft/rail:** 60 L **Cargo aircraft only:** 220 L**Vessel Stowage:** **Location:** A **Other:****Section 15 - Regulatory Information****EPA Regulations:****RCRA 40 CFR:** Listed**CERCLA 40 CFR 302.4:** Listed per CWA Section 307(a) 100 lb (45.35 kg)**SARA 40 CFR 372.65:** Listed**SARA EHS 40 CFR 355:** Not listed**TSCA:** Listed**Section 16 - Other Information**

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Methyl Ethyl Ketone

CAS Number: 78-93-3

Chemical Formula: C₅H₈O

Structural Chemical Formula: CH₃COCH₂CH₃

EINECS Number: 201-159-0

ACX Number: X1001472-1

Synonyms: ACETONE, METHYL-, AETHYLMETHYLKETON; 2-BUTANONE; 3-BUTANONE; BUTANONE; BUTANONE 2; EPA PESTICIDE CHEMICAL CODE 044103; ETHYL METHYL CETONE; ETHYL METHYL KETONE; ETHYLMETHYLCETONE; ETHYLMETHYLKETON; KETONE, ETHYL METHYL; MEETCO; MEK; METHYL ACETONE; METHYL ETHYL KETONE; METILETILCETONA; METILETILCHETONE; METYLOETYLOKETON

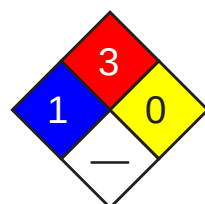
General Use: As a solvent in lacquers, thinners, solvent cements, adhesives, glues, in paint removers, nail polish removers, nail polish and cleaning solvents.

In the manufacture of smokeless gunpowder and colorless synthetic resins.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
methyl ethyl ketone	78-93-3	>99
OSHA PEL TWA: 200 ppm; 590 mg/m ³ .	NIOSH REL TWA: 200 ppm (590 mg/m ³); STEL: 300 ppm (885 mg/m ³).	DFG (Germany) MAK TWA: 200 ppm; PEAK: 200 ppm; skin.
ACGIH TLV TWA: 200 ppm; STEL: 300 ppm.	IDLH Level 3000 ppm.	
EU OEL TWA: 100 ppm.		

Section 3 - Hazards Identification



Fire Diamond

	ChemWatch Hazard Ratings				
Flammability	3	3	3	3	3
Toxicity	1	1	1	1	1
Body Contact	1	1	1	1	1
Reactivity	1	1	1	1	1
Chronic	1	1	1	1	1
	0 Min	1 Low	2 Moderate	3 High	4 Extreme

ANSI Signal Word

Danger!

HMIS	
2	Health
3	Flammability
0	Reactivity



Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless, volatile liquid; sweet mint odor. Irritating to eyes/respiratory tract. Other Acute Effects: corneal injury; inhalation may cause dizziness or vomiting. Chronic Effects: dry skin, dermatitis. Flammable. Can form explosive mixtures in air.

Potential Health Effects

Target Organs: respiratory system, central nervous system (CNS), skin, eyes

Primary Entry Routes: inhalation, eyes, skin contact/absorption

Acute Effects

Inhalation: The vapor is highly discomforting to the upper respiratory tract.

Inhalation hazard is increased at higher temperatures.

Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Inhalation of vapor may aggravate a pre-existing respiratory condition.

Easy odor recognition and irritant properties means that high vapor levels are readily detected and should be avoided by application of control measures; however odor fatigue may occur with loss of warning of exposure.

Exposure to ketone vapors may produce nose, throat and mucous membrane irritation. High concentrations of vapor may produce central nervous system depression characterized by headache, vertigo, loss of coordination, narcosis and cardiorespiratory failure. Some ketones produce neurological disorders (polyneuropathy) characterized by bilateral symmetrical paresthesia and muscle weakness primarily in the legs and arms.

Eye: The liquid is highly discomforting to the eyes if exposure is prolonged and is capable of causing pain and severe conjunctivitis.

Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.

The vapor is highly discomforting to the eyes if exposure is prolonged.

The vapor when concentrated has pronounced eye irritation; this gives some warning of high vapor concentrations. If eye irritation occurs seek to reduce exposure with available control measures, or evacuate area.

Skin: The liquid is highly discomforting to the skin, it is absorbed by the skin and may cause drying of the skin, which may lead to dermatitis.

Toxic effects may result from skin absorption.

The material may accentuate any pre-existing skin condition.

Material on the skin evaporates rapidly and may cause tingling, chilling and even temporary numbness.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid is highly discomforting if swallowed and toxic if swallowed in large quantity.

Ingestion may result in nausea, abdominal irritation, pain and vomiting.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.

The material is considered to have a low order of toxicity; however Methyl ethyl ketone is often used in combination with other solvents and the toxic effects of mix may be greater than either solvent alone.

Combinations of n-hexane with methyl ethyl ketone and also methyl n-butyl ketone with methyl ethyl ketone show increase in peripheral neuropathy, a progressive disorder of nerves of extremities.

Combinations with chloroform show increase in toxicity.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: -9 °C Closed Cup

Autoignition Temperature: 404 °C

LEL: 1.4% v/v

UEL: 11.4% v/v

Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.

Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.

Severe fire hazard when exposed to heat, flame and/or oxidizers.

Vapor forms an explosive mixture with air.

Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.

Heating may cause expansion/decomposition with violent rupture of containers.

On combustion, may emit toxic fumes of carbon monoxide (CO). Other combustion products include carbon dioxide (CO₂).

Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result. Attacks, softens and may dissolve rubber, many plastics, paints and coatings.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

Fight fire from a safe distance, with adequate cover.

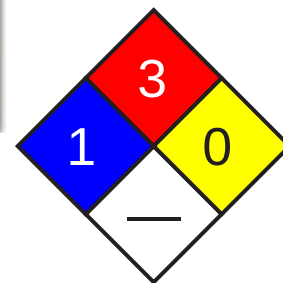
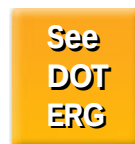
If safe, switch off electrical equipment until vapor fire hazard removed.

Use water delivered as a fine spray to control the fire and cool adjacent area. Avoid spraying water onto liquid pools.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protective location.

If safe to do so, remove containers from path of fire.



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.

Avoid breathing vapors and contact with skin and eyes.

Control personal contact by using protective equipment.

Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: Clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

No smoking, bare lights or ignition sources. Increase ventilation.

Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.

Use only spark-free shovels and explosion proof equipment.

Collect recoverable product into labeled containers for recycling.

Absorb remaining product with sand, earth or vermiculite.

Collect solid residues and seal in labeled drums for disposal.

Wash area and prevent runoff into drains.

If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).



Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Avoid all personal contact, including inhalation.

Wear protective clothing when risk of exposure occurs.

Use in a well-ventilated area. Prevent concentration in hollows and sumps.

DO NOT enter confined spaces until atmosphere has been checked.

Avoid smoking, bare lights, heat or ignition sources.

When handling, DO NOT eat, drink or smoke.

Vapor may ignite on pumping or pouring due to static electricity.

DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.

Avoid contact with incompatible materials.

Keep containers securely sealed. Avoid physical damage to containers.

Always wash hands with soap and water after handling.

Work clothes should be laundered separately.

Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.

Check all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.

CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear.

General exhaust is adequate under normal operating conditions.

Local exhaust ventilation may be required in special circumstances.

If risk of overexposure exists, wear NIOSH-approved respirator. NIOSH-approved respirator (supplied air type) may be required in special circumstances. Correct fit is essential to ensure adequate protection.

Provide adequate ventilation in warehouses and enclosed storage areas.

In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; or as required, chemical goggles.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Barrier cream with polyethylene gloves or Butyl rubber gloves.

Safety footwear.

Do NOT use this product to clean the skin.

Respiratory Protection:

Exposure Range >200 to 1000 ppm: Air Purifying, Negative Pressure, Half Mask

Exposure Range >1000 to <3000 ppm: Air Purifying, Negative Pressure, Full Face

Exposure Range 3000 to unlimited ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face; Self-contained Breathing Apparatus, Pressure Demand, Full Face

Cartridge Color: black

Other: Overalls or Impervious protective clothing.

Eyewash unit.

Ensure there is ready access to an emergency shower.

Glove Selection Index:

BUTYL Best selection

PE/EVAL/PE Best selection

TEFLON Best selection

PVA Satisfactory; may degrade after 4 hours continuous immersion

BUTYL/NEOPRENE Satisfactory; may degrade after 4 hours continuous immersion

SARANEX-23 Poor to dangerous choice for other than short-term immersion

NEOPRENE/NATURAL..... Poor to dangerous choice for other than short-term immersion

HYPALON Poor to dangerous choice for other than short-term immersion

NITRILE+PVC Poor to dangerous choice for other than short-term immersion

NATURAL+NEOPRENE..... Poor to dangerous choice for other than short-term immersion

VITON/NEOPRENE Poor to dangerous choice for other than short-term immersion

NATURAL RUBBER..... Poor to dangerous choice for other than short-term immersion

PVC..... Poor to dangerous choice for other than short-term immersion

NEOPRENE..... Poor to dangerous choice for other than short-term immersion

NITRILE Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Thin colorless highly flammable liquid. Penetrating, sharp smell. Very volatile and vapor is heavier than air. Mixes with alcohol, ether and hydrocarbon solvents, petrol, turps etc. Attacks, softens and may dissolve rubber, many plastics, paints and coatings.

Physical State: Liquid

Odor Threshold: 0.7375 to 147.5 mg/m³

Vapor Pressure (kPa): 9.5 at 20 °C

Vapor Density (Air=1): 2.4 at 20 °C

Formula Weight: 72.12

Specific Gravity (H₂O=1, at 4 °C): 0.81 at 20 °C

Evaporation Rate: 5.7 Fast (BuAc=1)

pH: Not applicable

pH (1% Solution): Not applicable.

Boiling Point: 79.6 °C (175 °F)

Freezing/Melting Point: -86.3 °C (-123.34 °F)

Volatile Component (% Vol): 100

Water Solubility: 353 g/L water at 10 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid storage with oxidizers hypochlorites, e.g. pool chlorine, bleaches and strong bases and chloroform.

Section 11 - Toxicological Information

Toxicity

Oral (rat) LD₅₀: 2737 mg/kg
 Inhalation (human) TC_{L0}: 100 ppm/5 m
 Inhalation (rat) LD₅₀: 23500 mg/m³/8 hr
 Dermal (rabbit) LD₅₀: 6480 mg/kg

Irritation

Eye (human): 350 ppm -irritant
 Eye (rabbit): 80 mg - irritant
 Skin (rabbit): 402 mg/24 hr - mild
 Skin (rabbit): 13.78mg/24 hr open - mild

See RTECS EL 6475000, for additional data.

Section 12 - Ecological Information

Environmental Fate: When discharged into water, it will be lost by evaporation (half-life 3-12 days) or be slowly biodegraded. When released to the atmosphere, it will photodegrade at a moderate rate (half-life 2.3 days or less). It would not be expected to bioconcentrate into aquatic organisms.

Ecotoxicity: LC₅₀ Pimephales promelas (fathead minnow) 3220 mg/l/96 hr (confidence limit 3130-3320 mg/l) /Conditions of bioassay not specified; Toxicity Threshold (Cell Multiplication Inhibition Test) Scenedesmus quadricauda (green algae) 4300 mg/l /Conditions of bioassay not specified; Toxicity Threshold (Cell Multiplication Inhibition Test) Entosiphon sulcatum (protozoa) 190 mg/l /Conditions of bioassay not specified

Henry's Law Constant: 2.4 x10⁻⁵

BCF: not significant

Biochemical Oxygen Demand (BOD): 214%, 5 days

Octanol/Water Partition Coefficient: log K_{ow} = 0.26 to 0.29

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
 Follow applicable federal, state, and local regulations.
 Incinerate residue at an approved site.
 Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Ethyl methyl ketone or Methyl ethyl ketone

ID: UN1193

Hazard Class: 3 - Flammable and combustible liquid

Packing Group: II - Medium Danger

Symbols:

Label Codes: 3 - Flammable Liquid

Special Provisions: IB2, T4, TP1

Packaging: Exceptions: 150 Non-bulk: 202 Bulk: 242

Quantity Limitations: Passenger aircraft/rail: 5 L Cargo aircraft only: 60 L

Vessel Stowage: Location: B Other:



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U159 Toxic Waste, Ignitable Waste

CERCLA 40 CFR 302.4: Listed per RCRA Section 3001 5000 lb (2268 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: 2-Methylnaphthalene

CAS Number: 91-57-6

Chemical Formula: C₁₁H₁₀

Structural Chemical Formula: C₁₀H₇CH₃

EINECS Number: 202-078-3

ACX Number: X1002705-9

Synonyms: 2-METHYLNAPHTHALENE; BETA-METHYLNAPHTHALENE; NAPHTHALENE,2-METHYL-; NAPHTHALENE,BETA-METHYL

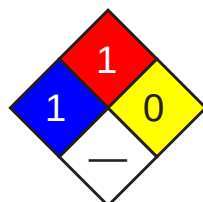
Derivation: 2-Methylnaphthalene is derived from coal tar.

General Use: 2-Methylnaphthalene is used in organic synthesis, vitamin K production, and insecticides; as a pesticide adjuvant, a dye carrier, and as a chemical intermediate.

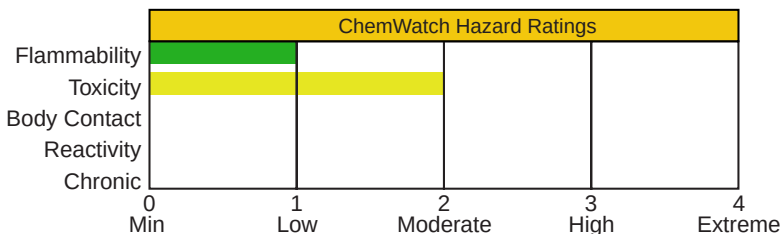
Section 2 - Composition / Information on Ingredients

Name	CAS	%
2-Methylnaphthalene	91-57-6	ca 95% wt (technical)
OSHA PEL	NIOSH REL	
ACGIH TLV		

Section 3 - Hazards Identification



Fire Diamond



HMIS	
1	Health
1	Flammability
0	Reactivity

ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

White solid. Irritating to eyes/skin/respiratory tract. Harmful by ingestion. Chronic effects: human mutation effects. Combustible.

Potential Health Effects

Target Organs: Eyes, skin, thorax and respiratory system

Primary Entry Routes: Ingestion, Inhalation, and skin/eye contact

Acute Effects

Inhalation: Causes upper respiratory system and mucous membrane irritation.

Eye: Contact causes eye irritation and possible corneal damage.

Skin: Contact causes skin irritation and skin photosensitization.

Ingestion: The toxic effects from ingestion of 2-methylnaphthalene have not been sufficiently investigated. However, naphthalene exposure causes facial flushing, fever, headache, restlessness, lethargy, nausea, vomiting, abdominal pain, anorexia, hemolysis, methemoglobinemia, hemoglobinuria, hyperkalemia, anemia, hepatocellular injury, and acute renal failure. Convulsion and coma may develop following severe exposures.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: None reported.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed. If breathing is difficult, give oxygen.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult a physician or ophthalmologist if pain or irritation persist.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Wash out mouth with water provided person is conscious. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Nausea, vomiting, abdominal pain, diarrhea, and anorexia may occur up to 48 hours following acute ingestion. Nausea may also occur after inhalation exposure. There is no specific antidote. Treatment is symptomatic and supportive. Consider GI decontamination with induced emesis or gastric lavage, followed by administration of activated charcoal. Hemolysis may require urinary alkalization and transfusion; methemoglobinemia may require treatment with methylene or toluidine blue.

Section 5 - Fire-Fighting Measures

Flash Point: 207 °F (97 °C)

Autoignition Temperature: Data not found.

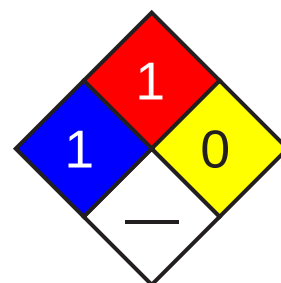
LEL: Data not found

UEL: Data not found

Extinguishing Media: Extinguish with water spray, carbon dioxide, dry chemical or appropriate foam.

General Fire Hazards/Hazardous Combustion Products: Acrid smoke, carbon monoxide, and carbon dioxide may be produced.

Fire-Fighting Instructions: Shut off all ignition sources. *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode, rubber boots, and heavy rubber gloves.



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources. Isolate and ventilate area, deny entry, stay upwind. Cleanup personnel should protect against exposure (Sec. 8). Wear an SCBA, rubber boots and heavy rubber gloves.

Small Spills: If in solid form, *do not* sweep! Avoid raising dust. Carefully scoop up or vacuum (with a HEPA filter). Absorb liquid spill with an inert, noncombustible absorbent such as sand or vermiculite. Wash spill site after material pickup is complete.

Large Spills: For large spills, dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Wear personal protective clothing and equipment to prevent vapor inhalation and contact with skin or eyes (Sec. 8).

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed containers in a cool, well-ventilated area away from heat, light, ignition sources, and incompatibles.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose and exhaust ventilate operations to avoid vapor dispersion into the work area. Provide general or local exhaust ventilation systems to maintain airborne concentrations below hazardous levels. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Educate workers about the health and safety hazards associated with this material. Train in work practices which minimize exposure.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, rubber boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not protective eye devices. Appropriate eye protection must be worn instead of, or in conjunction with, contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: White

Physical State: Solid; crystals.

Odor Threshold: Chemically pure 5.00×10^{-2} ppm

Vapor Pressure (kPa): 6.81×10^{-2} mm Hg at 77 °F (25 °C)

Formula Weight: 142.21

Density: 1.0058 g/cm³ at 20°/ 4°

Specific Gravity (H₂O=1, at 4 °C): 1.000

Refractive Index: 1.6015 at 77 °F (25 °C)

Boiling Point: 466 to 468 °F (241 to 242 °C)

Freezing/Melting Point: 93 to 97 °F (34 to 36 °C)

Ionization Potential (eV): 7.83 eV

Critical Temperature: 910 °F (488 °C)

Critical Pressure: 34.6 atm

Water Solubility: <1 mg/mL at 70 °F (21 °C)

Other Solubilities: Soluble in benzene and ether; at 70 °F (21 °C): ≥ 100 mg/mL 95% ethanol; ≥ 100 mg/mL acetone; ≥ 100 mg/mL DMSO.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: 2-Methylnaphthalene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Avoid contact with chemical incompatibles, heat, and sources of ignition.

Storage Incompatibilities: Include strong oxidizing agents.

Hazardous Decomposition Products: Thermal oxidative decomposition of 2-methylnaphthalene can produce acrid smoke and toxic fumes of carbon monoxide and carbon dioxide.

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral, LD₅₀: 1630 mg/kg.

Rat, oral: 5.00 mL/kg was lethal to all animals.

Other Effects:

Genetic Effects: Human, lymphocyte, 4 mmol/L induced cytogenetic analysis.

Human, lymphocyte, 250 μ mol/L induced sister chromatid exchange.

Mouse, intraperitoneal, LD₅₀: 1 g/kg produced toxic effects: lung, thorax, or respiration - structural or functional change in trachea or bronchi; lung, thorax, or respiration - other changes.

Mouse, oral, 28500 mg/kg administered for 81 weeks continuously produced toxic effects: Tumorigenic - equivocal tumorigenic agent by RTECS criteria; lung, thorax, or respiration - tumors.

See RTECS QJ9635000, for additional data.

Section 12 - Ecological Information

Environmental Fate: 2-Methylnaphthalene is a component of crude oil and a product of combustion which is produced and released to the environment during natural fires associated with lightning. Emissions from petroleum refining, coal tar distillation, and gasoline- and diesel-fueled engines are major contributors of 2-methylnaphthalene to the environment. 2-Methylnaphthalene should biodegrade rapidly in the environment where micro-organisms have acclimated to polycyclic aromatic hydrocarbons, and at a moderate rate in unacclimated soils and aquatic systems. Hydrolysis and bioconcentration of 2-methylnaphthalene should not be important fate processes in the environment. Photolysis is also likely to occur in air and on sunlit soil surfaces. 2-Methylnaphthalene is expected to exist entirely in the vapor phase in ambient air. Reactions with photochemically-produced hydroxyl radicals (half-life of 7.4 hours) and ozone (half-life of 28.7 days) in the atmosphere are likely to be important fate processes. A measured K_{oc} of 8500 indicates 2-methylnaphthalene will be immobile in soil. In aquatic systems, 2-methylnaphthalene may partition from the water column to organic matter contained in sediments and suspended solids. A Henry's Law constant of 5.18×10^{-4} (calculated) suggests volatilization of 2-methylnaphthalene from environmental waters may be important. $\log K_{ow}$: 3.86

Ecotoxicity: Moderately toxic to crustaceans and fish.

Henry's Law Constant: 5.18×10^{-4} (calculated)

BCF: 2.35×10^4 (rainbow trout)

Soil Sorption Partition Coefficient: $K_{oc} = 8500$

Section 13 - Disposal Considerations

Disposal: Dissolve or mix 2-methylnaphthalene with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable federal, state, and local regulations. Handle empty containers carefully as hazardous residues may still remain. Triple rinse containers and dispose of wash wastewater appropriately.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Not specifically listed.

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Not listed

CERCLA 40 CFR 302.4: Not listed

SARA 40 CFR 372.65: Not listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

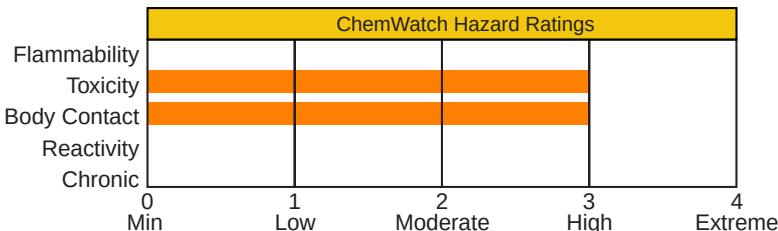
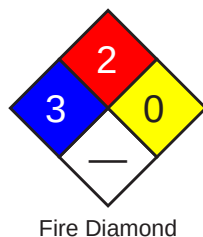
61

Material Name: o-Cresol **CAS Number:** 95-48-7
Chemical Formula: C₇H₈O
Structural Chemical Formula: CH₃C₆H₄OH
EINECS Number: 202-423-8
ACX Number: X1004974-2
Synonyms: 2-CRESOL; O-CRESOL; ORTHO-CRESOL; O-CRESYLIC ACID; 1-HYDROXY-2-METHYLBENZENE; 2-HYDROXYTOLUENE; O-HYDROXYTOLUENE; O-KRESOL; 2-METHYL PHENOL; 2-METHYLPHENOL; O-METHYLPHENOL; O-METHYLPHENYLOL; ORTHOCRESOL; O-OXYTOLUENE; PHENOL,2-METHYL-; PHENOL,2-METHYL-(9CI); O-TOLUOL
General Use: as a disinfectant, solvent, resins, metal cleaner, food antioxidant, ore flotation, textile scouring agent, organic intermediate surfactant, cresylic acid constituent, additives to lubricating oil and insecticide; in the manufacturing of perfumes, dyes, plastic herbicides, tricresyl phosphate, salicylaldehyde and coumarin

Section 2 - Composition / Information on Ingredients

Name	CAS	%
o-cresol	95-48-7	>99
OSHA PEL TWA: 5 ppm; 22 mg/m ³ ; skin.	NIOSH REL TWA: 2.3 ppm (10 mg/m ³).	DFG (Germany) MAK Skin.
ACGIH TLV TWA: 5 ppm; skin.	IDLH Level 250 ppm.	

Section 3 - Hazards Identification



HMIS	
4	Health
2	Flammability
0	Reactivity

ANSI Signal Word

Danger!



☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless to white crystalline solid; sweet tarry phenolic odor. Corrosive. Poison. Other Acute Effects: inflammation/edema/spasm of larynx/bronchi, sensation, coughing, shortness of breath, headache, nausea, CNS depression, dizziness, GI disturbances. Explosive. Combustible.

Potential Health Effects

Target Organs: eyes, skin, respiratory system, nervous system, liver

Primary Entry Routes: skin absorption

Acute Effects

Inhalation: The vapor/mist is highly discomforting to the upper respiratory tract.

Eye: The material is highly corrosive to the eyes and is capable of causing severe damage with loss of sight. The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The material is highly corrosive to the skin, is rapidly absorbed and is capable of causing burns and ulceration. Exposure limits with "skin" notation indicate that vapor and liquid may be absorbed through intact skin. Absorption by skin may readily exceed vapor inhalation exposure. Symptoms for skin absorption are the same as for inhalation. Contact with eyes and mucous membranes may also contribute to overall exposure and may also invalidate the exposure standard. The material may produce severe skin irritation after prolonged or repeated exposure, and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Prolonged contact is unlikely, given the severity of response, but repeated exposures may produce severe ulceration.

Ingestion: The material is highly corrosive to the gastrointestinal tract and may be fatal if swallowed. Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class C, Possible human carcinogen; MAK - Not listed.

Chronic Effects: Dilute solutions cause redness, vesiculation and burning of the skin. Chronic exposure to the skin can cause facial peripheral nerve damage, impairment of renal function and even necrosis of the liver and kidneys. Acute exposure by all routes of absorption may cause muscular weakness, gastroenteric disturbances, pancreas and spleen injury. In extreme cases it has been known to be a severe depressant of the cardiovascular system and the central nervous system, particularly the spinal cord. Symptoms of systemic absorption include: headache, nausea, shock, hypothermia, unconsciousness, respiratory failure and in some cases death.

Section 4 - First Aid Measures

Inhalation: • If fumes or combustion products are inhaled, remove to fresh air.

- Lay patient down. Keep warm and rested.
- If breathing is shallow or has stopped, ensure clear airway and apply resuscitation, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital or doctor.

See
DOT
ERG

Eye Contact: • Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Transport to hospital or doctor without delay.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: • Remove contaminated clothing, swab repeatedly with glycerin, PEG (polyethylene glycol), or PEG/methylated spirit mixture or if necessary with methylated spirit alone.

- Contamination of skin with phenol and some of its derivatives may produce rapid collapse and death.
- After skin contamination, keep patient under observation for at least 24-48 hours.
- Phenol-decontaminating fluid is more effective than water in removing phenol from the skin and retarding absorption; olive oil or vegetable oil may also be used; do not use mineral oil.
- Alcohols (methylated spirit, for example) may enhance absorption and their use alone may be ill-advised; some authorities however continue to advise the use of such treatment.
- Rapid water dilution of phenol burns may increase systemic absorption by decreasing the extent of the coagulum and thus allowing greater absorption.

Ingestion: Contact a Poison Control Center. Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to phenols/cresols:

- Phenol is absorbed rapidly through lungs and skin. Massive skin contact may result in collapse and death
- Ingestion may result in ulceration of upper respiratory tract; perforation of esophagus and/or stomach, with attendant complications, may occur. Esophageal stricture may occur.
- An initial excitatory phase may present. Convulsions may appear as long as 18 hours after ingestion. Hypotension and ventricular tachycardia that require vasopressor and antiarrhythmic therapy, respectively, can occur.
- Respiratory arrest, ventricular dysrhythmias, seizures and metabolic acidosis may complicate severe phenol exposures so the initial attention should be directed towards stabilization of breathing and circulation with ventilation, intubation, intravenous lines, fluids and cardiac monitoring as indicated.
- Vegetable oils retard absorption; do NOT use paraffin oils or alcohols. Gastric lavage, with endotracheal intubation, should be repeated until phenol odor is no longer detectable; follow with vegetable oil. A saline cathartic should then be given. ALTERNATELY: Activated charcoal (1g/kg) may be given. A cathartic should be given after oral activated charcoal.
- Severe poisoning may require slow intravenous injection of methylene blue to treat methemoglobinemia.
- Renal failure may require hemodialysis.
- Most absorbed phenol is biotransformed by the liver to ethereal and glucuronide sulfates and is eliminated almost completely after 24 hours.

BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

<u>Determinant</u>	<u>Index</u>	<u>Sampling Time</u>	<u>Comments</u>
Total phenol in blood	250 mg/g creatinine	End of shift	B,NS

B: Background levels occur in specimens collected from subjects NOT exposed
NS: Non-specific determinant; also seen after exposure to other materials.

Section 5 - Fire-Fighting Measures

Flash Point: 81 °C Closed Cup

Autoignition Temperature: 599 °C

LEL: 1.35% v/v

Extinguishing Media: Water spray or fog. Dry chemical powder. Dry agent.
Alcohol stable foam. Carbon dioxide.

General Fire Hazards/Hazardous Combustion Products: • Combustible. Vapor hazard when exposed to heat and flame.

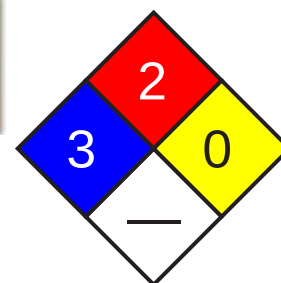
• Emits toxic fumes and gases, including carbon monoxide(CO).

Fire Incompatibility: Avoid reaction with oxidizing agents.

Fire-Fighting Instructions: • Contact fire department and tell them location and nature of hazard.

- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or waterways.
- Use fire fighting procedures suitable for surrounding fire.
- Use water delivered as a fine spray to control the fire and cool adjacent area.
- Cool fire-exposed containers with water spray from a protected location.
- Do not approach containers suspected to be hot.
- If safe to do so, remove containers from path of fire.
- Equipment should be thoroughly decontaminated after use.

See
DOT
ERG



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: • Remove all ignition sources.

- Clean up all spills immediately.
- Wear fully protective PVC clothing and breathing apparatus.
- Contain and absorb spill with sand, earth, inert material or vermiculite.
- Sweep up.
- Place in clean drum then flush area with water.

Large Spills: • Clear area of personnel and move upwind.

- Contact fire department and tell them location and nature of hazard. Pollutant - contain spillage.
- Wear full body protective clothing with breathing apparatus.
- Prevent, by any means available, spillage from entering drains or waterways.
- If contamination of drains or waterways occurs, advise emergency services.
- Contain spill with sand, earth or vermiculite.
- Shut off all possible sources of ignition and increase ventilation.
- Stop leak if safe to do so.
- Collect recoverable product into labeled containers for recycling.
- Absorb remaining product with sand, earth or vermiculite.
- Collect, using a spark-free shovel, and seal in labeled drums for disposal.
- Wash spill area with large quantities of water.
- After clean up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.
- If equipment is grossly contaminated, decontaminate and destroy.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: • Follow good occupational work practices.

- Avoid breathing vapors and contact with skin and eyes.
- Avoid all ignition sources.
- Avoid sources of heat.
- Wear personal protective equipment when handling.

- Handle and open container with care.
- When handling, DO NOT eat, drink or smoke.
- Use in a well-ventilated area.
- Keep containers securely sealed when not in use.
- Wash hands with soap and water after handling.
- Work clothes should be laundered separately: NOT at home.

Recommended Storage Methods: Check that containers are clearly labeled. Store in metal drums or safety cans. Steel drum. Packaging as recommended by manufacturer.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields. Chemical goggles. Full face shield. DO NOT wear contact lenses. Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Rubber gloves. PVC gloves.
PVC boots.

Respiratory Protection: Respirator protection may be required. Consult your supervisor.

Other: PVC apron. PVC protective clothing. Eyewash unit. Ensure there is ready access to a safety shower.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Solid crystals or liquid ranging from colorless to yellow but darkens with exposure to air and light. Sweet tar-like odor. Soluble in organic solvents, vegetable oils, ether, alcohol and benzene.

Physical State: colorless to white crystalline solid,
liquid above 88 °F

Odor Threshold: 5 ppm

Vapor Pressure (kPa): 1 mm Hg at 38.2 °C

Vapor Density (Air=1): 3.72

Formula Weight: 108.15

Specific Gravity (H₂O=1, at 4 °C): 1.047 at 20 °C/4 °C

Boiling Point: 190.95 °C (376 °F) at 760 mm Hg

Freezing/Melting Point: 30.9 °C (87.62 °F)

Water Solubility: 1 parts in about 40 parts Water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable under normal handling and storage conditions. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Toxicity

Oral (rat) LD₅₀: 121 mg/kg

Dermal (rabbit) LD₅₀: 890 mg/kg

Irritation

None reported

See RTECS GO6300000, for additional data.

Section 12 - Ecological Information

Environmental Fate: When released to the atmosphere it will react with photochemically produced hydroxyl radicals (half-life 9.6 hr) during the day or react with nitrate radicals at night (half-life 2 min). In addition it will be scavenged by rain. When released into water, biodegradation will generally occur within days. However, in surface layers of oligotrophic waters, photolysis may be important. Its fate in soil has not been well characterized; it is mobile and will likely biodegrade, but little evidence is available.

Ecotoxicity: Aquatic toxicity: 49.1-19 ppm/24-96 hr/goldfish/TL_m/soft water; 22.2-20.8 ppm/24-96 hr/bluegill/TL_m/soft water; 18-13.4 ppm/24-96 hr/fathead minnow/TL_m/hard water; 18-50 ppm/24-96 hr/guppy/TL_m/hard water; Waterfowl toxicity: Chronic water fowl toxic limit is 25 ppm

Henry's Law Constant: 1.6 x10⁻⁶

BCF: calculated at 18

Biochemical Oxygen Demand (BOD): 1.64 lb/lb, 5 days

Octanol/Water Partition Coefficient: log K_{ow} = 1.95

Soil Sorption Partition Coefficient: K_{oc} = brookston clay loam soil 22

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options. React the components and dispose using controlled incineration. Decontaminate empty containers. Recycle containers if possible, or dispose of in an authorized landfill. Follow applicable local, state, and federal regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Cresols, solid

ID: UN2076

Hazard Class: 6.1 - Poisonous materials

Packing Group: II - Medium Danger

Symbols:

Label Codes: 6.1 - Poison or Poison Inhalation Hazard if inhalation hazard, Zone A or B, 8 - Corrosive

Special Provisions: IB8, IP2, IP4, T7, TP2

Packaging: Exceptions: None **Non-bulk:** 202 **Bulk:** 243

Quantity Limitations: Passenger aircraft/rail: 1 L **Cargo aircraft only:** 30 L

Vessel Stowage: Location: B **Other:**



Shipping Name and Description: Cresols, liquid

ID: UN2076

Hazard Class: 6.1 - Poisonous materials

Packing Group: II - Medium Danger

Symbols:

Label Codes: 6.1 - Poison or Poison Inhalation Hazard if inhalation hazard, Zone A or B, 8 - Corrosive

Special Provisions: IB8, IP2, IP4, T7, TP2

Packaging: Exceptions: None **Non-bulk:** 202 **Bulk:** 243

Quantity Limitations: Passenger aircraft/rail: 1 L **Cargo aircraft only:** 30 L

Vessel Stowage: Location: B **Other:**



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Not listed U052 Toxic Waste

CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001 100 lb (45.35 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Listed

RQ: 100 lb

TPQ: 1000/10000 lb

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Methyl Isobutyl Ketone

CAS Number: 108-10-1

Chemical Formula: C₆H₁₂O

Structural Chemical Formula: (CH₃)₂CHCH₂COCH₃

EINECS Number: 203-550-1

ACX Number: X1001526-4

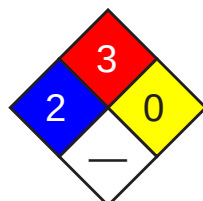
Synonyms: EPA PESTICIDE CHEMICAL CODE 044105; HEXON; HEXONE; ISOBUTYL METHYL KETONE; ISOBUTYL-METHYLKETON; ISOPROPYL ACETONE; ISOPROPYLACETONE; KETONE,ISOBUTYL METHYL; METHYL ISOBUTYL KETONE; 4-METHYL 2-PENTANONE; METHYL-ISOBUTYL-CETONE; METHYLISOBUTYLKETON; 4-METHYL-2-OXOPENTANE; 4-METHYL-2-PENTANON; 4-METHYL-PENTAN-2-ON; 2-METHYL-4-PENTANONE; 4-METHYL-2-PENTANONE; 4-METHYLPENTANONE-2; 2-METHYLPROPYL METHYL KETONE; METILISOBUTILCHETONE; 4-METILPENTAN-2-ONE; METYLOIZOBUTYLOKETON; MIBK; MIK; 2-PENTANONE,4-METHYL-; SHELL MIBK

General Use: Used as a solvent for paints, varnishes, nitrocellulose, lacquers; manufacture of methyl amyl alcohol; extraction processes including extraction of uranium from fission products; organic synthesis; denaturant for alcohol.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
methyl isobutyl ketone	108-10-1	>99
OSHA PEL TWA: 100 ppm; 410 mg/m ³ .	NIOSH REL TWA: 50 ppm (205 mg/m ³); STEL: 75 ppm (300 mg/m ³).	DFG (Germany) MAK TWA: 20 ppm; PEAK: 40 ppm; skin.
ACGIH TLV TWA: 50 ppm; STEL: 75 ppm.	IDLH Level 500 ppm.	
EU OEL TWA: 20 ppm; STEL: 50 ppm.		

Section 3 - Hazards Identification



Fire Diamond

	ChemWatch Hazard Ratings				
Flammability	3	2	1	0	
Toxicity	2	1	0		
Body Contact	0	0	0		
Reactivity	0	0	0		
Chronic	0	0	0		
	0 Min	1 Low	2 Moderate	3 High	4 Extreme

ANSI Signal Word

Warning!

HMIS	
2	Health
3	Flammability
0	Reactivity



Explosive



Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; camphor-like odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: headache, excitability, visual disturbances, nausea, vomiting. Chronic Effects: dermatitis, may cause reproductive effects. Flammable. Forms explosive peroxides in air.

Potential Health Effects

Target Organs: central nervous system (CNS), eyes, respiratory system, skin

Primary Entry Routes: inhalation, eye contact, skin contact, ingestion

Acute Effects

Inhalation: The vapor is discomforting to the upper respiratory tract.

Inhalation hazard is increased at higher temperatures.

Exposure to ketone vapors may produce nose, throat and mucous membrane irritation. High concentrations of vapor may produce central nervous system depression characterized by headache, vertigo, loss of coordination, narcosis and cardiorespiratory failure. Some ketones produce neurological disorders (polyneuropathy) characterized by bilateral symmetrical paresthesia and muscle weakness primarily in the legs and arms.

Overexposure in humans may produce weakness, loss of appetite, headache, a burning sensation to the eyes, stomach-ache, nausea and vomiting. Sore throat, insomnia, somnolence, heartburn and intestinal pain have been reported by some workers. Tolerance is reported to be acquired over the workweek and lost during the weekend.

Rats, mice, dogs and monkeys that inhaled 100 or 200 ppm MIBK 24 hrs/day showed no outward adverse effects during 2 weeks of exposure. At 200 ppm rats showed increased absolute liver and kidney weights and increased organ-to-body weight ratios. Examination of the proximal tubules showed toxic nephrosis (hyaline droplet degeneration and occasional focal tubular necrosis) in rats exposed to 100 ppm. This damage was considered transient and reversible. Discriminatory behavior and memory in baboons was effected at exposures of 50 ppm for 7 days.

Eye: The liquid is highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration. The vapor is discomforting to the eyes if exposure is prolonged.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

At concentrations of 100-200 ppm, the vapor may irritate the eyes and respiratory tract

Skin: The liquid is highly discomforting to the skin and may cause drying of the skin, which may lead to dermatitis. The material may accentuate any pre-existing skin condition.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid is highly discomforting and toxic if swallowed.

Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.

Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.

Experiments with rats have shown nerve changes characteristic of neuropathy (disease of the peripheral nerves usually causing weakness and numbness).

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: 23.889 °C Open Cup

Autoignition Temperature: 460 °C

LEL: 1.4% v/v

UEL: 7.5% v/v at 93 °C

Extinguishing Media: Alcohol stable foam; dry chemical powder; BCF (where regulations permit).
Carbon dioxide.

Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.

Severe fire hazard when exposed to heat, flame and/or oxidizers.

Vapor forms an explosive mixture with air.

Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.

Heating may cause expansion/decomposition with violent rupture of containers.

On combustion, may emit toxic fumes of carbon monoxide (CO).

Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

Fight fire from a safe distance, with adequate cover.

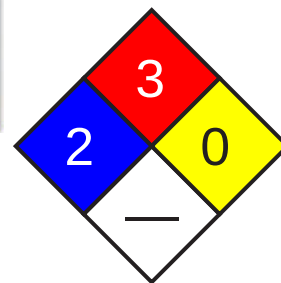
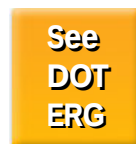
If safe, switch off electrical equipment until vapor fire hazard removed.

Use water delivered as a fine spray to control the fire and cool adjacent area. Avoid spraying water onto liquid pools.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protective location.

If safe to do so, remove containers from path of fire.



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.

Avoid breathing vapors and contact with skin and eyes.

Control personal contact by using protective equipment.

Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: Clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

No smoking, bare lights or ignition sources. Increase ventilation.

Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.

Use only spark-free shovels and explosion proof equipment.

Collect recoverable product into labeled containers for recycling.

Absorb remaining product with sand, earth or vermiculite.

Collect solid residues and seal in labeled drums for disposal.

Wash area and prevent runoff into drains.

If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).



Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.

Wear protective clothing when risk of exposure occurs.

Use in a well-ventilated area. Prevent concentration in hollows and sumps.

DO NOT enter confined spaces until atmosphere has been checked.

Avoid smoking, bare lights, heat or ignition sources.

When handling, DO NOT eat, drink or smoke.

Vapor may ignite on pumping or pouring due to static electricity.

DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.

Avoid contact with incompatible materials.

Keep containers securely sealed. Avoid physical damage to containers.

Always wash hands with soap and water after handling.

Work clothes should be laundered separately.

Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

Recommended Storage Methods: Metal can; metal drum. Metal safety cans.

Packing as supplied by manufacturer.

Plastic containers may only be used if approved for flammable liquid.

Check that containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.

General exhaust is adequate under normal operating conditions.

Local exhaust ventilation may be required in special circumstances.

If risk of overexposure exists, wear NIOSH-approved respirator. NIOSH-approved respirator (supplied air type) may be required in special circumstances. Correct fit is essential to ensure adequate protection.

Provide adequate ventilation in warehouses and enclosed storage areas.

In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; or as required, chemical goggles.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Barrier cream with polyethylene gloves. Wear chemical protective gloves, eg. PVC.

Wear safety footwear.

Do NOT use this product to clean the skin.

Respiratory Protection:

Exposure Range >100 to <500 ppm: Air Purifying, Negative Pressure, Half Mask

Exposure Range 500 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Cartridge Color: black

Other: Overalls. Eyewash unit.

Glove Selection Index:

BUTYL/NEOPRENE Best selection

PE/EVAL/PE Best selection

PVA Best selection

TEFLON Best selection

BUTYL Satisfactory; may degrade after 4 hours continuous immersion

NATURAL RUBBER..... Poor to dangerous choice for other than short-term immersion

NEOPRENE..... Poor to dangerous choice for other than short-term immersion

NITRILE+PVC Poor to dangerous choice for other than short-term immersion

PVC..... Poor to dangerous choice for other than short-term immersion

NATURAL+NEOPRENE..... Poor to dangerous choice for other than short-term immersion

NITRILE Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear highly flammable liquid. Sharp mint-like odor. Mixes with alcohol, ether, acetone, and most organic solvents

Physical State: Liquid

pH: Not applicable

Odor Threshold: 0.410 to 192.7 mg/m³

pH (1% Solution): Not applicable

Vapor Pressure (kPa): 1.33 at 30 °C

Boiling Point: 116.8 °C (242 °F) at 760 mm Hg

Vapor Density (Air=1): 3.5

Freezing/Melting Point: -84.7 °C (-120.46 °F)

Formula Weight: 100.16

Volatile Component (% Vol): 100

Specific Gravity (H₂O=1, at 4 °C): 0.80

Water Solubility: 1.91% in water

Evaporation Rate: 1.62 (BuAc=1))

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Toxicity

Oral (rat) LD₅₀: 2080 mg/kg

Irritation

Eye (human): 200 ppm/15m

Skin (rabbit): 500 mg/24h - mild

Eye (rabbit): 40 mg - SEVERE

Eye (rabbit): 500 mg/24h - mild

See RTECS SA 9275000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it may be removed by direct photolysis on soil surfaces, volatilization, or aerobic biodegradation. This compound is also susceptible to extensive leaching and has been detected in landfill leachate. Chemical hydrolysis is not expected to be environmentally significant. If released to water, the primary removal mechanisms are expected to be volatilization (t_{1/2} 15-33 hours) and direct photolysis. Aerobic biodegradation may be of minor importance. It is not expected to undergo chemical oxidation or chemical hydrolysis, bioaccumulate in aquatic organisms or adsorb significantly to suspended solids or sediments in water. In the atmosphere, it will be subject to direct photolysis (t_{1/2} 15 hours in sunlight) and reaction with hydroxyl radical (t_{1/2} 16-17 hours). In photochemical smog situations, it may also react with nitrogen oxides. Acetone is a major photooxidation product, and in the presence of nitrogen oxides, peroxyacetylnitrate (PAN) and methyl nitrate will also be formed.

Ecotoxicity: LC₅₀ Pimephales promelas (fathead minnow) 505 mg/l 96 hr flow-through bioassay, wt 0.12 g, water hardness 45.5 mg/l CaCO₃, temp: 25 +/- 1 °C, pH 7.5, dissolved oxygen greater than 60% of saturation; LD₅₀ Angelaius phoeniceus (Redwinged blackbird) oral 100 mg/kg; LC₅₀ Carassius auratus (goldfish) 460 mg/l/24 hr /Conditions of bioassay not specified

Henry's Law Constant: estimated at 9.4 x10⁻⁵

BCF: estimated at 2 to 5

Biochemical Oxygen Demand (BOD): theoretical 1.8%, 5 days

Octanol/Water Partition Coefficient: log K_{ow} = 1.19

Soil Sorption Partition Coefficient: K_{oc} = estimated at 19 to 106

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.

Follow applicable federal, state, and local regulations.

Incinerate residue at an approved site.

Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Methyl isobutyl ketone

ID: UN1245

Hazard Class: 3 - Flammable and combustible liquid

Packing Group: II - Medium Danger

Symbols:

Label Codes: 3 - Flammable Liquid

Special Provisions: IB2, T4, TP1

Packaging: Exceptions: 150 Non-bulk: 202 Bulk: 242

Quantity Limitations: Passenger aircraft/rail: 5 L Cargo aircraft only: 60 L

Vessel Stowage: Location: B Other:



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U161 Toxic Waste

CERCLA 40 CFR 302.4: Listed per RCRA Section 3001 5000 lb (2268 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Cresols

CAS Number: 1319-77-3

Chemical Formula: C₇H₈O

Structural Chemical Formula: CH₃C₆H₄OH

EINECS Number: 215-293-2

ACX Number: X1001165-1

Synonyms: ACEDE CRESYLIQUE; ACIDE CRESYLIQUE; BACILLOL; COMPONENT 1 (60%): M-CRESOL; COMPONENT 2 (40%): P-CRESOL; 3-CRESOL; 4-CRESOL; CRESOL; PARA-CRESOL; CRESOL, ALL ISOMERS; CRESOL; CRESOLS; CRESOLUM CRUDUM; CRESYLIC ACID; P-CRESYLIC ACID; 1-HYDROXY-4-METHYLBENZENE; HYDROXYMETHYLBENZENE; 4-HYDROXYTOLUENE; P-HYDROXYTOLUENE; HYDROXYTOLUOLE; P-KRESOL; KRESOLE; KRESOLEN; KRESOLUM VENALE; KREZOL; METHYL PHENOL; 1-METHYL-4-HYDROXYBENZENE; P-METHYLHYDROXYBENZENE; 3-METHYLPHENOL; 4-METHYLPHENOL; METHYLPHENOL; P-METHYLPHENOL; P-OXYTOLUENE; PARAMETHYL PHENOL; PHENOL,METHYL-; PHENOL,METHYL-(9CI); TEKRESOL; AR-TOLUENOL; P-TOLUOL; P-TOLYL ALCOHOL; TRICRESOL; TRICRESOLUM; TRIKRESOLUM

General Use: In cresol formaldehyde thermoset synthetic resins. Ore floatation; textiles scouring and degreasing agent; and as fumigant.

As a component in photographic developers.

As an organic intermediate in the manufacture of salicylaldehyde, coumarin, herbicides, surfactants, dyes, plastics, antioxidants, plasticizer tricresyl phosphate, wire and enamel solvents, and phosphate esters.

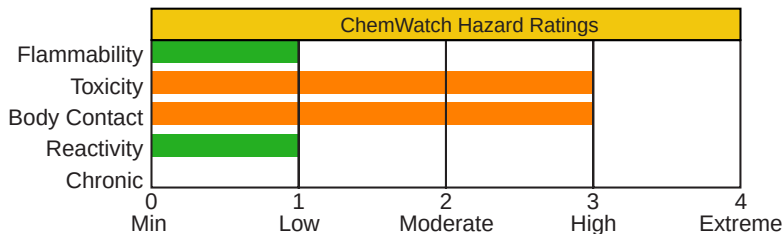
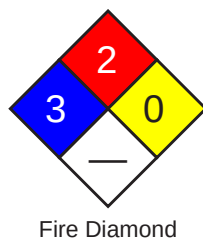
In grinding and cutting fluid formulations where cresols act as bacteriostatic agents.

As a therapeutic agent: local antiseptic, parasiticide, disinfectant, intestinal antiseptic, and sanitising agent (in soaps and emulsions).

Section 2 - Composition / Information on Ingredients

Name	CAS	%
cresols	1319-77-3	100
OSHA PEL TWA: 5 ppm; 22 mg/m ³ ; skin.	NIOSH REL TWA: 2.3 ppm, 10 mg/m ³ .	DFG (Germany) MAK Skin.
ACGIH TLV TWA: 5 ppm; skin.		

Section 3 - Hazards Identification



HMIS	
3	Health
2	Flammability
0	Reactivity

ANSI Signal Word

Danger!



☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless, yellow/pinkish liquid; phenolic odor. Corrosive, causes severe burns to eyes/skin/respiratory tract. Contact with eyes may result in blindness. Chronic Effects: liver/kidney/spleen/pancreatic damage, skin eruptions/dermatitis. Combustible.

Potential Health Effects

Target Organs: eyes, skin, central nervous system (CNS), liver, kidneys

Primary Entry Routes: skin contact/absorption, eye contact/absorption

Acute Effects

Inhalation: The vapor is highly discomforting to the upper respiratory tract and lungs, may cause severe mucous membrane damage and is harmful if inhaled.

Inhalation of vapor may aggravate a pre-existing respiratory condition such as asthma, bronchitis, emphysema.

Pulmonary absorption may lead to systemic toxicity affecting the cardiovascular and central nervous system.

Inhalation of phenol and some of its derivatives may produce profuse perspiration, intense thirst, nausea, vomiting, diarrhea, cyanosis, hyperactivity, stupor, falling blood pressure, hypernea, abdominal pain, hemolysis, convulsions, coma and pulmonary edema with pneumonia. Respiratory failure and kidney damage may follow.

Eye: The material is corrosive to the eyes and is capable of causing severe damage with loss of sight.

Concentrated cresols instilled into the eyes of rabbits caused permanent opacification and vascularization. A 33% solution applied as a drop to rabbit eyes and removed with irrigation within 60 seconds caused moderate and reversible injury.

Some phenol derivatives may produce mild to severe eye irritation with redness, pain and blurred vision. Permanent eye injury may occur; recovery may also be complete or partial.

Skin: The material is corrosive to the skin and it is rapidly absorbed through intact skin and may cause chemical burns if exposure is prolonged.

Bare unprotected skin should not be exposed to this material.

Toxic effects may result from skin absorption.

Exposure limits with "skin" notation indicate that vapor and liquid may be absorbed through intact skin. Absorption by skin may readily exceed vapor inhalation exposure. Symptoms for skin absorption are the same as for inhalation. Contact with eyes and mucous membranes may also contribute to overall exposure and may also invalidate the exposure standard.

Skin absorption produces toxic effects within 30 minutes.

Acute cresol poisoning occurs from exposure by inhalation, combined with ingestion and skin absorption. Signs and symptoms may appear within 20-30 minutes including headache, stomach upset, depression, dizziness, mental confusion, irregular and rapid breathing, weak pulse, muscle weakness, cloudy vision and ringing in the ears.

The symptoms normally disappear after exposure stops. In extreme cases, loss of consciousness, lung damage (edema), damage to the kidney, liver, pancreas and spleen, and death may result.

Phenol and some of its derivatives may produce mild to severe skin irritation on repeated or prolonged contact, producing second and third degree chemical burns. Rapid cutaneous absorption may lead to systemic toxicity affecting the cardiovascular and central nervous system.

Absorption through the skin may result in profuse perspiration, intense thirst, nausea, vomiting, diarrhea, cyanosis (following the formation of methemoglobin), hyperactivity, stupor, falling blood pressure, hypernea, abdominal pain, hemolysis, convulsions, coma and pulmonary edema followed by pneumonia. Respiratory failure and kidney damage may follow.

Ingestion: The material is highly discomforting to the gastrointestinal tract, may cause severe mucous membrane damage and may be harmful if swallowed.

Ingestion may result in nausea, abdominal irritation, pain and vomiting.

Several cases of ingestion have shown cresol to be corrosive to body tissues and to cause toxic effects on the vascular system, liver, kidneys and pancreas.

Some phenol derivatives may produce mild to severe damage within the gastrointestinal tract. Phenolic groups with ortho and para positions free from substitution are reactive; this is because the ortho and para positions on the aromatic ring are highly activated by the phenolic hydroxyl group and are therefore readily substituted.

Severe phenol ingestions cause hypotension, coma, ventricular dysrhythmias, seizures and white coagulative chemical burns.

Absorption may result in profuse perspiration, intense thirst, nausea, vomiting, diarrhea, cyanosis (following the formation of methemoglobin), hyperactivity, stupor, falling blood pressure, hypernea, abdominal pain, hemolysis, convulsions, coma and pulmonary edema followed by pneumonia.

Respiratory failure and kidney damage may follow. Phenol does not uncouple oxidative phosphorylation like dinitrophenol and pentachlorophenol and thus does not cause a heat exhaustion-like syndrome.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: Symptoms of chronic poisoning are abundant production of saliva, vomiting, diarrhea, loss of appetite, headache, dizziness, mental disturbances and fainting. Contact dermatitis may also occur.

Workers exposed to cresol vapor for 1.5 to 3 years experienced headaches that were frequently accompanied by nausea and vomiting. Other symptoms included elevated blood pressure, signs of impaired kidney function, blood calcium imbalance and marked tremors.

Isomers of cresol are tumor promoters.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: If spilled on skin remove contaminated clothing, swab repeatedly with glycerin, PEG (polyethylene glycol), or PEG/ methylated spirit mixture or if necessary with methylated spirit alone.

Contamination of skin with phenol and some of its derivatives may produce rapid collapse and death. After skin contamination, keep patient under observation for at least 24-48 hours. Phenol-decontaminating fluid is more effective than water in removing phenol from the skin and retarding absorption; olive oil or vegetable oil may also be used; do not use mineral oil. Alcohols (methylated spirit, for example) may enhance absorption and their use alone may be ill-advised; some authorities, however, continue to advise the use of such treatment. Rapid water dilution of phenol burns may increase systemic absorption by decreasing the extent of the coagulum and thus allowing greater absorption.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Preplacement and annual medical examinations are recommended for workers exposed to cresol. Preplacement examinations should include:

- (1) work histories evaluating preexisting disorders particularly of the lungs, liver, kidneys, pancreas, nervous and cardiovascular systems, and skin.
 - (2) physical examination with emphasis on the lungs, liver, kidneys, pancreas, skin, and nervous and cardiovascular systems.
 - (3) urinalysis that includes a microscopic examination.
 - (4) additional tests such as complete blood counts, and liver and kidney function tests.
- Annual examinations should include the above tests, and monitor cases of skin abnormalities, such as scaling, crusting, or irritation.

For acute or short-term repeated exposures to phenols/ cresols:

1. Phenol is absorbed rapidly through lungs and skin. Massive skin contact may result in collapse and death.
2. Ingestion may result in ulceration of upper respiratory tract; perforation of esophagus and/or stomach, with attendant complications, may occur. Esophageal stricture may occur.
3. An initial excitatory phase may present. Convulsions may appear as long as 18 hours after ingestion. Hypotension and ventricular tachycardia that require vasopressor and antiarrhythmic therapy, respectively, can occur.
4. Respiratory arrest, ventricular dysrhythmias, seizures and metabolic acidosis may complicate severe phenol exposures so the initial attention should be directed towards stabilization of breathing and circulation with ventilation, intubation, intravenous lines, fluids and cardiac monitoring as indicated.
5. Vegetable oils retard absorption; do NOT use paraffin oils or alcohols. Gastric lavage, with endotracheal intubation, should be repeated until phenol odor is no longer detectable; follow with vegetable oil. A saline cathartic should then be given. ALTERNATELY: Activated charcoal (1g/kg) may be given. A cathartic should be given after oral activated charcoal.
6. Severe poisoning may require slow intravenous injection of methylene blue to treat methemoglobinemia.
7. Renal failure may require hemodialysis.
8. Most absorbed phenol is biotransformed by the liver to ethereal and glucuronide sulfates and is eliminated almost completely after 24 hours.

BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

<u>Determinant</u>	<u>Index</u>	<u>Sampling Time</u>	<u>Comments</u>
Total phenol in blood	250 mg/gm creatinine	End of shift	B, NS

B: Background levels occur in specimens collected from subjects NOT exposed

NS: Non-specific determinant; also seen after exposure to other materials.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: 86 °C

Autoignition Temperature: 593 °C

LEL: 1.1% v/v

UEL: meta or para 1.4% v/v

Extinguishing Media: Water spray or fog; alcohol stable foam; dry chemical powder; carbon dioxide.

General Fire Hazards/Hazardous Combustion Products: Combustible. Slight fire hazard when exposed to heat or flame.

Heating may cause expansion or decomposition leading to violent rupture of containers.

On combustion, may emit toxic fumes of carbon monoxide (CO).

May emit acrid smoke.

Mists containing combustible materials may be explosive.

Hot organic vapors or mist are capable of sudden spontaneous combustion when mixed with air even at temperatures below their published autoignition temperatures. The temperature of ignition decreases with increasing vapor volume and vapor/air contact times and is influenced by pressure change.

Ignition may occur under elevated-temperature process conditions especially in processes performed under vacuum subjected to sudden ingress of air or in processes performed at elevated pressure, where sudden escape of vapors or mists to the atmosphere occurs.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways.

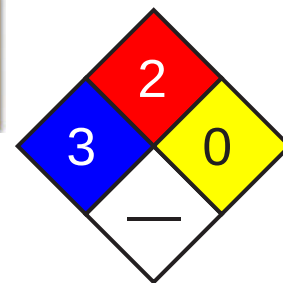
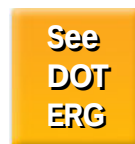
Use fire fighting procedures suitable for surrounding area.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protected location.

If safe to do so, remove containers from path of fire.

Equipment should be thoroughly decontaminated after use.



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Clean up all spills immediately. Environmental hazard - contain spillage.

Absorbs water and carbon dioxide from the air.

Avoid breathing vapors and contact with skin and eyes.

Wear fully protective PVC clothing and breathing apparatus.

Remove all ignition sources.

Wipe up and absorb small quantities with vermiculite or other absorbent material.

Trowel up/scrape up.

Large Spills: Clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways.

Stop leak if safe to do so.

Contain spill with sand, earth or vermiculite.

Collect recoverable product into labeled containers for recycling.

Neutralize/decontaminate residue.

Collect solid residues and seal in labeled drums for disposal.

Wash area and prevent runoff into drains.

After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).



Section 7 - Handling and Storage

Handling Precautions: Use good occupational work practices. Observe manufacturer's storing and handling recommendations.

Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Avoid all personal contact, including inhalation.

Avoid generating and breathing mist and vapor.

Wear protective clothing when risk of exposure occurs.

Avoid smoking, bare lights, heat or ignition sources.

Vapor may travel a considerable distance to source of ignition.
 Use in a well-ventilated area.
 Avoid contact with incompatible materials.
 Handle and open container with care.
 DO NOT spray directly on humans, exposed food or food utensils.
 When handling, DO NOT eat, drink or smoke.
 Avoid physical damage to containers.
 Always wash hands with soap and water after handling. Work clothes should be laundered separately.

Recommended Storage Methods: Check that containers are clearly labeled.

Packaging as recommended by manufacturer.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Local exhaust ventilation usually required.

If risk of overexposure exists, wear NIOSH-approved respirator.

Correct fit is essential to obtain adequate protection.

Provide adequate ventilation in warehouse or closed storage area.

Personal Protective Clothing/Equipment:

Eyes: Chemical goggles. Full face shield.

DO NOT wear contact lenses. Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Rubber gloves; Impervious gloves.

Rubber boots.

Respiratory Protection:

Exposure Range >5 to 50 ppm: Air Purifying, Negative Pressure, Half Mask

Exposure Range >50 to <250 ppm: Air Purifying, Negative Pressure, Full Face

Exposure Range 250 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Cartridge Color: black with dust/mist prefilter (use P100 or consult supervisor for appropriate dust/mist prefilter)

Other: Acid resistant overalls.

Ensure there is ready access to a safety shower.

Eyewash unit.

PVC apron.

Glove Selection Index:

BUTYL Best selection

VITON Best selection

SARANEX-23 Best selection

NEOPRENE..... Satisfactory; may degrade after 4 hours continuous immersion

PE..... Satisfactory; may degrade after 4 hours continuous immersion

NITRILE Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless, yellow, pink or brown liquid (turns brown on exposure to air). Crystals colorless to yellow. Semi sweet tar-like or phenolic odor. The odor threshold is 5 ppm. Material is hygroscopic, absorbs moisture from surrounding air. Soluble or miscible in alcohol, glycol, dilute alkalies, organic solvents, vegetable oils, ether, benzene and glycerol.

Physical State: Liquid

pH: < 7

Odor Threshold: 0.012 to 22.000 mg/m³

Boiling Point: 191 °C (376 °F) to 203 °C (397 °F)

Vapor Pressure (kPa): <0.13 at 38 °C

Freezing/Melting Point: 11 °C (51.8 °F) to 35 °C (95 °F)

Vapor Density (Air=1): 3.72

Formula Weight: 108.15

Water Solubility: 1 part in about 50 parts water

Specific Gravity (H₂O=1, at 4 °C): 1.03 - 1.05

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid reaction with oxidizing agents.

Segregate from strong alkalis, oleum, nitric acid and chlorosulfonic acid.

Section 11 - Toxicological Information

Toxicity

Oral (man) TD_{Lo} : 177 mg/kg
 Oral (rat) LD_{50} : 1454 mg/kg
 Dermal (rabbit) LD_{50} : 2000 mg/kg

Irritation

Nil Reported

See RTECS GO 5950000, for additional data.

Section 12 - Ecological Information

Environmental Fate: When released to the atmosphere, cresols will degrade by reacting with photochemically produced hydroxyl radicals during the day (half-life 8-10 hr). However, at nighttime reaction with nitrate radicals predominate (half-life 2-5 min). In addition, cresols are soluble compounds and will be scavenged by rain. When released into natural waters, degradation generally occurs within 8 hours after an acclimation period of up to several days. However, in oligotrophic lakes, estuarine, and marine waters the degradation process would be expected to take longer. Volatilization, adsorption, and bioconcentration are not important. Cresols are mobile in soil but biodegradation is probable although data are scant.

Ecotoxicity: LC_{50} Gammarus fasciatus 7.0 mg/l/48 hr (Immature stage); TL_m Shrimp 10-100 ppm/48 hr (salt water) /Conditions of bioassay not specified; TL_m Bluegill 24 mg/l/96 hr (fresh water) /Conditions of bioassay not specified

Henry's Law Constant: calculated at 8.7×10^{-7}

BCF: calculated at 18

Biochemical Oxygen Demand (BOD): meta- 170%, 5 days

Octanol/Water Partition Coefficient: $\log K_{ow} = 1.94$ to 1.96

Soil Sorption Partition Coefficient: K_{oc} = brookston clay loam soil 22 to 49

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options.

Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

Evaporate or incinerate residue at an approved site or bury spilled material in an authorized landfill.

Return empty containers to supplier or bury empty containers at an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Cresols, liquid

ID: UN2076

Hazard Class: 6.1 - Poisonous materials

Packing Group: II - Medium Danger

Symbols:

Label Codes: 6.1 - Poison or Poison Inhalation Hazard if inhalation hazard, Zone A or B, 8 - Corrosive

Special Provisions: IB8, IP2, IP4, T7, TP2

Packaging: Exceptions: None **Non-bulk:** 202 **Bulk:** 243

Quantity Limitations: Passenger aircraft/rail: 1 L **Cargo aircraft only:** 30 L

Vessel Stowage: Location: B **Other:**



Shipping Name and Description: Cresols, solid

ID: UN2076

Hazard Class: 6.1 - Poisonous materials

Packing Group: II - Medium Danger

Symbols:

Label Codes: 6.1 - Poison or Poison Inhalation Hazard if inhalation hazard, Zone A or B, 8 - Corrosive

Special Provisions: IB8, IP2, IP4, T7, TP2

Packaging: Exceptions: None **Non-bulk:** 202 **Bulk:** 243

Quantity Limitations: Passenger aircraft/rail: 1 L **Cargo aircraft only:** 30 L

Vessel Stowage: Location: B **Other:**



Section 15 - Regulatory Information**EPA Regulations:****RCRA 40 CFR:** Listed U052 Toxic Waste**CERCLA 40 CFR 302.4:** Listed per CWA Section 311(b)(4), per RCRA Section 3001 100 lb (45.35 kg)**SARA 40 CFR 372.65:** Listed**SARA EHS 40 CFR 355:** Not listed**TSCA:** Listed**Section 16 - Other Information**

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Acenaphthene

CAS Number: 83-32-9

Chemical Formula: C₁₂H₁₀

Structural Chemical Formula: C₁₀H₆(CH₂)₂

EINECS Number: 201-469-6

ACX Number: X1001052-9

Synonyms: ACENAPHTHENE; ACENAPHTHYLENE,1,2-DIHYDRO-; 1,8-DIHYDROACENAPHTHALENE; 1,2-DIHYDROACENAPHTHYLENE; 1,8-DIHYDROACENAPHTHYLENE; 1,8-ETHYLENENAPHTHALENE; ETHYLENENAPHTHALENE; NAPHTHYLENEETHYLENE; PERI-ETHYLENE NAPHTHALENE; PERIETHYLENENAPHTHALENE

Derivation: By passing ethylene and benzene or naphthalene through a red hot tube; by heating tetrahydroacenaphthene with sulfur to 356 °F (180 °C); or by reacting acenaphthenone or acenaphthenequinone by high-pressure hydrogenation in decalin with nickel at 356 to 464 °F (180 to 240 °C). Occurs as a by-product in coal tar production during the high-temperature carbonization or coking of coal.

General Use: Used as an intermediate for dyes, pharmaceuticals, insecticides, fungicides, and plastics.

Section 2 - Composition / Information on Ingredients

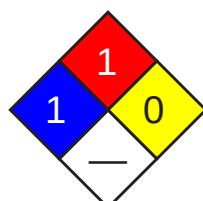
Name	CAS	%
Acenaphthene	83-32-9	ca 98% wt

OSHA PEL

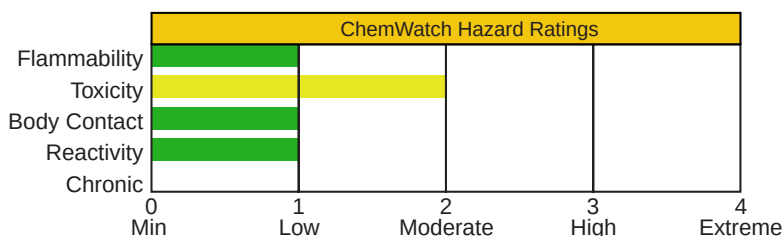
NIOSH REL

ACGIH TLV

Section 3 - Hazards Identification



Fire Diamond



HMIS	
①	Health
①	Flammability
①	Reactivity

ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

White, needle-like crystals. Irritating to eyes/skin/respiratory tract. Also causes: vomiting if large amounts are ingested. Chronic: possible mutagenic activity (animal studies). Combustible.

Potential Health Effects

Target Organs: Eyes, skin, respiratory tract.

Primary Entry Routes: Inhalation, skin and eye contact.

Acute Effects

Inhalation: Irritation of the respiratory tract may occur.

Eye: Irritation may occur.

Skin: Irritation may occur.

Ingestion: Ingestion of large amounts may cause vomiting. Irritation of the gastrointestinal tract may occur.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: Pre-existing skin disorders.

Chronic Effects: None reported.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water. Consult a physician or ophthalmologist if pain or irritation persist.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water followed by a thorough soap and water wash.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water to dilute. Vomiting may be spontaneous if large amounts are ingested.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treatment is symptomatic and supportive.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: Combustible

Autoignition Temperature: None reported.

LEL: None reported.

UEL: None reported.

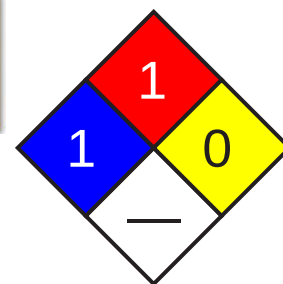
Flammability Classification: Combustible Solid

Extinguishing Media: Use dry chemical, carbon dioxide, water spray, fog, or foam.

General Fire Hazards/Hazardous Combustion Products: Carbon oxide(s).

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

See
DOT
ERG



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, isolate and ventilate area.

Small Spills: *Do not* sweep! Carefully scoop up or vacuum (with appropriate filter) and place in suitable containers.

Large Spills: Flush spills with water to containment area for later disposal. *Do not* release into sewers or waterways. Damp mop any residue.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: Use only with ventilation adequate to prevent airborne hazards. *Do not* use near heat and ignition sources.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using acenaphthene, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in a cool, dry, well-ventilated area away from heat, ignition sources and incompatibles (Sec. 10).

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where possible, enclose all processes to prevent dust dispersion into work area. To prevent static sparks, electrically ground and bond all equipment used with and around acenaphthene. Provide general or local exhaust ventilation systems to maintain airborne concentrations at least as low as those given for *nuisance dusts*. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Consider periodic medical exams to determine if any irritation upon exposure to acenaphthene has occurred.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove acenaphthene from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: White, needle-like crystals.

Physical State: Solid

Odor Threshold: 0.5048 mg/m³

Vapor Pressure (kPa): < 0.02 mm Hg at 68 °F (20 °C);
10 mm Hg at 268 °F (131 °C)

Formula Weight: 154.21

Specific Gravity (H₂O=1, at 4 °C): 1.0242 at (194 °F)
90 °C

Refractive Index: 1.6048 at 212 °F (100 °C)

Boiling Point: 531.5 °F (277.5 °C)

Freezing/Melting Point: 200.5 °F (93.6 °C)

Water Solubility: 100 mg/L

Other Solubilities: Soluble as 1 g/ 31 mL (ethanol), 56 mL (methanol), 25 mL (propanol), 2.5 mL (chloroform), 5 mL (benzene & toluene); 3.2 g/100 mL glacial acetic acid.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Acenaphthene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization does not occur. Exposure to heat, ignition sources, and incompatibles.

Storage Incompatibilities: Acenaphthene reacts with molecular oxygen in the presence of alkali-earth metal bromides to form acenaphthequinone; reacts with ozone in the presence of alkali-earth metal hydroxides to form 1,8-naphthaldehyde carboxylic acid; and is oxidized to aromatic alcohols and ketones by reaction with transition metal catalysts.

Hazardous Decomposition Products: Thermal oxidative decomposition of acenaphthene can produce carbon oxide(s) and thick, acrid smoke.

Section 11 - Toxicological Information

Other Effects:

Microorganisms (species unspecified): 3 mg (-S9) caused mutation.

Rat, intraperitoneal, LD₅₀: 600 mg/kg.

See RTECS AB1000000, for additional data.

Section 12 - Ecological Information

Environmental Fate: In soil, acenaphthene will biodegrade under aerobic conditions with a half-life of 10 to 60 days. A soil absorption coefficient of 2065 to 3230 indicates slight mobility. In water, biodegradation will occur under aerobic conditions with a half-life of 1 to 25 days, as well as photolysis in direct sunlight. Volatilization is another means of removal with half-lives of 11 hr from a model river and 39 days from a model pond which considers the effect of adsorption. In air, acenaphthene reacts with photochemically-produced hydroxyl radicals with a half-life of 7.2 hr.

Ecotoxicity: *Pimephales promelas* (fathead minnow), LC₅₀ = 1700 µg/L/72 hr, 1600 µg/L/96 hr; *Salmo gairdneri* (rainbow trout), LC₅₀ = 1570 µg/L/24 hr, 1130 µg/L/48 hr, 800 µg/L/72 hr, 670 µg/L/96 hr.

Henry's Law Constant: 1.55 x 10⁻⁴ atm/m³/mole at 77 °F (25 °C)

Octanol/Water Partition Coefficient: log K_{ow} = 3.92

Section 13 - Disposal Considerations

Disposal: Acenaphthene is a good candidate for rotary-kiln incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information**DOT Hazardous Materials Table Data (49 CFR 172.101):****Shipping Name and Description:** Environmentally hazardous substances, solid, n.o.s.**ID:** UN3077**Hazard Class:** 9 - Miscellaneous hazardous material**Packing Group:** III - Minor Danger**Symbols:** G - Technical Name Required**Label Codes:** 9 - Class 9**Special Provisions:** 8, 146, B54, IB8, N20**Packaging:** **Exceptions:** 155 **Non-bulk:** 213 **Bulk:** 240**Quantity Limitations:** **Passenger aircraft/rail:** No limit **Cargo aircraft only:** No limit**Vessel Stowage:** **Location:** A **Other:****Section 15 - Regulatory Information****EPA Regulations:****RCRA 40 CFR:** Not listed**CERCLA 40 CFR 302.4:** Listed per CWA Section 307(a) 100 lb (45.35 kg)**SARA 40 CFR 372.65:** Not listed**SARA EHS 40 CFR 355:** Not listed**TSCA:** Listed**Section 16 - Other Information**

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Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Acenaphthylene

CAS Number: 208-96-8

Chemical Formula: C₁₂H₈

EINECS Number: 205-917-1

ACX Number: X1001734-6

Synonyms: ACENAPHTHYLENE; CYCLOPENTA(DE)NAPHTHALENE

Derivation: Acenaphthylene is formed upon catalytic dehydration of acenaphthene. It was also extracted from oil furnace black. Not produced commercially.

General Use: Acenaphthylene is a constituent of coal tar and crude oil, a product of combustion, and can be released to the environment via natural fires associated with lightning, volcanic activity, and spontaneous combustion.

Section 2 - Composition / Information on Ingredients

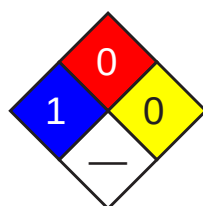
Name	CAS	%
Acenaphthylene	208-96-8	ca 99+% wt

OSHA PEL

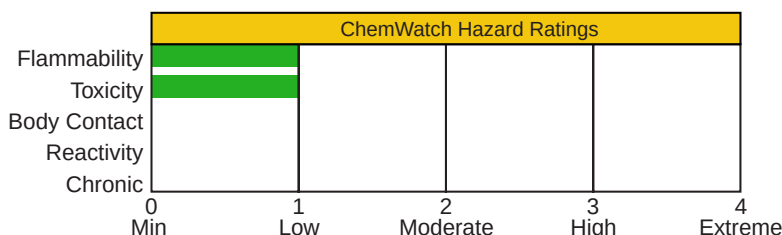
NIOSH REL

ACGIH TLV

Section 3 - Hazards Identification



Fire Diamond



HMIS	
1	Health
0	Flammability
0	Reactivity

ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Yellow crystalline solid. Irritating to eyes/skin/respiratory tract. Chronic: mutation effects, possible kidney and bladder cancer.

Potential Health Effects

Target Organs: Skin, eyes, blood, and respiratory and autonomic nervous systems

Primary Entry Routes: Inhalation, ingestion, skin/eye contact

Acute Effects

Inhalation: Causes irritation of the respiratory system and mucous membranes.

Eye: Contact causes irritation.

Skin: Contact causes irritation and burning.

Ingestion: No acute effects reported.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: Liver, kidney, and bladder damage.

Chronic Effects: Polycyclic aromatic hydrocarbons (PAH's) may cause coughing and bronchitis, eye photosensitivity, coal tar warts, erythema, dermal burns, acneiform lesions, and photosensitization of the skin. They may also cause leukoplakia, mild hepatotoxicity or mild nephrotoxicity (in animals), hematuria, and in rats - agranulocytosis, anemia, and pancytopenia. PAH's have been associated with kidney, bladder, lung, gastrointestinal tract, and skin cancer. PAH's may cross the placenta and are excreted in breast milk. Laboratory experiments have shown mutagenic effects.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult a physician or ophthalmologist if pain, irritation, swelling, lacrimation, or photophobia persist.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water. *Do not* induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Arterial blood gases, pulmonary function, chest x-ray, and other monitoring may be indicated, based on the patient's presentation and the exposure characteristics. If cough or difficulty in breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Inhalation exposure to PAH's may be complicated by exposure to other substances which produce acute respiratory and systemic effects. Treat according to clinical presentation and exposure history. If bronchospasm and wheezing occur, consider treatment with inhaled sympathomimetic agent. Carefully observe patients with inhalation exposure for the developments of any systemic signs or symptoms and administer symptomatic treatment as necessary.

Section 5 - Fire-Fighting Measures

Flash Point: Data not found.

Autoignition Temperature: Data not found.

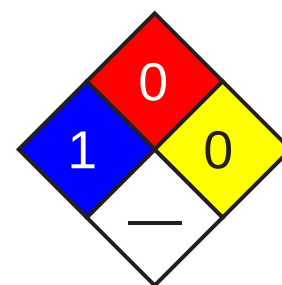
LEL: Data not found.

UEL: Data not found.

Extinguishing Media: Extinguish with water spray, carbon dioxide, dry chemical powder or appropriate foam.

General Fire Hazards/Hazardous Combustion Products: Toxic fumes of carbon monoxide and carbon dioxide can be released.

Fire-Fighting Instructions: *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources. Isolate and ventilate area, deny entry, stay upwind. Cleanup personnel should protect against exposure (Sec. 8). Most commonly produced as a product of incineration or combustion.

Small Spills: Carefully sweep, scoop up, or vacuum (with a HEPA filter). Avoid raising dust.

Large Spills: For large spills, dike far ahead of spill for later disposal. *Do not* release into sewers or waterways.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Wear personal protective clothing and equipment to prevent vapor inhalation and contact with skin or eyes (Sec. 8). Avoid prolonged or repeated exposure.

Never eat, drink, or smoke in work areas. Workers subjected to skin contact with acenaphthylene should wash any areas of the body that may have contacted the material, whether or not contact actually occurred. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed containers in a cool, well-ventilated area away from heat, light, ignition sources, and incompatibles.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose operations to avoid dispersion into the work area. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Educate workers about the health and safety hazards associated with this material. Train in work practices which minimize exposure. Identify areas in which exposure to acenaphthylene may occur by signs or other appropriate means and restrict access to these areas to authorized persons only. Routine monitoring and physical assessments (e.g., complete blood count, hepatic and renal function tests, chest x-ray and pulmonary function tests, dermal assessments) of individuals with significant exposure is recommended. Make available to employees exposed to acenaphthylene a complete history and physical examination with emphasis on the oral cavity, respiratory tract, bladder, and kidneys. Examine the skin for evidence of chronic disorders, for premalignant and malignant lesions, and evidence of hyperpigmentation or photosensitivity. Obtain a urinalysis including specific gravity, albumin, glucose, and a microscopic examination of centrifuged sediment, as well as a test for red blood cells. Also perform a complete blood count to search for leukemia and aplastic anemia. Employees having 5 or more years of exposure or who are 45 years of age or older should have a urinary cytology exam. Employees having 10 or more years of exposure or who are 45 year of age or older should have a sputum cytology examination, a 14" x 17" chest roentgenogram, and periodic measure of FVC and FEV (1 sec).

Personal Protective Clothing/Equipment: Wear chemically protective gloves, rubber boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear splash-proof chemical safety goggles with face shield (8 in. min), per OSHA eye- and face- protection regulations (29 CFR 1910.133). Contact lenses are not protective eye devices. Appropriate eye protection must be worn in conjunction with, or instead of, contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. The following recommendations are for coal tar pitch volatiles: For exposure to concentrations $\leq 2 \text{ mg/m}^3$, wear a chemical cartridge respirator with an organic vapor cartridge(s) and with a fume or high efficiency filter or any supplied-air respirator or any SCBA; for exposure to concentrations $\leq 10 \text{ mg/m}^3$, wear a chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s) and with a fume or high efficiency filter, or a gas mask with a chin style or a front- or back- mounted organic vapor canister and with a full facepiece and a fume or high efficiency filter, or any supplied-air respirator with a full facepiece, helmet, or hood or any SCBA with a full facepiece; for exposure to concentrations $\leq 200 \text{ mg/m}^3$, wear a type C supplied-air respirator operated in pressure-demand or other positive-pressure or continuous flow mode, or a powered air-purifying respirator with an organic vapor cartridge and a high efficiency particulate filter; for exposure to concentrations $\leq 400 \text{ mg/m}^3$, wear a type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive-pressure mode, or with a full facepiece, helmet, or hood operated in continuous flow mode. For exposure to concentrations $\geq 400 \text{ mg/m}^3$ or for emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Place clothing contaminated with acenaphthylene in closed containers for storage until it can be discarded or laundered by someone informed of the hazards of working with acenaphthylene. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Yellow

Physical State: Crystalline solid; prisms from ether; plates from alcohol

Vapor Pressure (kPa): 9.12×10^{-4} mm Hg at 77 °F (25 °C)

Formula Weight: 152.20

Density: 0.8988 g/cm^3 at 16 °C/2°C

Boiling Point: 509 °F (265 °C) to 527 °F (275 °C)

Freezing/Melting Point: 194 °F (90 °C) to 197.6 °F (92 °C)

Ionization Potential (eV): $8.22 \pm 0.2 \text{ eV}$

Water Solubility: Slightly soluble; 3.93 mg/L distilled water at 77 °F (25 °C)

Other Solubilities: Very soluble in 95% ethanol, benzene, and ether.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Acenaphthylene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Avoid contact with chemical incompatibles, heat, and sources of ignition.

Storage Incompatibilities: Include strong oxidizing agents.

Hazardous Decomposition Products: Thermal oxidative decomposition of acenaphthylene can produce toxic fumes of carbon monoxide and carbon dioxide.

Section 11 - Toxicological Information

Acute Oral Effects:

Mouse, oral, LD₅₀: 1760 mg/kg produced toxic effects of parasympathomimetic, respiratory depression, hemorrhage.

Other Effects:

Multiple Dose Toxicity Effects: Rat, inhalation, 500 µg/m³ administered for 4 hours over 17 weeks intermittently produced toxic effects: lung, thorax, or respiration - structural or functional change in trachea or bronchi; lung, thorax, or respiration - bronchiolar dilation; nutritional and gross metabolic - weight loss or decreased weight gain.

Genetic Effects: Bacteria - *S Typhimurium*, 1 mmol/L/2 hr (-S9) induced mutations in microorganisms.

Human, lymphocyte, 15 mg/L induced mutations in mammalian somatic cells.

Rat, intraperitoneal, LD₅₀: 1700 mg/kg.

See RTECS AB1254000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Acenaphthylene is expected to biodegrade in the environment. It is not expected to hydrolyze or bioconcentrate in the environment, yet may undergo direct photolysis in sunlit environmental media. Volatilization from environmental waters may be important. It is expected to exist entirely in the vapor phase in ambient air. In the atmosphere, reactions with photochemically-produced hydroxyl radicals and ozone are likely to be important fate processes. Acenaphthylene is expected to have a low to slight mobility in soil. It could adsorb to, run off with, and bioaccumulate in, soil. In aquatic systems, it may partition from the water column to organic matter contained in sediments and suspended solids.

Ecotoxicity: Data not found.

Henry's Law Constant: 1.13x10⁻⁵ (calculated)

BCF: 2.11 (estimated)

Octanol/Water Partition Coefficient: log K_{ow} = 4.07

Soil Sorption Partition Coefficient: K_{oc} = 950 to 3315 (estimated)

Section 13 - Disposal Considerations

Disposal: Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber or consider chemical precipitation. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable federal, state, and local regulations. Handle empty containers carefully as hazardous residues may still remain. Triple rinse containers and dispose of wash wastewater appropriately.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Not specifically listed.

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Not listed

CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 5000 lb (2268 kg)

SARA 40 CFR 372.65: Not listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Acetone

CAS Number: 67-64-1

Chemical Formula: C₃H₆O

Structural Chemical Formula: CH₃COCH₃

EINECS Number: 200-662-2

ACX Number: X1001253-6

Synonyms: ACETON; ACETONE; CHEVRON ACETONE; DIMETHYL KETONE; DIMETHYLFORMALDEHYDE; DIMETHYLKETAL; EPA PESTICIDE CHEMICAL CODE 004101; KETONE PROPANE; KETONE,DIMETHYL; BETA-KETOPROPANE; METHYL KETONE; 2-PROPANONE; PROPANONE; PYROACETIC ACID; PYROACETIC ETHER

General Use: Solvent for fats, oils, waxes, resins, rubber, plastics, lacquers.

Used in manufacture of methyl isobutyl ketone, mesityl oxide, acetic acid, diacetone alcohol, isoprene. Used in solvent extraction processes.

Solvent in the manufacture of explosives and rayon. Component of adhesives, glues, cleaning solvents, lacquer thinners, nail polish, paint removers.

Storing acetylene gas (takes up about 24 times its volume of the gas).

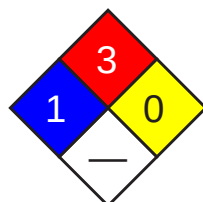
Purifying paraffin and biomedical hardening and dehydrating tissues.

Minor food additive, permitted in USA.

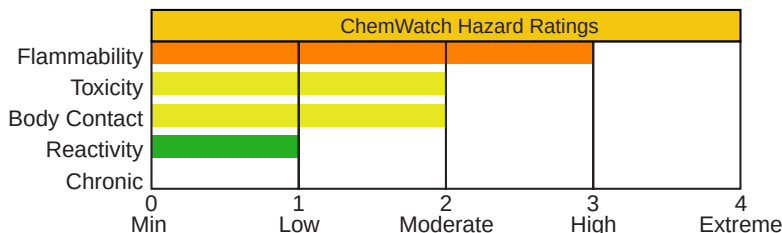
Section 2 - Composition / Information on Ingredients

Name	CAS	%
acetone	67-64-1	95-99.5
OSHA PEL TWA: 1000 ppm; 2400 mg/m ³ .	NIOSH REL TWA: 250 ppm (590 mg/m ³).	DFG (Germany) MAK TWA: 500 ppm; PEAK: 1000 ppm.
ACGIH TLV TWA: 500 ppm; STEL: 750 ppm.	IDLH Level 2500 ppm (10% LEL).	
EU OEL TWA: 500 ppm.		

Section 3 - Hazards Identification



Fire Diamond



ANSI Signal Word

Danger!

HMIS	
①	Health
③	Flammability
①	Reactivity



Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless, highly volatile liquid; sweet odor. Irritating. Other Acute Effects: muscle weakness, mental confusion, coma (high concentrations). Ingestion: GI irritation, kidney/liver damage, metabolic changes, coma. Chronic Effects: dermatitis. Highly flammable.

Potential Health Effects

Target Organs: respiratory system, central nervous system (CNS), skin

Primary Entry Routes: inhalation, skin contact, eye contact, ingestion

Acute Effects

Inhalation: The vapor is discomforting to the upper respiratory tract.

Inhalation hazard is increased at higher temperatures.

Exposure to ketone vapors may produce nose, throat and mucous membrane irritation. High concentrations of vapor may produce central nervous system depression characterized by headache, vertigo, loss of coordination, narcosis and cardiorespiratory failure. Some ketones produce neurological disorders (polyneuropathy) characterized by bilateral symmetrical paresthesia and muscle weakness primarily in the legs and arms.

Symptoms of exposure may include restlessness, headache, vomiting, stupor, low blood pressure and rapid and irregular pulse, eye and throat irritation, weakness of the legs, dizziness and lightheadedness.

Inhalation of high concentrations produces dryness of the mouth and throat, dizziness, nausea, incoordinated movements, loss of coordinated speech, drowsiness, and in extreme cases, coma.

Inhalation of acetone vapors over long periods causes irritation of the respiratory tract, coughing, headache. Acetone concentrations of 52200 ppm for 1 hour produced narcosis in rats and fatalities at 126600 ppm.

Eye: The liquid may produce eye discomfort and is capable of causing temporary impairment of vision and/or transient eye inflammation, ulceration.

The vapor is discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid is discomforting to the skin if exposure is prolonged and may cause drying of the skin, which may lead to dermatitis.

Toxic effects may result from skin absorption.

Open cuts, abraded or irritated skin should not be exposed to this material.

The material may accentuate any pre-existing skin condition.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid is highly discomforting and mildly toxic if swallowed but may be harmful if swallowed in quantity.

Small amounts or low dose rates are regarded as practically non-harmful.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.

Workers exposed to 700 ppm acetone for 3 hours/day for 7-15 years showed inflammation of the respiratory tract, stomach and duodenum, attacks of giddiness and loss of strength. Exposure to acetone may enhance liver toxicity of chlorinated solvents.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush with fresh running water.

Ensure irrigation under the eyelids by occasionally lifting upper and lower lids. If pain persists or recurs seek medical attention.

Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Rinse mouth out with plenty of water.

Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to acetone:

1. Symptoms of acetone exposure approximate ethanol intoxication.

2. About 20% is expired by the lungs and the rest is metabolized.

Alveolar air half-life is about 4 hours following two hour inhalation at levels near the Exposure Standard; in overdose, saturable metabolism and limited clearance, prolong the elimination half-life to 25-30 hours.

3. There are no known antidotes and treatment should involve the usual methods of decontamination followed by supportive care.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: -20 °C

Autoignition Temperature: 465 °C

LEL: 2.15% v/v

UEL: 13% v/v

Extinguishing Media: Water spray or fog; alcohol stable foam.

Dry chemical powder.

Bromochlorodifluoromethane (BCF) (where regulations permit).

Carbon dioxide.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.

Severe fire hazard when exposed to heat, flame and/or oxidizers.

Vapor forms an explosive mixture with air.

Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.

Heating may cause expansion/decomposition with violent rupture of containers.

On combustion, may emit toxic fumes of carbon monoxide (CO). Other combustion products include carbon dioxide (CO₂).

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

PLEASE NOTE: 10% of acetone in water has a flash point below 20 deg. C.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

Fight fire from a safe distance, with adequate cover.

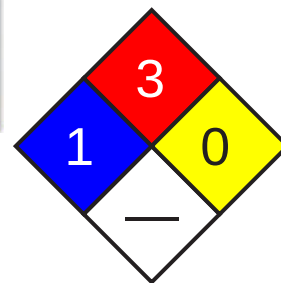
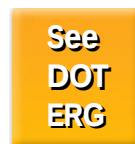
If safe, switch off electrical equipment until vapor fire hazard removed.

Use water delivered as a fine spray to control the fire and cool adjacent area. Avoid spraying water onto liquid pools.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protective location.

If safe to do so, remove containers from path of fire.



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.

Avoid breathing vapors and contact with skin and eyes.

Control personal contact by using protective equipment.

Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: Clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

Avoid breathing vapors and contact with skin and eyes.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

Shut off all possible sources of ignition and increase ventilation.

Water spray or fog may be used to disperse vapor.

Stop leak if safe to do so. Contain spill with sand, earth or vermiculite.

Collect residues and place in flammable waste container.

Any electric cleaning equipment must be explosion proof.

Wash spill area with large quantities of water.

If contamination of drains or waterways occurs, advise emergency services.

After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).



Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.

Wear protective clothing when risk of exposure occurs.

Use in a well-ventilated area. Prevent concentration in hollows and sumps.

DO NOT enter confined spaces until atmosphere has been checked.

Avoid smoking, bare lights, heat or ignition sources.

When handling, DO NOT eat, drink or smoke.

Vapor may ignite on pumping or pouring due to static electricity.

DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.

Avoid contact with incompatible materials.

Keep containers securely sealed. Avoid physical damage to containers.

Always wash hands with soap and water after handling.

Work clothes should be laundered separately.

Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.

Check all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear. Use in a well-ventilated area. Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.

None required when handling small quantities. OTHERWISE: If inhalation risk of overexposure exists, wear NIOSH-approved organic-vapor respirator.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; or as required, chemical goggles.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Barrier cream with polyethylene gloves or Butyl rubber gloves or Neoprene rubber gloves.

Safety footwear.

Respiratory Protection:

Exposure Range >1000 to <2500 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face

Exposure Range 2500 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Note: use ov (black) cartridge for nuisance(<1000)

Other: Overalls. Ensure that there is ready access to eye wash unit and Ensure there is ready access to an emergency shower.

Glove Selection Index:

BUTYL/NEOPRENE Best selection

PE/EVAL/PE Best selection

PVDC/PE/PVDC Best selection

BUTYL Best selection

SARANEX-23 2-PLY..... Satisfactory; may degrade after 4 hours continuous immersion

TEFLON Satisfactory; may degrade after 4 hours continuous immersion

SARANEX-23 Poor to dangerous choice for other than short-term immersion

CPE Poor to dangerous choice for other than short-term immersion

HYPALON Poor to dangerous choice for other than short-term immersion

NITRILE+PVC Poor to dangerous choice for other than short-term immersion

PVA Poor to dangerous choice for other than short-term immersion

VITON/NEOPRENE Poor to dangerous choice for other than short-term immersion

NEOPRENE..... Poor to dangerous choice for other than short-term immersion

PVC..... Poor to dangerous choice for other than short-term immersion

NATURAL+NEOPRENE..... Poor to dangerous choice for other than short-term immersion

NATURAL RUBBER..... Poor to dangerous choice for other than short-term immersion

NITRILE Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, colorless, highly volatile, highly flammable liquid with characteristic sweet odor.

Mixes in alcohol, ether, most hydrocarbons and oils.

Physical State: Liquid

pH: Not applicable

Odor Threshold: 47.5 to 1613.9 mg/m³

pH (1% Solution): Not applicable.

Vapor Pressure (kPa): 24 at 20 °C

Boiling Point: 56.2 °C (133 °F) at 760 mm Hg

Vapor Density (Air=1): 2.0

Freezing/Melting Point: -95.35 °C (-139.63 °F)

Formula Weight: 58.08

Volatile Component (% Vol): 100

Specific Gravity (H₂O=1, at 4 °C): 0.79 at 20 °C

Water Solubility: Miscible

Evaporation Rate: 11 (BuAc=1) VFast

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid storage with oxidizers, strong acids and strong alkalis.
Reacts violently with bromoform and chloroform in the presence of alkalies or in contact with alkaline surfaces.

Section 11 - Toxicological Information

Toxicity

Oral (man) TD_{Lo}: 2857 mg/kg
Oral (rat) LD₅₀: 5800 mg/kg
Inhalation (human) TC_{Lo}: 500 ppm
Inhalation (man) TC_{Lo}: 12000 ppm/4 hr
Inhalation (man) TC_{Lo}: 10 mg/m³/6 hr
Inhalation (rat) LC₅₀: 50100 mg/m³/8 hr
Dermal (rabbit) LD₅₀: 20000 mg/kg

Irritation

Eye (human): 500 ppm - irritant
Eye (rabbit): 3.95 mg - SEVERE
Eye (rabbit): 20 mg/24 hr -moderate
Skin (rabbit): 395 mg (open) - mild
Skin (rabbit): 500 mg/24 hr - mild

See RTECS AL 3150000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released on soil, it will both volatilize and leach into the ground and probably biodegrade. If released into water, it will probably biodegrade. It will also be lost due to volatilization (estimated half-life 20 hr from a model river). Bioconcentration in aquatic organisms and adsorption to sediment should not be significant. In the atmosphere, it will be lost by photolysis and reaction with photochemically produced hydroxyl radicals. Half-life estimates from these combined processes average 22 days and are shorter in summer and longer in winter. It will also be washed out by rain.

Ecotoxicity: LD₁₀₀ Asellus aquaticus 3 ml/l (within 3 days of exposure) /Conditions of bioassay not specified; LC₅₀ Mexican axolotl 20.0 mg/l/48 hr (3-4 weeks after hatching) /Conditions of bioassay not specified; TL_m Mosquito fish 13,000 mg/l/24, 48, 96 hr /Conditions of bioassay not specified; LD₁₀₀ Gammarus fossarum 10 ml/l (within 48 hr) /Conditions of bioassay not specified; LC₅₀ Poecilia reticulata (guppy) 7,032 ppm/14 days /Conditions of bioassay not specified; LC₅₀ Ring-necked pheasant oral greater than 40,000 ppm, in diet, age 10 days, (no mortality to 40,000 ppm); LC₅₀ Salmo gairdneri (Rainbow trout) 5,540 mg/l/96 hr at 12 °C (95% confidence limit 4,740-6,330 mg/l), wt 1.0 g /static bioassay; LC₅₀ Clawed toad 24.0 mg/l/48 hr (3-4 weeks after hatching) /Conditions of bioassay not specified; TL_m Daphnia magna 10 mg/l/24, 48 hr /Conditions of bioassay not specified

Henry's Law Constant: 3.97 x10⁻⁵

BCF: negligible

Biochemical Oxygen Demand (BOD): theoretical 122%, 5 days

Octanol/Water Partition Coefficient: log K_{ow} = -0.24

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Acetone

ID: UN1090

Hazard Class: 3 - Flammable and combustible liquid

Packing Group: II - Medium Danger

Symbols:

Label Codes: 3 - Flammable Liquid

Special Provisions: IB2, T4, TP1

Packaging: Exceptions: 150 Non-bulk: 202 Bulk: 242

Quantity Limitations: Passenger aircraft/rail: 5 L Cargo aircraft only: 60 L

Vessel Stowage: Location: B Other:



Section 15 - Regulatory Information**EPA Regulations:****RCRA 40 CFR:** Listed U002 Ignitable Waste**CERCLA 40 CFR 302.4:** Listed per RCRA Section 3001 5000 lb (2268 kg)**SARA 40 CFR 372.65:** Not listed**SARA EHS 40 CFR 355:** Not listed**TSCA:** Listed**Section 16 - Other Information**

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Anthracene

CAS Number: 120-12-7

Chemical Formula: C₁₄H₁₀

Structural Chemical Formula: (C₆H₄CH)₂

EINECS Number: 204-371-1

ACX Number: X1001589-1

Synonyms: ANTHRACEN; ANTHRACENE; ANTHRACENE OIL; ANTHRACIN; COAL TAR PITCH
 VOLATILES; ANTHRACENE; GREEN OIL; P-NAPHTHALENE; PARANAPHTHALENE; PARANAPHTHALENE;
 TETRA OLIVE N2G

Derivation: Occurs naturally in smoke (gasoline, coal, cigarette, etc.), charbroiled foods, and coal tar pitch volatiles. Obtained by distilling crude anthracene oil with alkali carbonate in iron retorts (phenanthrene is removed via carbon disulfide) or by salting out from crude anthracene oil and draining; the crude salts are then purified by pressing and the use of various solvents (phen-anthrene and carbazole are removed).

General Use: Used in chemical manufacture (phenanthrene, carbazole, anthraquinone), in calico printing; as a component of dyes, scintillation fluid, smoke screens; and in organic semi-conductor research.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Anthracene	120-12-7	ca 90 to 95% wt (commercial grade); 90 to 98% wt (technical grade)

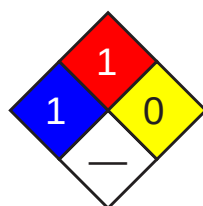
Trace Impurities: phenanthrene, carbazole, chrysene, pyridine (0.2%), iron (0.03%)

OSHA PEL

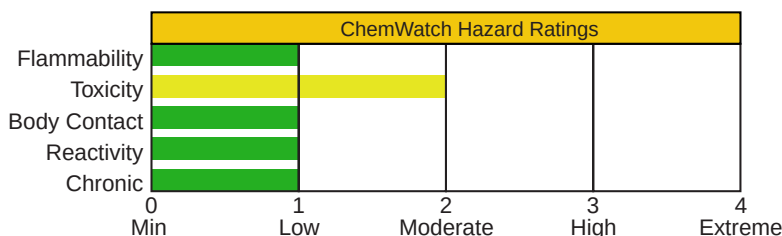
NIOSH REL

ACGIH TLV

Section 3 - Hazards Identification



Fire Diamond



HMIS	
1	Health
1	Flammability
0	Reactivity

ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless crystals with violet fluorescence (pure) or yellow crystals with green fluorescence. Irritating to eyes/skin/respiratory tract. Other Acute Effects: sun exposure can aggravate skin irritation and cause dermatitis. Combustible.

Potential Health Effects

Target Organs: Eyes, skin, respiratory and digestive tracts.

Primary Entry Routes: Inhalation, skin/eye contact

Acute Effects

Inhalation: Symptoms include irritation of the respiratory tract, headache, nausea and vomiting, loss of appetite, slowed reactions, and adynamia (lack or loss of strength due to disease or other outside agent). Acute symptoms disappear within several days of last exposure.

Eye: Irritation of the conjunctiva with burning, itching and watering.

Skin: Irritation with burning, itching, and edema (fluid build-up). Volunteers with a 2% crude tar solution applied to the skin showed anthracene absorption via blood tests.

Ingestion: Gastrointestinal tract irritation.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: Dermatitis.

Chronic Effects: Repeated skin contact can cause pigmentation of the skin with cornification of surface layers and telangioectasis (an abnormal dilatation of capillary vessels that often form small, raised, red, wart-like spots).

Sensitization (including photo-sensitization) may also occur. Anthracene appears to concentrate in the fat and liver.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult an ophthalmologist if pain and irritation persist.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water to dilute. Vomiting may be spontaneous.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treatment is symptomatic and supportive.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: 250 °F (121 °C), Closed Cup

Autoignition Temperature: 1004 °F (540 °C)

LEL: 0.6% v/v

UEL: Not reported.

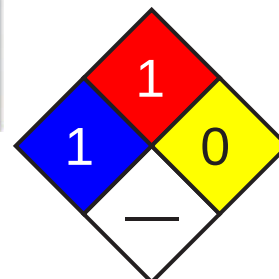
Flammability Classification: Combustible

Extinguishing Media: Use water spray, carbon dioxide, dry chemical, or foam.

General Fire Hazards/Hazardous Combustion Products: Include carbon oxide(s) and irritating, acrid smoke. May explode in air.

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

See
DOT
ERG



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Cleanup personnel should protect against inhalation and skin/eye contact.

Small Spills: Carefully scoop up or vacuum (with appropriate filter) and place in suitable containers for disposal.

Large Spills: Use water to flush large spills to containment area for later disposal. Do not release into sewers or waterways. Damp mop any residue.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: *Do not* use near heat or flame. Wear appropriate PPE.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using anthracene, especially before eating, drinking, smoking, using the toilet, or applying cosmetics. Skin cleansers (ex. 55% kaolin, 25% neutral soap, 20% bran) are recommended.

Recommended Storage Methods: Store in a cool, dry, well-ventilated area away from heat, ignition sources, and incompatibles (Sec. 10).

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond equipment used with and around anthracene. Enclosure of equipment and mechanization of processes will aid in exposure control. Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on the skin.

Personal Protective Clothing/Equipment: Limit work in sunlight as much as possible to prevent photosensitization. Photoprotective creams or pastes must be applied to bare skin regions. Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Polyvinyl chloride is a suitable material for PPE. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For any detectable concentration, use a SCBA or supplied-air respirator with a full facepiece and operated in pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive-pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes and place in closed containers until laundered. Remove anthracene from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless crystals with a violet fluorescence (pure), yellow crystals with a green fluorescence (due to tetracene and naphthacene).

Physical State: Solid

Vapor Pressure (kPa): 1mm Hg at 293 °F (145 °C)

Formula Weight: 178.22

Density: 1.25 g/cm³ at 80.6 °F (27 °C)

Boiling Point: 644 °F (340 °C)

Freezing/Melting Point: 423 °F (217 °C)

Water Solubility: 1.29 mg/L at 77 °F/25 °C (*distilled water*), 0.6 mg/L at 77 °F/25 °C (*salt water*)

Other Solubilities: 1 g in 67 mL absolute alcohol, 70 mL methanol, 62 mL benzene, 85 mL chloroform, 200 mL ether, 31 mL carbon disulfide, 86 mL carbon tetrachloride, and 125 mL toluene. Also soluble in acetone.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Anthracene darkens upon exposure to sunlight (transformed to *para*-anthracene). Hazardous polymerization *does not* occur. Exposure to heat, ignition sources, sunlight, and incompatibles.

Storage Incompatibilities: Include calcium hypochlorite (exothermic), fluorine (explodes), chromic acid, and calcium oxychloride.

Hazardous Decomposition Products: Thermal oxidative decomposition of anthracene can produce carbon oxide(s) and acrid, irritating smoke.

Section 11 - Toxicological Information

Acute Oral Effects:

Mouse, oral, LD: > 17 g/kg caused fatty liver degeneration.

Irritation Effects:

Mouse, skin: 118 µg caused mild irritation.

Other Effects:

Rat, oral: 20 g/kg intermittently for 79 weeks caused liver tumors.

Genetic Effects - Rat, liver cell: 300 µmol caused DNA damage.

See RTECS CA9350000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, anthracene is expected to absorb strongly and not leach to groundwater. It will not hydrolyze, but may be subject to biodegradation, the rate of which depends on soil type. In water, anthracene is subject to direct photolysis near the surface and undergoes significant biodegradation. Biodegradation in water is faster with increased temperature, increased oxygen, and acclimated microbes. Evaporation may also be significant with an estimated half-life range of 4.3 to 5.9 days from a river 1 m deep, flowing 1 m/sec, with a wind velocity of 3 m/sec. In the air, photolysis and reaction with photochemically-produced hydroxyl radicals (half-life: 1.67 days). Vapor phase anthracene is expected to degrade faster than particle-sorbed anthracene. A K_{oc} of 26,000 suggests anthracene is relatively immobile in soil and unlikely to leach to groundwater; it will absorb strongly to soil.

Ecotoxicity: *Leponis macrochirus* (bluegill sunfish), $LC_{50} = 11.9 \mu\text{g/L/96 hr}$; *Rana pipiens* (leopard frog), $LC_{50} = 0.065 \text{ ppm/30 min}$ & 0.025 ppm/5 hr . BCF (bioconcentration factor): goldfish (162), rainbow trout (4400-9200). Bioconcentration occurs most heavily in organisms which lack the enzyme microsomal oxidase. Anthracene can become concentrated on the waxy surface of some plant leaves and fruits.

Octanol/Water Partition Coefficient: $\log K_{ow} = 4.45$ (calc.)

Section 13 - Disposal Considerations

Disposal: Anthracene is a waste chemical stream constituent which may be subjected to ultimate disposal by controlled incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Environmentally hazardous substances, solid, n.o.s.

ID: UN3077

Hazard Class: 9 - Miscellaneous hazardous material

Packing Group: III - Minor Danger

Symbols: G - Technical Name Required

Label Codes: 9 - Class 9

Special Provisions: 8, 146, B54, IB8, N20

Packaging: Exceptions: 155 **Non-bulk:** 213 **Bulk:** 240

Quantity Limitations: **Passenger aircraft/rail:** No limit **Cargo aircraft only:** No limit

Vessel Stowage: **Location:** A **Other:**



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Not listed

CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 5000 lb (2268 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Section 1 - Chemical Product and Company Identification

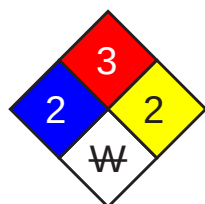
61

Material Name: Barium **CAS Number:** 7440-39-3
Chemical Formula: Ba
Structural Chemical Formula: Ba
EINECS Number: 231-149-1
ACX Number: X1002791-5
Synonyms: BARIO; BARIUM; BARYUM
General Use: Occurs in barite and witherite.
 Used as "getter" in vacuum tubes. Carrier for radium.

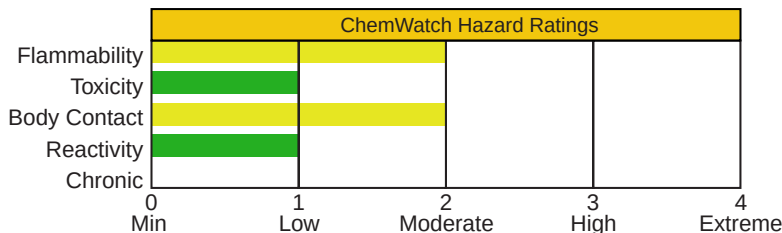
Section 2 - Composition / Information on Ingredients

Name	CAS	%
Barium	7440-39-3	100
OSHA PEL TWA: 0.5 mg/m ³ .	NIOSH REL TWA: 0.5 mg/m ³ .	DFG (Germany) MAK TWA: 0.5 mg/m ³ ; PEAK: 1 mg/m ³ ; measured as inhalable fraction of the aerosol.
ACGIH TLV TWA: 0.5 mg/m ³ .		
EU OEL TWA: 0.5 mg/m ³ .		

Section 3 - Hazards Identification



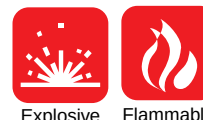
Fire Diamond



HMIS	
2	Health
3	Flammability
3	Reactivity

ANSI Signal Word

Danger!



Explosive Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Silver/white powder. Chronic Effects: benign pneumoconiosis. Explosive. Flammable. Pyrophoric. Reacts violently with water.

Potential Health Effects

Target Organs: skin, eyes, mucous membranes, lung, heart

Primary Entry Routes: inhalation of dust or fume, ingestion, skin contact, eye contact

Acute Effects

Inhalation: The dust may be discomforting to the upper respiratory tract and may cause severe mucous membrane damage.

Barium fumes are respiratory irritants. Over-exposure to barium dusts and fume may result in rhinitis, frontal headache, wheezing, laryngeal spasm, salivation and anorexia. Long term effects include nervous disorders and adverse effects on the heart, circulatory system and musculature. Heavy exposures may result in a benign pneumoconiosis.

Eye: The material is moderately discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

Skin: The material is moderately discomforting to the skin.

Solution of material in moisture on the skin, or perspiration, may increase irritant effects.

Ingestion: The material is moderately discomforting to the gastrointestinal tract and may be harmful if swallowed.

Reaction with acid in the stomach environment will produce soluble barium compounds.

Ingestion of soluble barium compounds may result in ulceration of the mucous membranes of the gastrointestinal tract, tightness in the muscles of the face and neck, gastroenteritis, vomiting, diarrhea, muscular tremors and paralysis, anxiety, weakness, labored breathing, cardiac irregularity due to contractions of smooth striated and cardiac muscles (often violent and painful), slow irregular pulse, hypertension, convulsions and respiratory failure.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Not listed; MAK - Not listed.

Chronic Effects: Metallic dusts generated by the industrial process give rise to a number of potential health problems. The larger particles, above 5 micron, are nose and throat irritants. Smaller particles however, may cause lung deterioration. Particles of less than 1.5 micron can be trapped in the lungs and, dependent on the nature of the particle, may give rise to further serious health consequences.

Section 4 - First Aid Measures

Inhalation: If dust is inhaled, remove to fresh air.

Encourage patient to blow nose to ensure clear breathing passages. Rinse mouth with water.

Consider drinking water to remove dust from throat.

If irritation or discomfort persists seek medical attention.

If fumes or combustion products are inhaled: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and wash continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Brush off dust. Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: If swallowed, do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Long-term exposure to high dust concentrations may cause changes in lung function i.e. pneumoconiosis; caused by particles less than 0.5 micron penetrating and remaining in the lung. Prime symptom is breathlessness; lung shadows show on X-ray.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Extinguishing Media: Sand, dry powder extinguishers or other inerts should be used to smother dust fires.

These are the only suitable means for extinguishing metal dust fires.

Do NOT use water. Contact with water liberates highly flammable gases.

Do NOT use CO₂ extinguishers.

General Fire Hazards/Hazardous Combustion Products: Flammable solid. Metal powders, while generally regarded as noncombustible, may burn when metal is finely divided and energy input is high. Metal dust fires are slow moving but intense and difficult to extinguish. DO NOT disturb burning dust. Explosion may result if dust is stirred into a cloud, by providing oxygen to a large surface of hot metal. DO NOT use water or foam as generation of explosive hydrogen may result.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

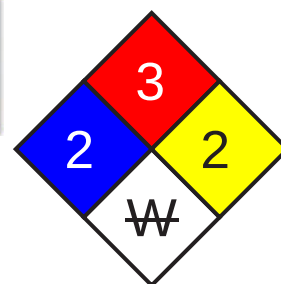
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

If safe to do so, remove containers from path of fire.

Fight fire from a safe distance, with adequate cover.

See
DOT
ERG



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Clean up all spills immediately. Avoid contact with skin and eyes.

Wear protective neoprene gloves and chemical goggles.

Use dry clean up procedures and avoid generating dust.

Place in suitable containers for disposal.

DO NOT return unused product to containers.

Large Spills: Clear area of personnel. Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

No smoking, bare lights or ignition sources.

See
DOT
ERG

Use dry clean up procedures and avoid generating dust.
 DO NOT use water.
 Use only spark-free shovels and explosion proof equipment.
 Collect recoverable product into labeled containers for recycling. Collect residues and place in labeled plastic containers with vented lids.
 DO NOT put the wetted material into a container.
 After clean up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.
 If contamination of drains or waterways occurs, advise emergency services.
 Material from spill may be contaminated with water resulting in generation of highly flammable hydrogen gas with pressurizing of closed containers. Hold spill material in vented containers only and plan for prompt disposal.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Use good occupational work practice. Observe manufacturer's storing and handling recommendations. Avoid all personal contact, including inhalation.

Wear protective clothing when risk of exposure occurs.

Avoid smoking, bare lights, heat or ignition sources.

Use spark-free tools when handling.

Avoid contact with incompatible materials.

Handle and open container with care.

WARNING: Contact with water generates heat.

DO NOT return unused product to containers.

When handling, DO NOT eat, drink or smoke.

Keep containers securely sealed when not in use.

Always wash hands with soap and water after handling. Work clothes should be laundered separately.

Recommended Storage Methods: Check that containers are clearly labeled.

Packaging as recommended by manufacturer.

Heavy gauge metal packages/heavy gauge metal drums.

Storage Requirements: Air-sensitive.

Observe manufacturer's storing and handling recommendations. Keep dry.

Store in original containers. Store away from sources of heat or ignition / bare lights. Store in a cool, dry and well-ventilated area. Store away from incompatible materials.

No smoking, bare lights, heat or ignition sources.

Protect containers against physical damage.

Keep containers securely sealed. Check regularly for spills and leaks.

CARE: Packing of high density product in light weight metal or plastic packages may result in container collapse with product release.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Metal dusts must be collected at the source of generation as they are potentially explosive.

1. Vacuum cleaners, of flame-proof design, should be used to minimize dust accumulation.

2. Metal spraying and blasting should, where possible, be conducted in separate rooms. This minimizes the risk of supplying oxygen, in the form of metal oxides, to potentially reactive finely divided metals such as aluminum, zinc, magnesium or titanium.

3. Work-shops designed for metal spraying should possess smooth walls and a minimum of obstructions, such as ledges, on which dust accumulation is possible.

4. Wet scrubbers are preferable to dry dust collectors.

5. Bag or filter-type collectors should be sited outside the workrooms and be fitted with explosion relief doors.

6. Cyclones should be protected against entry of moisture as reactive metal dusts are capable of spontaneous combustion in humid or partially wetted state.

7. Local exhaust systems must be designed to provide a minimum capture velocity at the fume source, away from the worker, of 0.5 meter/sec.

If exposure to workplace dust is not controlled, respiratory protection is required; wear NIOSH-approved dust respirator. Provide adequate ventilation in warehouse or closed storage areas.

Personal Protective Clothing/Equipment:

Eyes: Chemical goggles. DO NOT wear contact lenses.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: PVC gloves. Rubber gloves.

Safety footwear.

Respiratory Protection:

Exposure Range >0.5 to 5 mg/m³: Air Purifying, Negative Pressure, Half Mask

Exposure Range >5 to <50 mg/m³: Air Purifying, Negative Pressure, Full Face
 Exposure Range 50 to unlimited mg/m³: Self-contained Breathing Apparatus, Pressure Demand, Full Face
 Cartridge Color: dust/mist filter (use P100 or consult supervisor for appropriate dust/mist filter)
Other: Overalls. Eyewash unit. Barrier cream. Skin cleansing cream.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Silvery- to yellowish-white malleable, lustrous metal.
Physical State: Divided solid **pH:** Not applicable
Vapor Density (Air=1): Not applicable **Boiling Point:** 1640 °C (2984 °F)
Formula Weight: 137.34 **Freezing/Melting Point:** 725 °C (1337 °F)
Specific Gravity (H₂O=1, at 4 °C): 3.6 **Volatile Component (% Vol):** 0
Evaporation Rate: Not applicable **Water Solubility:** Decomposes

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Reacts with ammonia, halogens, oxygen and most acids. Is pyrophoric at room temperatures when in powder form. Easily oxidized - kept under petroleum or other oxygen-free liquid to exclude air.
 Presence of water. Presence of heat source and ignition source. Product is considered stable under normal handling conditions. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid reaction with oxidizing agents.
 Reacts slowly with water. CAUTION contamination with moisture will liberate explosive hydrogen gas, causing pressure build up in sealed containers.
 Reacts violently with acids and chlorinated solvents.

Section 11 - Toxicological Information

No significant acute toxicological data identified in literature search.
 See RTECS CQ 8370000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: No data found.

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options.
 Recycle if possible, otherwise dispose in a chemically secure landfill.
 Follow applicable federal, state, and local regulations.
 Puncture containers to prevent reuse.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Barium
ID: UN1400
Hazard Class: 4.3 - Dangerous when wet material
Packing Group: II - Medium Danger
Symbols:
Label Codes: 4.3 - Dangerous When Wet
Special Provisions: A19, IB7, IP2
Packaging: Exceptions: 151 Non-bulk: 212 Bulk: 241
Quantity Limitations: Passenger aircraft/rail: 15 kg Cargo aircraft only: 50 kg
Vessel Stowage: Location: E Other:



Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed
CERCLA 40 CFR 302.4: Not listed
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Benz[a]anthracene

CAS Number: 56-55-3

Chemical Formula: C₁₈H₁₂

EINECS Number: 200-280-6

ACX Number: X1002793-9

Synonyms: B(A)A; BA; BAA; 1,2-BENZ(A)ANTHRACENE; 1,2-BENZANTHRACENE;
 BENZ(A)ANTHRACENE; BENZANTHRACENE; BENZ[A]ANTHRACENE; 1,2-BENZANTHRAZEN; 1,2-
 BENZANTHRENE; BENZANTHRENE; 1,2-BENZOANTHRACENE; BENZO(A)ANTHRACENE;
 BENZOANTHRACENE; 2,3-BENZOPHENANTHRENE; BENZO(A)PHENANTHRENE;
 BENZO(B)PHENANTHRENE; 2,3-BENZPHENANTHRENE; NAPHTHANTHRACENE; TETRAPHENE

General Use: research chemistry

Section 2 - Composition / Information on Ingredients

Name	CAS	%
benz[a]anthracene	56-55-3	>98

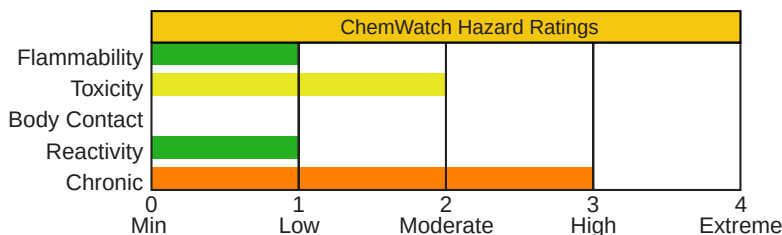
OSHA PEL

NIOSH REL

ACGIH TLV

Exposure by all routes should be
 carefully controlled to levels as
 low as possible.

Section 3 - Hazards Identification



ANSI Signal Word

Danger!



Poison

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless plates. May cause irritation. Poison. Other Acute Effects: may be fatal if inhaled, swallowed, or absorbed through skin. Chronic Effects: may cause heritable genetic damage; may alter genetic material. Carcinogen. Will burn.

Potential Health Effects

Target Organs: No data found.

Primary Entry Routes: accidental skin and eye contact, inhalation of generated dusts

Acute Effects

Inhalation: The dust is harmful and discomforting to the upper respiratory tract. Persons with impaired respiratory function, airway diseases, or conditions such as emphysema or chronic bronchitis may incur further disability if excessive concentrations of particulate are inhaled.

Eye: The dust may be discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/ or other transient eye damage/ ulceration.

Skin: The material may be mildly discomforting to the skin. Open cuts and abraded or irritated skin should not be exposed to this material. Toxic effects may result from skin absorption.

Ingestion: The solid/dust is discomforting to the gastrointestinal tract and harmful if swallowed. Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Class 2B, Reasonably anticipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals; IARC - Group 2A, Probably carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A2, Suspected human carcinogen; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Class A2, Unmistakably carcinogenic in animal experimentation only.

Chronic Effects: Cited in many publications and by a number of regulatory authorities as a suspected human carcinogen. Subcutaneous injection produces sarcomas (soft tissue growths) in rats and mice. When administered by gavage benz[a]anthracene induced papillomas to the forestomach in mice and hamsters and mammary tumors in female rats.

Section 4 - First Aid Measures

Inhalation: • If dust is inhaled, remove to fresh air.

- Encourage patient to blow nose to ensure clear breathing passages.
- Rinse mouth with water. Consider drinking water to remove dust from throat.
- Seek medical attention if irritation or discomfort persist.
- If fumes or combustion products are inhaled, remove to fresh air.
- Lay patient down. Keep warm and rested.
- Other measures are usually unnecessary.

Eye Contact: • Immediately hold the eyes open and flush with fresh running water.

- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Seek medical attention if pain persists or recurs.

• Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: • Immediately remove all contaminated clothing, including footwear (after rinsing with water).

- Wash affected areas thoroughly with water (and soap if available).
- Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center. If more than 15 minutes from a hospital:

- INDUCE vomiting with IPECAC SYRUP, or fingers down the back of the throat, ONLY IF CONSCIOUS. Lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. NOTE: Wear a protective glove when inducing vomiting by mechanical means.
- SEEK MEDICAL ATTENTION WITHOUT DELAY.
- In the meantime, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient's condition.
- If the services of a medical officer or medical doctor are readily available, the patient should be placed in his/her care and a copy of the MSDS should be provided.
- If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of the MSDS.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: Not available; probably combustible

Extinguishing Media: Foam. Dry chemical powder. BCF (where regulations permit). Carbon dioxide. Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: • Solid which exhibits difficult combustion or is difficult to ignite.

- Avoid generating dust, particularly clouds of dust in a confined or unventilated space, as dust may form an explosive mixture with air and any source of ignition, e.g., flame or spark, will cause fire or explosion.
- Dry dust can also be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport.
- Build-up of electrostatic charge may be prevented by bonding and grounding.
- Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e., nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: • Contact fire department and tell them location and nature of hazard.

- Wear breathing apparatus plus protective gloves for fire only.
- Prevent, by any means available, spillage from entering drains or waterways.
- Use fire fighting procedures suitable for surrounding fire.
- Do not approach containers suspected to be hot.
- Cool fire-exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.

See
DOT
ERG

- Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: • Clean up all spills immediately.

- Avoid contact with skin and eyes.
- Wear protective clothing, gloves, safety glasses and dust respirator.
- Use dry clean up procedures and avoid generating dust.
- Vacuum up or sweep up.
- Place in clean drum then flush area with water.

Large Spills: • Clear area of personnel and move upwind.

- Contact fire department and tell them location and nature of hazard.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or waterways.
- No smoking, bare lights or ignition sources.
- Increase ventilation.
- Stop leak if safe to do so.
- Water spray or fog may be used to disperse/absorb vapor.
- Contain or absorb spill with sand, earth or vermiculite.
- Collect recoverable product into labeled containers for recycling.
- Collect solid residues and seal in labeled drums for disposal.
- Wash area and prevent runoff into drains.
- After clean up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.
- If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: • Avoid all personal contact, including inhalation.

- Wear protective clothing when risk of overexposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.
- DO NOT enter confined spaces until atmosphere has been checked.
- Do not allow material to contact humans, exposed food or food utensils.
- Avoid smoking, bare lights or ignition sources.
- When handling, DO NOT eat, drink or smoke.
- Avoid contact with incompatible materials.
- Keep containers securely sealed when not in used.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Working clothes should be laundered separately. Launder contaminated clothing before reuse.
- Follow good occupational work practices.
- Observe manufacturer's storage/handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Recommended Storage Methods: Glass container. Plastic container. Metal can. Metal drum. Check that all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Local exhaust ventilation usually required. If risk of overexposure exists, wear NIOSH-approved respirator. Provide adequate ventilation in warehouse or closed storage area.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields or chemical goggles. Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Wear chemical protective gloves, e.g. PVC. Wear safety footwear.

Other: • Overalls.

- PVC Apron.
- PVC protective suit may be required if exposure severe.
- Eyewash unit.
- Ensure there is ready access to a safety shower.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Light yellow to tan crystalline powder.

Physical State: colorless plates

Vapor Pressure (kPa): 5×10^{-9} torr at 20 °C

Formula Weight: 228.29

Evaporation Rate: Half life 89 hours

Boiling Point: Sublimes at 435 °C (815 °F)

Freezing/Melting Point: 162 °C (323.6 °F)

Volatile Component (% Vol): Negligible

Water Solubility: 0.014 mg/L in Water at 25 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid reaction with oxidizing agents.

Section 11 - Toxicological Information

Toxicity

Intravenous (rat) LD₅₀: > 200 mg/kg

Irritation

Nil reported

See RTECS CV9275000, for additional data.

Section 12 - Ecological Information

Environmental Fate: When released into water it will rapidly become adsorbed to sediment or particulate matter in the water column, and bioconcentrate into aquatic organisms. In the unadsorbed state, it will degrade by photolysis in a matter of hours to days. Its slow desorption from sediment and particulate matter will maintain a low concentration in the water. Because it is strongly adsorbed to soil it will remain in the upper few centimeters of soil and not leach into groundwater. It will very slowly biodegrade when colonies of microorganisms are acclimated but this is too slow a process (half-life ca 1 year to be significant). In the atmosphere it will be transported long distances and will probably be subject to photolysis and photooxidation although there is little documentation about the rate of these processes in the literature.

Ecotoxicity: Algae: *Anabaena flos-aquae* 2w EC₅₀ growth +0.014 mg/l NOEC growth +0.003 mg/l

BCF: daphnia 4.0

Octanol/Water Partition Coefficient: log K_{ow} = 5.61

Soil Sorption Partition Coefficient: K_{oc} = sediments 55 to 1.87×10^6

Section 13 - Disposal Considerations

Disposal: • Recycle wherever possible or consult manufacturer for recycling options.

• Follow applicable local, state, and federal regulations.

• Bury residue in an authorized landfill.

• Recycle containers if possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Toxic solids, organic, n.o.s.

ID: UN2811

Hazard Class: 6.1 - Poisonous materials

Packing Group: I - Great Danger

Symbols: G - Technical Name Required

Label Codes: 6.1 - Poison or Poison Inhalation Hazard *if inhalation hazard, Zone A or B*

Special Provisions: IB7

Packaging: Exceptions: None **Non-bulk:** 211 **Bulk:** 242

Quantity Limitations: Passenger aircraft/rail: 5 kg **Cargo aircraft only:** 50 kg

Vessel Stowage: Location: B **Other:**



Shipping Name and Description: Toxic solids, organic, n.o.s.**ID:** UN2811**Hazard Class:** 6.1 - Poisonous materials**Packing Group:** II - Medium Danger**Symbols:** G - Technical Name Required**Label Codes:** 6.1 - Poison or Poison Inhalation Hazard *if inhalation hazard, Zone A or B***Special Provisions:** IB8, IP2, IP4**Packaging:** **Exceptions:** None **Non-bulk:** 212 **Bulk:** 242**Quantity Limitations:** **Passenger aircraft/rail:** 25 kg **Cargo aircraft only:** 100 kg**Vessel Stowage:** **Location:** B **Other:****Shipping Name and Description:** Toxic solids, organic, n.o.s.**ID:** UN2811**Hazard Class:** 6.1 - Poisonous materials**Packing Group:** III - Minor Danger**Symbols:** G - Technical Name Required**Label Codes:** 6.1 - Poison or Poison Inhalation Hazard *if inhalation hazard, Zone A or B***Special Provisions:** IB8, IP3**Packaging:** **Exceptions:** 153 **Non-bulk:** 213 **Bulk:** 240**Quantity Limitations:** **Passenger aircraft/rail:** 100 kg **Cargo aircraft only:** 200 kg**Vessel Stowage:** **Location:** A **Other:**

Section 15 - Regulatory Information

EPA Regulations:**RCRA 40 CFR:** Listed U018 Toxic Waste**CERCLA 40 CFR 302.4:** Listed per RCRA Section 3001, per CWA Section 307(a) 10 lb (4.535 kg)**SARA 40 CFR 372.65:** Listed**SARA EHS 40 CFR 355:** Not listed**TSCA:** Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Benzo(a)pyrene

CAS Number: 50-32-8

Chemical Formula: C₂₀H₁₂

EINECS Number: 200-028-5

ACX Number: X1002798-4

Synonyms: B(A)P; BAP; BENZO(D,E,F)CHRYSENE; 3,4-BENZOPYRENE; 1,2-BENZOPYRENE; 3,4-BENZOPYRENE; 6,7-BENZOPYRENE; BENZO(A)PYRENE; 3,4-BENZPYREN; 3,4-BENZ(A)PYRENE; 3,4-BENZPYRENE; BENZ(A)PYRENE; BENZ[A]PYRENE; 3,4-BENZYLPIRENE; 3,4-BENZYPYRENE; 3,4-BP; BP; COAL TAR PITCH VOLATILES: BENZO(A)PYRENE

Derivation: Synthesized from pyrene and succinic anhydride.

General Use: Benzo(a)pyrene is no longer used or produced commercially in the US. In its pure form, benzo(a)pyrene may be used as a research laboratory reagent. It also occurs in combustion products of coal, oil, petroleum, wood and other biological matter; in motor vehicle and other gasoline and diesel engine exhaust; in charcoal-broiled foods; in cigarette smoke and general soot and smoke of industrial, municipal, and domestic origin. It occurs naturally in crude oils, shale oils, coal tars, gases and fly ash from active volcanoes and forest fires.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Benzo(a)pyrene	50-32-8	ca 100% wt

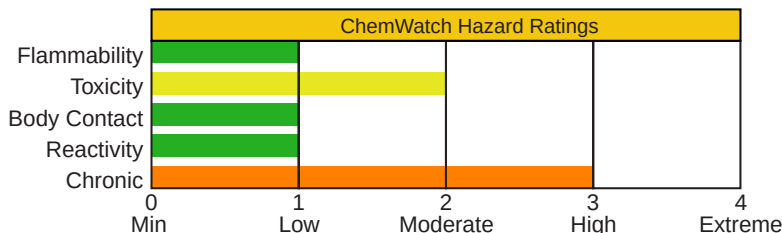
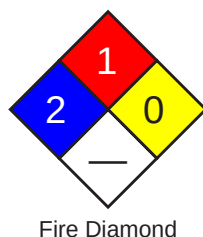
Except in laboratories, benzo(a)pyrene is usually mixed with other coal tar pitch chemicals. Consider exposure limits for coal tar pitch volatiles as a guideline. However, because benzo(a)pyrene is considered a probable carcinogen to humans, it is recommended that exposures to carcinogens be limited to the lowest feasible concentration.

OSHA PEL
 TWA: 0.2 mg/m³.

NIOSH REL

ACGIH TLV
 Exposure by all routes should be carefully controlled to levels as low as possible.

Section 3 - Hazards Identification



HMIS	
2	Health
1	Flammability
0	Reactivity

ANSI Signal Word

Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Pale yellow, crystalline solid or powder. Irritating to skin, eyes, respiratory tract. Chronic Effects: carcinogen, mutagen. Handle with extreme caution!

Potential Health Effects

Target Organs: Respiratory system, bladder, kidneys, skin.

Primary Entry Routes: Inhalation, ingestion.

Acute Effects

Inhalation: Respiratory tract irritation. Pregnant women may be especially susceptible to exposure effects of benzo(a)pyrene; exposure may damage the fetus. In general, polyaromatic hydrocarbons such as benzo(a)pyrene tend to localize primarily in body fat and fatty tissues (for ex. breasts) and are excreted in breast milk. Benzo(a)pyrene may also affect the male reproductive system (testes and sperm).

Eye: Irritation and/or burns on contact.

Skin: Irritation with burning sensation, rash, and redness; dermatitis on prolonged exposure. Sunlight enhances effects (photosensitization).

Ingestion: None reported.

Carcinogenicity: NTP - Class 2B, Reasonably anticipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals; IARC - Group 2A, Probably carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A2, Suspected human carcinogen; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Class A2, Unmistakably carcinogenic in animal experimentation only.

Medical Conditions Aggravated by Long-Term Exposure: Respiratory system, bladder, kidney, and skin disorders.

Chronic Effects: Inhalation: Cough and bronchitis. Eye: Photosensitivity and irritation. Skin: Skin changes such as thickening, darkening, pimples, loss of color, reddish areas, thinning of the skin, and warts. Sunlight enhances effects (photosensitization). Other: Gastrointestinal (GI) effects include leukoplakia (a pre-cancerous condition characterized by thickened white patches of epithelium on mucous membranes, especially of the mouth). Cancer of the lung, skin, kidneys, bladder, or GI tract is also possible. Smoking in combination with exposure to benzo(a)pyrene increases the chances of developing lung cancer. Persons with a high degree of inducibility of the enzyme aryl hydrocarbon hydroxylase may be a high risk population.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of tepid water for at least 15 min. Consult an ophthalmologist if irritation or pain persist.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water (less than 15 min). Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water to dilute. Inducing vomiting is not necessary since benzo(a)pyrene has a low acute toxicity and therefore, is generally an unnecessary procedure. Consider activated charcoal/cathartic.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Monitor CBC and arterial blood gases, conduct liver, renal, and pulmonary function tests (if respiratory tract irritation is present), and urinalysis. Biological monitoring techniques testing for metabolites in blood or urine, or DNA adducts in blood or tissues are useful for epidemiological studies that determine if exposure has occurred. Because neither normal nor toxic levels have been established, those techniques may not be useful for evaluating individual patients.

Special Precautions/Procedures: Emergency personnel should protect against exposure.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: None reported. Benzo(a)pyrene may burn, but does *not* readily ignite.

Autoignition Temperature: None reported.

LEL: None reported.

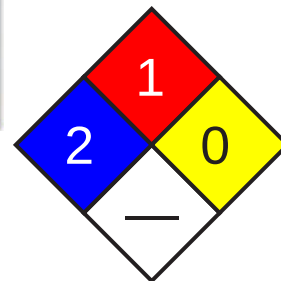
UEL: None reported.

Extinguishing Media: For small fires, use dry chemical, sand, water spray, or foam. For large fires, use water spray, fog, or foam.

General Fire Hazards/Hazardous Combustion Products: Carbon monoxide and carbon dioxide.

Fire-Fighting Instructions: Isolate hazard and deny entry. If feasible and without undue risk, move containers from fire hazard area. Otherwise, cool fire-exposed containers with water spray until well after fire is extinguished. Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode and full protective clothing.

See
DOT
ERG



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel of large spills, remove heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against dust inhalation and skin or eye contact. Clean up spills promptly.

Small Spills: Carefully scoop up spilled material and place into appropriate containers for disposal. For liquid spills, take up with a noncombustible, inert absorbent and place into appropriate containers for disposal.

Large Spills: For large spills, dike far ahead of liquid spill or contain dry spill for later disposal. Do not release into sewers or waterways. *Do not* dry sweep! Use a vacuum with a HEPA filter or a wet method to reduce dust. After cleanup is complete, thoroughly decontaminate all surfaces. *Do not* reuse contaminated cleaning materials.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).



See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: Handle with extreme caution and take all necessary measures to avoid exposure to benzo(a)pyrene because it is a carcinogen and mutagen. Follow good personal hygiene procedures and thoroughly wash hands with soap and water after handling. Use safety pipettes for all pipetting. Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed and properly labeled containers in a cool, well-ventilated area.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use a Class I, Type B, biological safety hood when working with benzo(a)pyrene in a laboratory. Decrease the rate of air extraction, so that benzo(a)pyrene can be handled without powder being blown around the hood. Keep glove boxes under negative pressure. Use vertical laminar-flow, 100% exhaust, biological safety cabinets for containment of in vitro procedures. The exhaust air flow should be sufficient to provide an inward air flow at the face opening of the cabinet. Ensure contaminated air sheaths that are under positive pressure are leak-tight. Never use horizontal laminar-flow hoods or safety cabinets where filtered air is blown across the working area towards the operator. Test cabinets before work begins to ensure they are functioning properly. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Consider preplacement and periodic medical examinations with emphasis on the oral cavity, bladder, kidneys, skin, and respiratory tract. Conduct urinalysis including specific gravity, albumin, glucose, and microscopic examination of centrifuged sediment for red blood cells. Also, include 14" x 17" chest roentgenogram, FVC + FEV1, and CBC to detect any leukemia or aplastic anemia. It is recommended that this exam be repeated on an annual basis and semiannual basis for employees 45 yr of age or older or with 10 or more years of exposure to coal tar pitch volatiles. Train workers about the hazards of benzo(a)pyrene and the necessary protective measures to prevent exposure. Periodically inspect lab atmospheres, surfaces such as walls, floors, and benches, and interior of fume hoods and air ducts for contamination. Post appropriate signs and labels on doors leading into areas where benzo(a)pyrene is used.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. In animal laboratories, wear protective suits (disposable, one-piece and close-fitting at ankles and wrists), gloves, hair covering, and overshoes. In chemical laboratories, wear gloves and gowns. Wear protective eyeglasses or chemical safety, gas-proof goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. The following respirator recommendations are for coal tar pitch volatiles. For any unknown concentration, wear any SCBA with a full facepiece and operated in a pressure-demand or other positive pressure mode, or any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive pressure mode. For escape, wear any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister having a high-efficiency particulate filter, or any appropriate escape-type SCBA. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Shower and change clothes after exposure or at the end of the workshift. Separate contaminated work clothes from street clothes. Launder before reuse. Remove benzo(a)pyrene from your shoes and clean personal protective equipment. Use procedures to ensure laundry personnel are not exposed. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Pale yellow monoclinic needles with a faint, aromatic odor.

Physical State: Solid

Vapor Pressure (kPa): >1 mm Hg at 68 °F (20 °C)

Formula Weight: 252.30

Specific Gravity (H₂O=1, at 4 °C): 1.351

Boiling Point: >680 °F (>360 °C); 590 °F (310 °C) at 10 mm Hg

Freezing/Melting Point: 354 °F (179 °C)

Water Solubility: Insoluble; 0.0038 mg (+/- 0.00031 mg) in 1 L at 77 °F (25 °C)

Other Solubilities: Ether, benzene, toluene, xylene, concentrated hydrosulfuric acid; sparingly soluble in alcohol, methanol.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Benzo(a)pyrene is stable at room temperature in closed containers under normal storage and handling conditions. It undergoes photo-oxidation when exposed to sunlight or light in organic solvents and is also oxidized by chromic acid and ozone. Hazardous polymerization cannot occur. Avoid heat and ignition sources and incompatibles.

Storage Incompatibilities: Strong oxidizers (chlorine, bromine, fluorine) and oxidizing chemicals (chlorates, perchlorates, permanganates, and nitrates).

Hazardous Decomposition Products: Thermal oxidative decomposition of benzo(a)pyrene can produce carbon monoxide and carbon dioxide.

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral: 15 mg/kg produced gastrointestinal and musculoskeletal tumors.

Irritation Effects:

Mouse: 14 µg caused mild irritation.

Other Effects:

Rat, oral: 40 mg/kg on the 14th day of pregnancy caused changes in the extra embryonic structures.

Rat, oral: 2 g/kg administered 28 days prior to mating and 1-22 days of pregnancy produced a stillbirth.

Tumorigenicity, mouse, oral: 75 mg/kg administered to the female during the 12- 14 day of pregnancy produced biochemical and metabolic effects on the newborn.

Mouse, inhalation: 200 ng/m³/6 hr administered intermittently over 13 weeks produced tumors of the lungs.

Human, HeLa cell: 1500 nmol/L caused DNA inhibition.

Human, lung cell: 1 µmol/L caused DNA damage.

Human, liver cell: 100 nmol/L caused DNA damage.

Rabbit, skin: 17 mg/kg administered intermittently over 57 weeks produced tumors of the skin and appendages.

See RTECS DJ3675000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to water, benzo(a)pyrene adsorbs very strongly to particulate matter and sediments, bioconcentrates in aquatic organisms which cannot metabolize it, but does not hydrolyze. Direct photolysis at the water surface, evaporation, or biodegradation may be important, but adsorption may significantly retard these processes. Adsorption to particulates may also retard direct photolysis when benzo(a)pyrene is released to air. Benzo(a)pyrene may be removed from air by reaction with nitrogen dioxide (half-life, 7 days) or ozone (half-life, 37 min), or photochemically produced hydroxyl radicals (estimated half-life, 21.49 hr). It will adsorb very strongly to the soil. Although it is not expected to appreciably leach to the groundwater, groundwater samples indicate that it can be transported there. It is not expected to significantly evaporate or hydrolyze from soils and surfaces. However, it may be subject to appreciable biodegradation in soils. It will adsorb very strongly to the soil. Although it is not expected to appreciably leach to the groundwater, groundwater samples indicate that it can be transported there. It is not expected to significantly evaporate or hydrolyze from soils and surfaces. However, it may be subject to appreciable biodegradation in soils.

Ecotoxicity: Oysters, BCF (bioconcentration factor): 3000; rainbow trout, BCF: 920; *Daphnia pulex*, BCF: 13,000.

BCF: Some marine organisms such as phytoplankton, certain zooplankton, scallops (*Placopecten sp.*), snails (*Littorina littorea*), and mussels (*Mytilus edulis*) lack a metabolic detoxification enzyme system to metabolize benzo(a)pyrene and therefore, tend to accumulate benzo(a)pyrene. Humic acid in solution may decrease bioconcentration.

Octanol/Water Partition Coefficient: log K_{ow} = 6.04

Section 13 - Disposal Considerations

Disposal: Small quantities: 10 mL of a solution containing 0.3 mol/L of potassium permanganate and 3 mol/L of sulfuric acid will degrade 5 mg of benzo(a)pyrene. Also, can treat with sodium dichromate in strong sulfuric acid (1-2 days). Benzo(a)pyrene is also a good candidate for fluidized bed incineration at a temperature range of 842 to 1796 °F (450 to 980 °C) or rotary kiln incineration at 820 to 1600°C. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Environmentally hazardous substances, solid, n.o.s.

ID: UN3077

Hazard Class: 9 - Miscellaneous hazardous material

Packing Group: III - Minor Danger

Symbols: G - Technical Name Required

Label Codes: 9 - Class 9

Special Provisions: 8, 146, B54, IB8, N20

Packaging: Exceptions: 155 **Non-bulk:** 213 **Bulk:** 240

Quantity Limitations: **Passenger aircraft/rail:** No limit **Cargo aircraft only:** No limit

Vessel Stowage: **Location:** A **Other:**



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U022 Toxic Waste

CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a) 1 lb (0.454 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Benzo[*a*]fluoranthene

CAS Number: 205-99-2

Chemical Formula: C₂₀H₁₂

EINECS Number: 205-911-9

ACX Number: X1004486-7

Synonyms: B B F; B E F; B (B) F; B(B)F; B(E)F; BBF; BEF; 3,4-BENZ(E)ACEPHENANTHRYLENE; BENZ(E)ACEPHENANTHRYLENE; 2,3-BENZFLUORANTHENE; 3,4-BENZFLUORANTHENE; BENZO(B)FLUORANTHENE; BENZO[*a*]FLUORANTHENE; 2,3-BENZOFLUORANTHENE; 3,4-BENZOFLUORANTHENE; BENZO(B)FLUORANTHENE; BENZO(E)FLUORANTHENE; BENZO[B]FLUORANTHENE; 2,3-BENZOFLUORANTHRENE

Derivation: No manufacturing information available; found in coal tar, coke oven emissions, cigarette smoke and automobile exhaust. There is no commercial production of this compound in the U.S.

General Use: Used as a research chemical.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Benzo[<i>a</i>]fluoranthene	205-99-2	ca 100% wt

(Note that, except when in the form of a laboratory research chemical, benzo[*a*]fluoranthene is typically found in mixtures with other PAHs (polycyclic aromatic hydrocarbons), such as coal tar pitch).

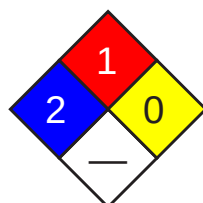
OSHA PEL

NIOSH REL

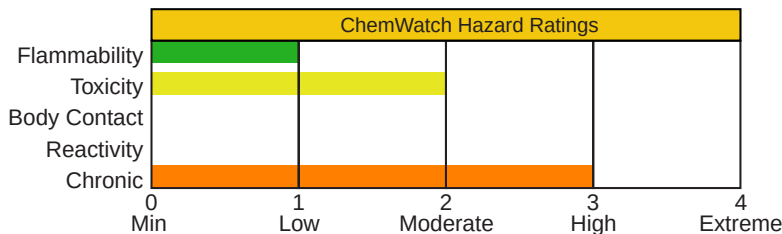
ACGIH TLV

Exposure by all routes should be carefully controlled to levels as low as possible.

Section 3 - Hazards Identification



Fire Diamond



HMIS	
2	Health
1	Flammability
0	Reactivity

ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless needles. May be irritating to eyes/skin/respiratory tract. Possible human carcinogen and mutagen.

Potential Health Effects

Target Organs: Eyes, skin, respiratory system, gastrointestinal (GI) system, blood, liver, kidneys

Primary Entry Routes: Inhalation, ingestion, skin and/or eye contact/absorption

Acute Effects

Inhalation: Irritation may result from inhalation of benzo[*a*]fluoranthene dust or fumes.

Eye: Contact may result in irritation.

Skin: Contact may cause irritation.

Ingestion: None reported.

Carcinogenicity: NTP - Class 2B, Reasonably anticipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A2, Suspected human carcinogen; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Class A2, Unmistakably carcinogenic in animal experimentation only.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: Although there is no direct epidemiological evidence linking benzo[*i*]fluoranthene with cancer, it is frequently a component of mixtures associated with human cancer. Epidemiological studies demonstrate increased incidence of cancer (skin, lung, urinary tract, GI system) with exposure to mixed PAHs and substances that contain them. Coal tar pitch volatiles are reported to cause an excess of bronchitis. In animal studies, benzo[*i*]fluoranthene has been found to be tumorigenic and mutagenic.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult a physician or ophthalmologist if pain and/or irritation develop.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat overexposure symptomatically and supportively. Medical surveillance may be necessary for high exposures (skin, mouth, GI, respiratory system). Animal testing suggests a synergism (combined effect greater than sum of parts) of mutagenicity between benzo[*i*]fluoranthene and other PAHs.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: Probable combustible solid

Autoignition Temperature: None reported.

LEL: None reported.

UEL: None reported.

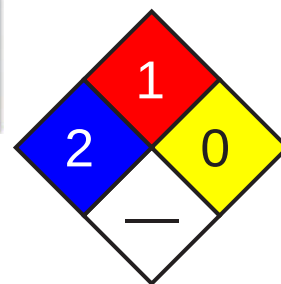
Flammability Classification: Probable combustible solid

Extinguishing Media: Use water spray; carbon dioxide, dry chemical powder or appropriate foam.

General Fire Hazards/Hazardous Combustion Products: Heating benzo[*i*]fluoranthene to decomposition can produce carbon monoxide (CO) and carbon dioxide (CO₂).

Fire-Fighting Instructions: *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

See
DOT
ERG



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, isolate area and deny entry. Remove sources of ignition, and provide maximum ventilation.

Small Spills: Vacuum or carefully scoop up material and deposit in sealed containers. Absorb liquid containing benzo[*i*]fluoranthene with vermiculite, earth, sand or similar material.

Large Spills: Dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways. Stay upwind and have cleanup personnel protect against inhalation and contact.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: Avoid dust inhalation, and skin and eye contact. Avoid sunlight exposure of contaminated skin. Use only with ventilation sufficient to reduce airborne concentrations as low as possible. Wear protective gloves, goggles, and clothing (see Sec. 8). Keep away from heat and ignition sources.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed container in cool, well-ventilated area, away from heat, ignition sources and incompatibles (see Sec. 10). Periodically inspect stored materials.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Work with benzo[*a*]fluoranthene only under an exhaust hood. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Have employees with potential for exposure submit to preplacement and periodic medical examinations with emphasis on oral cavity (including sputum cytology), respiratory tract, skin (chronic disorders, lesions), blood (complete count), bladder and kidneys (urinalysis: specific gravity, albumin, glucose, microscopic examination of sediment; urinary cytology). Repeat medical exam on an annual basis, or on a semi-annual basis for employees 45 years or older or with 10 or more years of exposure to pitch volatiles. Periodically inspect lab atmospheres, and surfaces such as walls, floors, and benches and interior of fume hoods and air ducts for contamination. Post appropriate signs and labels on doors leading to areas where benzo[*a*]fluoranthene is used.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Wear splash-proof chemical safety goggles, and face shield (8-inch minimum), per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For any detectable concentration (of coal tar pitch volatiles) use SCBA with full facepiece operated in pressure-demand or other positive pressure mode, or supplied-air respirator with full facepiece operated in pressure-demand or other positive pressure mode in combination with auxiliary SCBA operated in pressure-demand or other positive pressure mode; escape, air purifying full face respirator (gas mask) with a chin-style or a front- or back-mounted organic vapor canister and with a full facepiece and a fume or high-efficiency filter, or escape-type SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless needles

Physical State: Solid

Vapor Pressure (kPa): 5×10^{-7} mm Hg at 68 °F (20 °C)

Formula Weight: 252.32

Freezing/Melting Point: 334.4 °F (168 °C)

Water Solubility: 0.0012 mg/L

Other Solubilities: 95% ethanol: <1 mg/mL at 66 °F (19 °C); acetone: 10-50 mg/mL at 66 °F (19 °C); benzene: slightly soluble; DMSO: 10-50 mg/mL at 66 °F (19 °C).

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Benzo[*a*]fluoranthene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Heat, sunlight.

Storage Incompatibilities: Include strong oxidizing agents.

Hazardous Decomposition Products: Thermal oxidative decomposition of benzo[*a*]fluoranthene will produce carbon monoxide (CO) and carbon dioxide (CO₂).

Section 11 - Toxicological Information

Other Effects:

Tumorigenicity, mouse, skin: 88 ng/kg/120 weeks intermittently produced toxic effects: tumorigenic - carcinogenic by RTECS criteria; skin and appendages - tumors; tumorigenic - tumors at site of application.

Hamster, lung cells: 100 µg/L produced morphological transformation.

Mouse, skin: 4037 µg/kg/20 days intermittently produced toxic effects: tumorigenic - equivocal tumorigenic agent by RTECS criteria; skin and appendages - tumors.

Rat, intraperitoneal: 100 mg/kg resulted in DNA adducts.

Mouse, skin: 72 mg/kg/60 weeks intermittently produced toxic effects: tumorigenic - equivocal tumorigenic agent by RTECS criteria; skin and appendages - tumors; tumorigenic - tumors at site of application.

Rat, intraperitoneal: 100 mg/kg induced sister chromatid exchange.

Rat, implant: 5 mg/kg produced toxic effects: tumorigenic - equivocal tumorigenic agent by RTECS criteria; lungs, thorax, or respiration - tumors; tumorigenic - tumors at site of application.

Human, lymphocyte cells: 55 µg/L produced mutation.

See RTECS CU1400000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Benzo[*a*]fluoranthene has a low vapor pressure and Henry's Law Constant, and will not readily evaporate from water or soil. In surface water, it will partition from the water column to suspended sediments. Limited bioconcentration in aquatic organisms may occur (polychaete worms, BCF = 9.1); however, fish have an enzyme (microsomal oxidase) capable of rapidly metabolizing PAHs. Photolysis, photo-oxidation, and volatilization of dissolved benzo[*a*]fluoranthene may occur, but adsorption to suspended sediments is expected to inhibit these processes. Release to the soil may result in some biodegradation. Photolysis is not expected to be significant after release to soil. In the atmosphere it is likely to be adsorbed to particulate matter, and will be subject to wet and dry deposition. In the atmosphere, benzo[*a*]fluoranthene will rapidly degrade by reaction with photochemically produced hydroxyl radicals (half life 1.00 day). A high K_{oc} indicates significant sorption and low mobility in the soil column.

Ecotoxicity: Evidence suggests that PAHs in lake bottom sediments may cause tumors in fish.

Henry's Law Constant: 1.38×10^{-4} atm-m³/mole, estimated

Octanol/Water Partition Coefficient: $\log K_{ow} = 6.124$

Soil Sorption Partition Coefficient: $K_{oc} = 5.88$, estimated

Section 13 - Disposal Considerations

Disposal: Benzo[*a*]fluoranthene is a good candidate for rotary kiln incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Environmentally hazardous substances, solid, n.o.s.

ID: UN3077

Hazard Class: 9 - Miscellaneous hazardous material

Packing Group: III - Minor Danger

Symbols: G - Technical Name Required

Label Codes: 9 - Class 9

Special Provisions: 8, 146, B54, IB8, N20

Packaging: Exceptions: 155 **Non-bulk:** 213 **Bulk:** 240

Quantity Limitations: Passenger aircraft/rail: No limit **Cargo aircraft only:** No limit

Vessel Stowage: Location: A **Other:**



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed

CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 1 lb (0.454 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Not listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Benzo(g,h,i)perylene

CAS Number: 191-24-2

Chemical Formula: C₂₂H₁₂

EINECS Number: 205-883-8

ACX Number: X1007822-5

Synonyms: BENZO (G,H,I) PERYLENE; BENZO(GHI)PERYLENE; BENZO[GHI]PERYLENE; 1,12-BENZOPERYLENE; BENZO(G,H,I)PERYLENE; 1,12-BENZPERYLENE

Derivation: Combustion product of wood, coal, oil, propane, and diesel fuels.

General Use: Used for scientific research. There is no commercial production of this compound.

Section 2 - Composition / Information on Ingredients

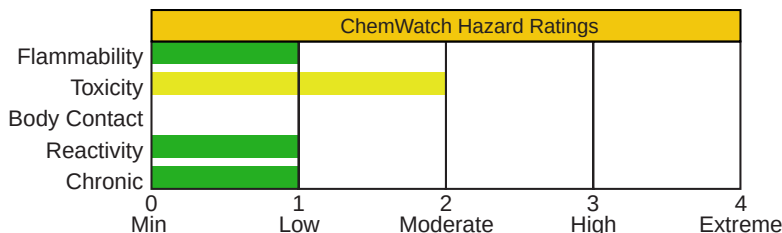
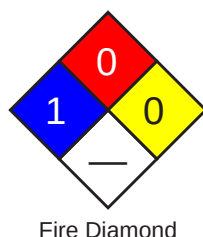
Name	CAS	%
Benzo(g,h,i)perylene	191-24-2	

OSHA PEL

NIOSH REL

ACGIH TLV

Section 3 - Hazards Identification



HMIS	
1	Health
0	Flammability
0	Reactivity

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Yellowish-green leaflets or plates. Acute toxicity is probably low in humans but it may produce chronic effects. Questionable carcinogen. Mutation data reported.

Potential Health Effects

Target Organs: Skin, eyes

Primary Entry Routes: Inhalation, skin/eye contact, skin absorption, ingestion

Acute Effects

Inhalation: The toxicological properties of benzo(g,h,i)perylene have not been thoroughly investigated. In general, polynuclear aromatic hydrocarbons (PAHs) have a low order of acute toxicity in humans, but can produce a variety of non-cancer effects with chronic exposure.

Eye: Effects unknown.

Skin: May be absorbed through skin.

Ingestion: Effects unknown.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: Polynuclear aromatic hydrocarbons (PAH's) may produce chronic effects such as eye photosensitivity and irritation; respiratory irritation with cough and bronchitis; leukoplakia; skin irritation, "coal tar warts" (precancerous lesions enhanced by UV light exposure), redness, dermal burns, photosensitivity, and acneiform lesions; mild kidney and liver toxicity (animals). Some, but not all, PAHs are carcinogens.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult a physician or ophthalmologist if pain or irritation persist.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water. *Do not* induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Section 5 - Fire-Fighting Measures

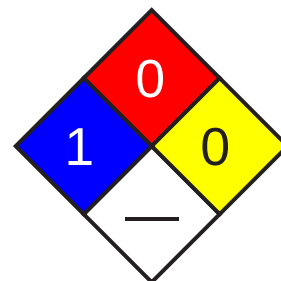
Flash Point: Data not found.

Autoignition Temperature: Data not found.

Extinguishing Media: Extinguish with water spray, carbon dioxide, dry chemical powder or appropriate foam.

General Fire Hazards/Hazardous Combustion Products: Toxic fumes of carbon monoxide and carbon dioxide.

Fire-Fighting Instructions: *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources. Isolate and ventilate area, deny entry, stay upwind. Cleanup personnel should protect against exposure (Sec. 8).

Small Spills: If in solid form, *do not* sweep! Carefully scoop up or vacuum (with a HEPA filter). Avoid raising dust. Absorb liquid spill with an inert, noncombustible absorbent such as sand or vermiculite.

Large Spills: For large spills, dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Wear personal protective clothing and equipment to prevent dust inhalation and contact with skin or eyes (Sec. 8).

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed containers in a cool, well-ventilated area away from heat, light, ignition sources, and incompatibles.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose operations to avoid dust dispersion into the work area. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Educate workers about the health and safety hazards associated with this material. Train in work practices which minimize exposure. Consider preplacement and periodic medical exams with emphasis on liver and kidney functions, complete blood count, chest X-ray, pulmonary function tests, and skin and oral cavity examinations.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not protective eye devices. Appropriate eye protection must be worn instead of, or in conjunction with, contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, cartridge change schedules, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Yellowish-green; fluorescent

Physical State: Solid; leaflets or plates

Vapor Pressure (kPa): 1×10^{-10} mm Hg at 77 °F (25 °C)

Formula Weight: 276.34

Boiling Point: 1022 °F (550 °C)

Freezing/Melting Point: 530.6 °F (277 °C)

Ionization Potential (eV): 7.15 eV

Water Solubility: Insoluble; $2.5 - 2.7 \times 10^{-4}$ mg/L at 77 °F (25 °C)

Other Solubilities: Soluble in 1,4-dioxane, dichloromethane, benzene, and acetone

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Benzo(g,h,i)perylene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Avoid contact with chemical incompatibles, heat, and sources of ignition.

Storage Incompatibilities: Include strong oxidizing agents. Reacts with NO and NO₂ to form nitro derivatives.

Hazardous Decomposition Products: Thermal oxidative decomposition of benzo(g,h,i)perylene can produce toxic fumes of carbon dioxide and carbon monoxide.

Section 11 - Toxicological Information

Other Effects:

Genetic Effects: *S Typhimurium*, 2 µg/plate/48 hours (-S9) induced mutation.

Mouse, skin, 40 µmol/kg induced DNA damage.

Human, lymphocyte cell, 80 µg/L induced mutations in mammalian somatic cells.

See RTECS DI6200500, for additional data.

Section 12 - Ecological Information

Environmental Fate: Benzo(g,h,i)perylene biodegrades slowly in the environment, with a half-life range in aerobic soil from 600 to 650 days. It is not expected to hydrolyze. In aquatic systems it partitions from the water column to organic matter contained in sediments and suspended solids. It also has the potential to bioconcentrate in aquatic systems. Volatilization from shallow, fast-moving waters may be important. In the atmosphere, the vapor phase reaction with photochemically-produced hydroxyl radicals with a half-life of 2 hours may be an important fate process. However, benzo(g,h,i)perylene is expected to exist almost entirely in the particulate phase in ambient air, though it may undergo direct photolysis in the atmosphere. Benzo(g,h,i)perylene is expected to be highly immobile in soil. Log K_{ow}: 6.58 - 6.63

Ecotoxicity: Data not found.

Henry's Law Constant: 2.66×10^{-7} atm·m³/mol

BCF: 64,000, estimated

Soil Sorption Partition Coefficient: K_{oc} = $> 1 \times 10^6$

Section 13 - Disposal Considerations

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable federal, state, and local regulations. Handle empty containers carefully as hazardous residues may still remain. Triple rinse containers and dispose of wash wastewater appropriately.

Section 14 - Transport Information**DOT Hazardous Materials Table Data (49 CFR 172.101):**

Shipping Name and Description: Not specifically listed.

Section 15 - Regulatory Information**EPA Regulations:**

RCRA 40 CFR: Not listed

CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 5000 lb (2268 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Not listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Benzo[k]fluoranthene

CAS Number: 207-08-9

Chemical Formula: C₂₀H₁₂

EINECS Number: 205-916-6

ACX Number: X1004488-1

Synonyms: B; B (K) F; B K F; 8,9-BENZFLUORANTHENE; BENZO(K) FLUORANTHENE; 11,12-BENZO(K)FLUORANTHENE; 11,12-BENZOFLUORANTHENE; 8,9-BENZOFLUORANTHENE; BENZO(K)FLUORANTHENE; BENZO[K]FLUORANTHENE; 11,12-BENZOFLURANTHENE; 2,3,1',8'-BINAPHTHYLENE; 2,3,1',8'-BINAPHTHYLENE; BKF; DIBENZO(B,JK)FLUORENE

General Use: there is no commercial use of this compound

Section 2 - Composition / Information on Ingredients

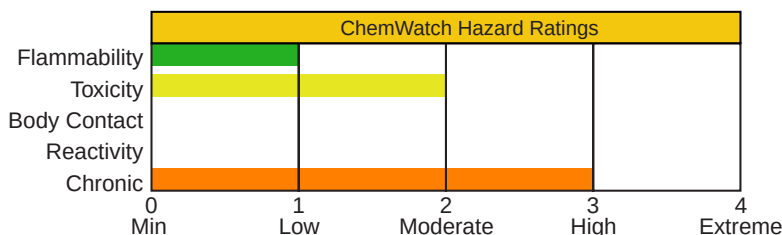
Name	CAS	%
benzo[k]fluoranthene	207-08-9	>98

OSHA PEL

NIOSH REL

ACGIH TLV

Section 3 - Hazards Identification



ANSI Signal Word

Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Pale yellow needles. Irritating to eyes/skin/respiratory tract. Toxic. Probable human carcinogen. Will burn.

Potential Health Effects

Target Organs: eyes, skin, respiratory system

Primary Entry Routes: skin contact/absorption, inhalation of generated dust

Acute Effects

Inhalation: The dust may be discomforting to the upper respiratory tract. Persons with impaired respiratory function, airway diseases, or conditions such as emphysema or chronic bronchitis may incur further disability if excessive concentrations of particulate are inhaled.

Eye: The material is moderately discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/ or other transient eye damage/ ulceration.

Skin: The material may be mildly discomforting to the skin. Open cuts and abraded or irritated skin should not be exposed to this material. The material may accentuate any pre-existing skin condition.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments. The material is moderately discomforting and harmful if swallowed in large quantity.

Carcinogenicity: NTP - Listed; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Not listed.

Chronic Effects: When injected into pulmonary tissue of female rats benzo[k]fluoranthene induced squamous cell carcinomas. Topical administration initiated skin tumors in female mice whilst subcutaneous injection induced local sarcomas in mice of both sexes. Although there is no adequate data available to evaluate carcinogenicity of PAHs in

humans, there are a number of epidemiologic and mortality studies to show increased incidences of cancer in humans exposed to mixtures of PAHs. Lung and genitourinary cancer mortality amongst coke oven workers and skin tumors in workers exposed to creosote are examples.

Section 4 - First Aid Measures

Inhalation: • If dust is inhaled, remove to fresh air.

- Encourage patient to blow nose to ensure clear breathing passages.
- Rinse mouth with water. Consider drinking water to remove dust from throat.
- Seek medical attention if irritation or discomfort persist.

Eye Contact: • Immediately hold the eyes open and flush with fresh running water.

- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Seek medical attention if pain persists or recurs.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: • Immediately remove all contaminated clothing, including footwear (after rinsing with water).

- Wash affected areas thoroughly with water (and soap if available).
- Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center. If more than 15 minutes from a hospital:

- INDUCE vomiting with IPECAC SYRUP, or fingers down the back of the throat, ONLY IF CONSCIOUS. Lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. NOTE: Wear a protective glove when inducing vomiting by mechanical means.
- SEEK MEDICAL ATTENTION WITHOUT DELAY.
- In the meantime, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient's condition.
- If the services of a medical officer or medical doctor are readily available, the patient should be placed in his/her care and a copy of the MSDS should be provided.
- If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of the MSDS.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: Not available; probably combustible

Extinguishing Media: Foam. Dry chemical powder. BCF (where regulations permit). Carbon dioxide. Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: • Solid which exhibits difficult combustion or is difficult to ignite.

- Avoid generating dust, particularly clouds of dust in a confined or unventilated space, as dust may form an explosive mixture with air and any source of ignition, e.g., flame or spark, will cause fire or explosion.
- Dry dust can also be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport.
- Build-up of electrostatic charge may be prevented by bonding and grounding.
- Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting. Combustion products include carbon dioxide (CO₂).

Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.

Fire-Fighting Instructions: • Use water delivered as a fine spray to control fire and cool adjacent area.

- Do not approach containers suspected to be hot.
- Cool fire-exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.
- Equipment should be thoroughly decontaminated after use.

See
DOT
ERG

Section 6 - Accidental Release Measures

Small Spills: • Clean up all spills immediately.

- Avoid contact with skin and eyes.
- Wear impervious gloves and safety glasses.
- Use dry clean up procedures and avoid generating dust.
- Vacuum up or sweep up.
- Place spilled material in clean, dry, sealable, labeled container.

Large Spills: • Clear area of personnel and move upwind.

- Contact fire department and tell them location and nature of hazard.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or waterways.

See
DOT
ERG

- Stop leak if safe to do so.
- Contain spill with sand, earth or vermiculite.
- Collect recoverable product into labeled containers for recycling.
- Neutralize/decontaminate residue.
- Collect solid residues and seal in labeled drums for disposal.
- Wash area and prevent runoff into drains.
- After clean up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.
- If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: • Avoid all personal contact, including inhalation.

- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.
- DO NOT enter confined spaces until atmosphere has been checked.
- Avoid smoking, bare lights or ignition sources.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately.
- Follow good occupational work practices.
- Observe manufacturer's storage and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

Recommended Storage Methods: Metal can. Metal drum. Check that all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: General exhaust is adequate under normal operating conditions. If risk of overexposure exists, wear NIOSH-approved respirator. Provide adequate ventilation in warehouse or closed storage areas.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses, safety glasses with side shields, or chemical goggles. Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Wear general protective gloves, e.g. light weight rubber gloves.

Other: Overalls; impervious protective clothing. Eyewash unit.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Yellow powder.

Physical State: pale yellow needles

Vapor Pressure (kPa): 0.0000000000959 mm Hg at 25 °C

Vapor Density (Air=1): > 1

Formula Weight: 252.32

Boiling Point: 480 °C (896 °F) at 760 mm Hg

Freezing/Melting Point: 217 °C (422.6 °F)

Water Solubility: Insoluble in Water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Tumors at site of application.

NOTE: Substance has been shown to be mutagenic in various assays, or belongs to a family of chemicals producing damage or change to cellular DNA.

See RTECS DF6350000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Its presence in distant places indicates that it is reasonably stable in the atmosphere and capable of long distant transport. Atmospheric losses are caused by gravitational settling and rainout. On land it is strongly adsorbed to soil and remains in the upper soil layers and should not leach into groundwater. Biodegradation may occur but will be very slow (half-life ca 2 years with acclimated microorganisms). It will get into surface water from dust and precipitation in addition to runoff and effluents. In the water it will sorb to sediment and particulate matter in the water column. It would be expected to bioconcentrate in fish and seafood.

Ecotoxicity: No data found.

Henry's Law Constant: estimated at 4.2×10^8

BCF: fish 4.97

Octanol/Water Partition Coefficient: $\log K_{ow} = 6.84$

Soil Sorption Partition Coefficient: $K_{oc} = \text{nearly } 1 \times 10^6$

Section 13 - Disposal Considerations

Disposal: • Consult manufacturer for recycling options and recycle where possible.

• Follow applicable local, state, and federal regulations.

• Incinerate residue at an approved site.

• Recycle containers if possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Toxic solids, organic, n.o.s.

ID: UN2811

Hazard Class: 6.1 - Poisonous materials

Packing Group: I - Great Danger

Symbols: G - Technical Name Required

Label Codes: 6.1 - Poison or Poison Inhalation Hazard *if inhalation hazard, Zone A or B*

Special Provisions: IB7

Packaging: Exceptions: None **Non-bulk:** 211 **Bulk:** 242

Quantity Limitations: Passenger aircraft/rail: 5 kg **Cargo aircraft only:** 50 kg

Vessel Stowage: Location: B **Other:**



Shipping Name and Description: Toxic solids, organic, n.o.s.

ID: UN2811

Hazard Class: 6.1 - Poisonous materials

Packing Group: II - Medium Danger

Symbols: G - Technical Name Required

Label Codes: 6.1 - Poison or Poison Inhalation Hazard *if inhalation hazard, Zone A or B*

Special Provisions: IB8, IP2, IP4

Packaging: Exceptions: None **Non-bulk:** 212 **Bulk:** 242

Quantity Limitations: Passenger aircraft/rail: 25 kg **Cargo aircraft only:** 100 kg

Vessel Stowage: Location: B **Other:**



Shipping Name and Description: Toxic solids, organic, n.o.s.

ID: UN2811

Hazard Class: 6.1 - Poisonous materials

Packing Group: III - Minor Danger

Symbols: G - Technical Name Required

Label Codes: 6.1 - Poison or Poison Inhalation Hazard *if inhalation hazard, Zone A or B*

Special Provisions: IB8, IP3

Packaging: Exceptions: 153 **Non-bulk:** 213 **Bulk:** 240

Quantity Limitations: Passenger aircraft/rail: 100 kg **Cargo aircraft only:** 200 kg

Vessel Stowage: Location: A **Other:**



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed

CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 5000 lb (2268 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Not listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: di-sec-Octyl Phthalate

CAS Number: 117-81-7

Chemical Formula: $C_{24}H_{38}O_4$

Structural Chemical Formula: $C_6H_4[COOCH_2CH(C_2H_5)(CH_2)_3]_2$

EINECS Number: 204-211-0

ACX Number: X1003752-2

Synonyms: BEHP; 1,2-BENZENEDICARBOXYLIC ACID,BIS(2-ETHYLHEXYL) ESTER; 1,2-BENZENEDICARBOXYLIC ACID,BIS(ETHYLHEXYL) ESTER; BIS(2-ETHYLHEXYL) 1,2-BENZENEDICARBOXYLATE; BIS(2-ETHYLHEXYL)-1,2-BENZENEDICARBOXYLATE; BIS-(2-ETHYLHEXYL)-1,2-BENZENEDICARBOXYLATE; BIS-(2-ETHYLHEXYL)ESTER KYSELINY FTALOVE; BIS(2-ETHYLHEXYL)ESTER PHTHALIC ACID; BIS(2-ETHYLHEXYL)PHTHALATE; BIS-(2-ETHYLHEXYL)PHTHALATE; BISOFLEX 81; BISOFLEX DOP; COMPOUND 889; DAF 68; DEHP; DI(2-ETHYLHEXYL) PHTHALATE; DI(ETHYLHEXYL) PHTHALATE; DIETHYLHEXYL PHTHALATE; DI(2-ETHYLHEXYL)ORTHOPHTHALATE; DI(2-ETHYLHEXYL)PHTHALATE; DI-2-ETHYLHEXYLPHTHALATE; DI-SEC-OCTYL PHTHALATE; DIOCTYL PHTHALATE; DOF; DOP; ERGOPLAST FDO; ERGOPLAST FDO-S; 2-ETHYLHEXYL PHTHALATE; ETHYLHEXYL PHTHALATE; EVIPLAST 80; EVIPLAST 81; FLEXIMEL; FLEXOL DOP; FLEXOL PLASTICIZER DOP; GOOD-RITE GP 264; HATCOL DOP; HERCOFLEX 260; JAYFLEX DOP; KODAFLEX DOP; MOLLAN O; NUOPLAZ DOP; OCTOIL; OCTYL PHTHALATE; PALATINOL AH; PHTHALIC ACID DIOCTYL ESTER; PHTHALIC ACID,BIS(2-ETHYLHEXYL) ESTER; PITTSBURGH PX-138; PLATINOL AH; PLATINOL DOP; RC PLASTICIZER DOP; REOMOL D 79P; REOMOL DOP; SICOL 150; STAFLEX DOP; TRUFLEX DOP; VESTINOL AH; VINICIZER 80; WITCIZER 312

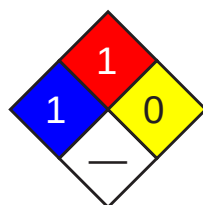
General Use: Used as a plasticizer for resins, elastomers, vinyl products, films for packaging, containers and electrical cables.

High purity grades used as electrical insulating (dielectric) fluid.

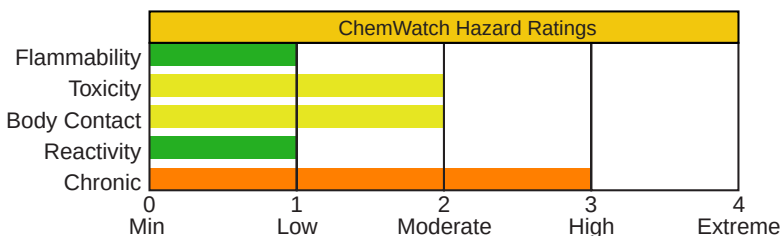
Section 2 - Composition / Information on Ingredients

Name	CAS	%
di-sec-octyl phthalate	117-81-7	>99
OSHA PEL TWA: 5 mg/m ³ .	NIOSH REL TWA: 5 mg/m ³ ; STEL: 10 mg/m ³ .	DFG (Germany) MAK TWA: 10 mg/m ³ ; PEAK: 80 mg/m ³ .
ACGIH TLV TWA: 5 mg/m ³ .	IDLH Level 5000 mg/m ³ .	

Section 3 - Hazards Identification



Fire Diamond



HMIS	
0	Health
1	Flammability
0	Reactivity

ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Light colored liquid; slight odor. Mildly irritating to eyes/skin/respiratory tract. Also causes: conjunctivitis, keratitis, bronchial irritation, eczema, staggering, abdominal cramps, nausea, diarrhea, CNS depression. Possible cancer hazard.

Potential Health Effects

Target Organs: eyes, upper respiratory system, skin, central nervous system (CNS)

Primary Entry Routes: inhalation, ingestion

Acute Effects

Inhalation: Not normally a hazard due to nonvolatile nature of product. Inhalation hazard is increased at higher temperatures.

The mist is discomforting to the upper respiratory tract.

Inhalation of concentrated mists can cause coughing, sneezing, severe irritation, dizziness, headache and nausea.

Eye: The liquid may produce eye discomfort and is capable of causing temporary impairment of vision and/or transient eye inflammation, ulceration. The mist is moderately discomforting to the eyes.

The material may be irritating to the eye, with prolonged contact causing inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid is mildly discomforting to the skin if exposure is prolonged and may cause drying of the skin, which may lead to dermatitis.

Irritation and skin reactions are possible with sensitive skin.

The material may accentuate any pre-existing dermatitis condition.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid is discomforting and is regarded as harmful if swallowed.

Ingestion may result in nausea, abdominal irritation, pain and vomiting.

Phthalates (aromatic dicarboxylic acid esters), in general, exhibit low toxicity, partly because of poor absorption but mainly as a result of rapid metabolism in which the esters are saponified to phthalic acid (which is rapidly excreted) and the parent alcohol (which is subsequently metabolized). The pathology of these compounds seems to be related to the released alcohol and its biological effects. Testicular atrophy produced in rats during feeding studies depends on the length and structure of the alcohol; in general the lower molecular weight esters produce the more severe effects. The toxicity of phthalic acid isomers decreases in the order o-phthalic acid, isophthalic acid and terephthalic acid.

Phthalic acid is not metabolized but is excreted, unchanged, in the urine and feces.

Terephthalic acid appears to potentiate the biological effects of substances such as antibiotics, thiamine and sulfonamides.

Carcinogenicity: NTP - Class 2B, Reasonably anticipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A3, Animal carcinogen; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Not listed.

Chronic Effects: Oral studies of 90-days to 2-years in rat, 1-year in guinea pig and up to 1-year in dog have shown a no-effect level of about 60 mg/kg/day. Higher doses produced growth retardation and increased weights of livers and kidneys.

Rats and mice fed on diets containing 6000-12000 (rats) and 3000-6000 (mice) mg/kg body weight for 103 weeks showed an increased incidence of hepatocellular carcinomas in female rats and male and female mice, and an increased incidence of either hepatocellular carcinomas or neoplastic nodules in male rats. About 35% of the hepatocellular carcinomas in mice had metastasised to the lungs.

The substance can cause testicular damage in rats (dietary and gavage studies) with a no-effect level in 0.3% to 0.5% in the diet. Inhalation or dermal exposures did not produce testicular effects. When the substance was fed to pregnant rats (5 mL/kg) it produced slight effects on embryonic and fetal development with skeletal abnormalities more common.

A Russian study describes exposure by workers to mixed phthalates (and other plasticizers) - pain, numbness and spasms in the upper and lower extremities were related to duration of exposures. Symptoms usually developed after the sixth or seventh year of work. Neurological studies revealed the development of polyneuritis in about 30% of the workers involved in this study. About 30% of the workforce showed depression of the vestibular receptors. Because the study described mixed exposures it is difficult to determine what, if any, unique role was played by the phthalates. Increased incidences of anovulatory reproductive cycles and low estrogen concentrations were reported among Russian women working with phthalate plasticizers; the abnormal cycles were associated with spontaneous abortion. The specific phthalates implicated, dose levels and other data were not reported.

It has been alleged that the phthalates mimic or interfere with sex hormones. Phthalates are added as plasticizers in plastics (including food packaging) and are used as ingredients in paints, inks and adhesives. Their potential for entering the human body is marked. They have been added to a list of chemicals (including alkyl phenolics, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and dioxins) which are implicated in reducing sperm counts and fertility in males a phenomenon which has apparently arisen since the mid 1960s.

Although the human fetus is "bathed" in naturally occurring estrogens during pregnancy it is suggested that it has developed a protective mechanism against natural estrogens but is not safe from synthetic variants. These tend to

accumulate in body fats which sets them apart from the natural product. During early pregnancy, fats are broken down and may flood the body with concentrated pollutants.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold eyes open and flush continuously with running water for at least 15 minutes. Ensure irrigation under eyelids.

Seek medical attention without delay.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

If more than 15 minutes from a hospital, induce vomiting, preferably using Ipecac Syrup APF.

Note: DO NOT INDUCE VOMITING in an unconscious person.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically.

Section 5 - Fire-Fighting Measures

Flash Point: 215 °C Open Cup

Autoignition Temperature: 391 °C

LEL: 0.3% v/v

Extinguishing Media: Water spray or fog; foam, dry chemical powder, or BCF (where regulations permit).

Carbon dioxide.

General Fire Hazards/Hazardous Combustion Products: Combustible. Slight fire hazard when exposed to heat or flame.

Heating may cause expansion or decomposition leading to violent rupture of containers.

On combustion, may emit toxic fumes of carbon monoxide (CO).

May emit acrid smoke.

Mists containing combustible materials may be explosive.

Hot organic vapors or mist are capable of sudden spontaneous combustion when mixed with air even at temperatures below their published autoignition temperatures. The temperature of ignition decreases with increasing vapor volume and vapor/air contact times and is influenced by pressure change.

Ignition may occur under elevated-temperature process conditions especially in processes performed under vacuum subjected to sudden ingress of air or in processes performed at elevated pressure, where sudden escape of vapors or mists to the atmosphere occurs.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

If safe, switch off electrical equipment until vapor fire hazard removed.

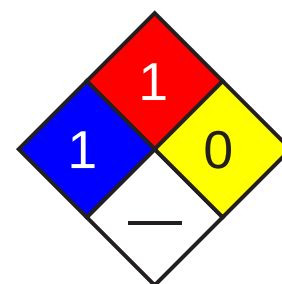
Use water delivered as a fine spray to control fire and cool adjacent area.

Avoid spraying water onto liquid pools.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protected location.

If safe to do so, remove containers from path of fire.



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.

Avoid breathing vapors and contact with skin and eyes.

Control personal contact by using protective equipment.

Contain and absorb spill with sand, earth, inert material or vermiculite.

Wipe up. Place in a suitable labeled container for waste disposal.

Large Spills: Contact fire department and tell them location and nature of hazard.

Clear area of personnel and move upwind.

Shut off all possible sources of ignition and increase ventilation.

Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

Stop leak if safe to do so.

Absorb or cover spill with sand, earth, inert material or vermiculite.
 Recover liquid and place in labeled, sealable container for recycling.
 Collect residues and seal in labeled drums for disposal.
 Wash spill area with detergent and water.
 If contamination of drains or waterways occurs, advise emergency services.
 After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Use good occupational work practices.

Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Use in a well-ventilated area.

Avoid generating and breathing mist and vapor.

Avoid contact with incompatible materials.

Avoid prolonged and repeated skin contact.

Avoid smoking, bare lights or ignition sources.

Avoid physical damage to containers.

Keep containers securely sealed when not in use.

Wear personal protective equipment when handling.

When handling, DO NOT eat, drink or smoke.

Always wash hands with soap and water after handling. Work clothes should be laundered separately.

Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.

Check all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: None under normal operating conditions. OTHERWISE: General exhaust is adequate under normal operating conditions.

If inhalation risk of overexposure exists, wear NIOSH-approved organic-vapor respirator.

If mist is present, use air supplied breathing apparatus.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; or as required, chemical goggles.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Barrier cream and Nitrile rubber gloves or Neoprene rubber gloves.

Safety footwear.

Respiratory Protection:

Exposure Range >5 to 50 mg/m³: Air Purifying, Negative Pressure, Half Mask

Exposure Range >50 to 500 mg/m³: Air Purifying, Negative Pressure, Full Face

Exposure Range >500 to <5000 mg/m³: Supplied Air, Constant Flow/Pressure Demand, Half Mask

Exposure Range 5000 to unlimited mg/m³: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Cartridge Color: dust/mist filter (use P100 or consult supervisor for appropriate dust/mist filter)

Other: Overalls. Eyewash unit.

Glove Selection Index:

BUTYL Best selection

VITON Best selection

NITRILE Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Light-colored, odorless and oily liquid. Mixes with mineral oil and most organic solvents.

Physical State: Liquid

pH: Not applicable

Vapor Pressure (kPa): 0.17 at 200 °C

pH (1% Solution): Not applicable.

Vapor Density (Air=1): 13.45

Boiling Point: 230 °C (446 °F) at 5 mm Hg

Formula Weight: 390.54

Freezing/Melting Point: -50 °C (-58 °F)

Specific Gravity (H₂O=1, at 4 °C): 0.99 at 20 °C

Water Solubility: < 0.01% at 25 °C

Evaporation Rate: Very Slow

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Hazardous polymerization will not occur. Stable under normal storage conditions.

Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Toxicity

Oral (rat) LD₅₀: 30000 mg/kg

Oral (human) TD_{Lo}: 143 mg/kg

Oral (mouse) LD₅₀: 1500 mg/kg

Oral (rabbit) LD₅₀: 34000 mg/kg

Dermal (rabbit) LD₅₀: 25000 mg/kg

Intraperitoneal (rabbit) LD₅₀: >31 mL/kg

Oral (guinea pig) LD₅₀: 26000 mg/kg

Dermal (g.pig) LD₅₀: 10000 mg/kg

Gastrointestinal changes, respiratory system changes, somnolence, hemorrhage, necrotic changes in GI tract, lowered blood pressure, liver, endocrine tumors, feto toxicity, paternal effects, maternal effects, specific developmental abnormalities (hepatobiliary system, musculoskeletal system, cardiovascular system, urogenital system, central nervous system, eye/ear), fetolethality recorded.

NOTE: Substance has been shown to be mutagenic in various assays, or belongs to a family of chemicals producing damage or change to cellular DNA.

Irritation

Skin (rabbit): 500 mg/24 hr mild

Eye (rabbit): 500 mg/24 hr mild

See RTECS TI 0350000, for additional data.

Section 12 - Ecological Information

Environmental Fate: In water it will biodegrade (half-life 2-3 wk), adsorb to sediments and bioconcentrate in aquatic organisms. Atmospheric material will be carried long distances and be removed by rain.

Ecotoxicity: LC₅₀ Gammarus pseudolimnaeus more than 32 mg/l/96 hr at 21 °C; juvenile /static bioassay; LC₅₀ Ictalurus punctatus (channel catfish) more than 100 mg/l/96 hr at 20 °C; wt 1.5 g /static bioassay; EC₅₀ Gymnodinium breve growth rate 3.1% vol/vol/96 hr /Conditions of bioassay not specified; LC₅₀ Oncorhynchus kisutch (coho salmon) more than 100 mg/l/96 hr at 16 °C; wt 1.5 g /static bioassay; LC₅₀ Daphnia magna: 1,000-5,000 ug/l/48 hr /Conditions of bioassay not specified; LC₅₀ Chironomus plumosus (Midge): > 18,000 ug/l/48 hr /Conditions of bioassay not specified

Henry's Law Constant: 1 x10⁻⁴

BCF: fish 2

Biochemical Oxygen Demand (BOD): acclimated < 1 lb/lb, 5 days

Octanol/Water Partition Coefficient: log K_{ow} = 4.89

Soil Sorption Partition Coefficient: K_{oc} = 4 to 5

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.

Follow applicable federal, state, and local regulations.

Incinerate residue at an approved site.

Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: None

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U028 Toxic Waste

CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Cadmium **CAS Number:** 7440-43-9
Chemical Formula: Cd
EINECS Number: 231-152-8
ACX Number: X1002486-9
Synonyms: C I 77180; C.I. 77180; CADMIUM; CADMIUM DUST FUME; CADMIUM POWDER; COLLOIDAL CADMIUM; KADMIUM
Derivation: Cadmium is collected as dust or fume from roasting zinc ores, mixed with coal or coke and sodium or zinc chloride, and sintered. The cadmium fume is collected in an electrostatic precipitator, leached, fractionally precipitated, and distilled; collected as sludge from zinc sulfate purification; prepared from direct distillation of cadmium-bearing zinc; obtained by recovery from electrolytic zinc process; may be prepared from cadmium sulfate in the laboratory.
General Use: Cadmium is used as a constituent of easily fusible alloys; soft solder and solder for aluminum; in electroplating; as a deoxidizer for nickel plating; for process engraving; electrodes for cadmium vapor lamps; photoelectric cells; photometry of ultraviolet sun-rays; in Ni-Cd storage batteries; to charge Jones reducers; as an amalgam in dentistry; power transmission wire; TV phosphors; basis of pigments used in ceramic glazing, machinery enamels, baking enamels; Weston-standard-cell control of atomic fission in nuclear reactors; reactor control rods; fungicide; photography and lithography; selenium rectifiers.

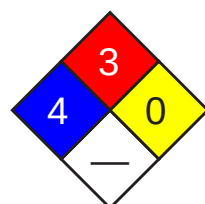
Section 2 - Composition / Information on Ingredients

Name	CAS	%
Cadmium		ca 99.5+% wt

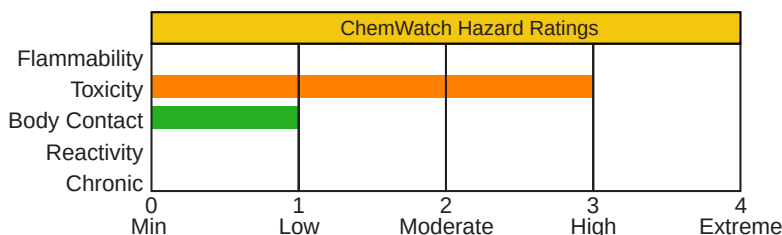
Trace Impurities: < 10 ppm

OSHA PEL TWA: 0.005 mg/m ³ .	NIOSH REL Lowest Feasible Concentration.
ACGIH TLV TWA: 0.01 mg/m ³ ; measured as inhalable fraction of the aerosol; TWA: 0.002 mg/m ³ ; measured as respirable fraction of the aerosol.	IDLH Level 9 mg/m ³ (as Cd).

Section 3 - Hazards Identification

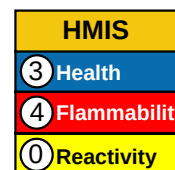


Fire Diamond



ANSI Signal Word

Danger!



☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Lustrous metal solid, silver-white to bluish color; odorless. Irritating to skin/respiratory tract. Toxic by inhalation. Chronic Effects: kidney damage, obstructive lung disease, possible carcinogen/teratogen. Dust ignites spontaneously in air. Forms explosive dust-air mixtures.

Potential Health Effects

Target Organs: Respiratory system, kidneys
Primary Entry Routes: Inhalation and ingestion

Acute Effects

Inhalation: Initial signs/symptoms of cadmium poisoning resemble those of the flu. Inhalation of dust or fumes causes throat dryness, cough, headache, vomiting, chest pain, dyspnea (shortness of breath), central nervous system (CNS) effects, extreme restlessness and irritability, pneumonitis, possibly bronchopneumonia, pulmonary edema, and death due to respiratory failure in severe cases. Symptoms may be delayed up to 24 hours. Residual emphysema and fibrosis may result. Note: heating of cadmium may produce cadmium oxide, the inhalation of which can result in metal fume fever, characterized by fever, chills, malaise, headache, myalgias, fatigue, cough, thirst, and abdominal discomfort, with symptom onset about 3 to 10 hours after exposure. Symptoms do not usually last beyond 24 to 48 hours.

Eye: May cause irritation.

Skin: Contact may cause irritation, skin eruptions and pruritus. Significant dermal absorption rarely occurs.

Ingestion: Causes increased salivation, dry mouth, choking, nausea, vomiting, abdominal pain and cramping, blurred vision, anemia, kidney dysfunction, diarrhea, gastroenteritis, and substernal pain.

Carcinogenicity: NTP - Class 2A, Reasonably anticipated to be a carcinogen, limited evidence of carcinogenicity from studies in humans; IARC - Group 1, Carcinogenic to humans; OSHA - Listed as a carcinogen; NIOSH - Listed as carcinogen; ACGIH - Class A2, Suspected human carcinogen; EPA - Class B1, Probable human carcinogen based on epidemiologic studies; MAK - Class A2, Unmistakably carcinogenic in animal experimentation only.

Medical Conditions Aggravated by Long-Term Exposure: Kidney disorders, respiratory disorders.

Chronic Effects: Include chronic obstructive lung disease such as emphysema, kidney damage (renal tubular disorder and proteinuria (low molecular weight)), bone demineralization, microfractures and osteomalacia, respiratory cancer, gastrointestinal symptoms, anosmia (loss of sense of smell), rhinitis and discoloration of the teeth. It is implicated as the causative agent in Itai- Itai disease in Japan.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult a physician or ophthalmologist if pain or irritation persist.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the conscious and alert person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Consider a chest X-ray after acute exposure.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: Data not found.

Autoignition Temperature: 482 °F (250 °C) (layer cadmium metal dust)

LEL: Data not found.

UEL: Data not found.

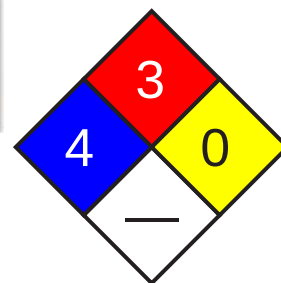
Flammability Classification: Flammable

Extinguishing Media: Extinguish with carbon dioxide, dolomite, dry powder, graphite, soda ash, sodium chloride, dry chemical, or sand.

General Fire Hazards/Hazardous Combustion Products: When heated to decomposition, toxic fumes of cadmium are emitted. The finely divided material is pyrophoric. The more finely divided the powder the greater the fire/explosion hazard.

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

See
DOT
ERG



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources. Isolate and ventilate area, deny entry, stay upwind. Cleanup personnel should protect against exposure. Prevent entry into water, sewers, basements or confined areas.

Small Spills: If in solid form, do not sweep! Absorb or cover with dry earth, sand or other noncombustible material. Carefully scoop up or vacuum (with a HEPA filter).

Large Spills: Do not release into sewers or waterways.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120). Also 1910.1027.

See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: Wear personal protective clothing and equipment to prevent dust inhalation and any contact with skin or eyes (Sec. 8). Wash thoroughly after handling cadmium.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed containers in a cool, well-ventilated area away from heat, light, ignition sources, incompatibles, and air. Cadmium slowly oxidizes in air to form cadmium oxide.

Storage Requirements: Areas where cadmium is used or stored must be labeled according to 29 CFR 1910.1027.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose operations to avoid dust dispersion into the work area. Provide general or local exhaust ventilation systems to maintain airborne concentrations below exposure limits (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Educate workers about the health and safety hazards associated with this material. Train in work practices which minimize exposure. Consider preplacement and periodic medical exams with emphasis on kidney functions (including urine screening for micro-globulins), lungs and blood. Follow written procedures set forth by OSHA in 29 CFR 1910.1027.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent any skin contact. Butyl rubber, chlorinated polyethylene, and polyvinyl chloride are recommended materials. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not protective eye devices. Appropriate eye protection must be worn instead of, or in conjunction with, contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. Select respirator based on exposure range as follows. Exposure range >0.005 to 0.05 mg/m^3 use air purifying respirator, negative-pressure, half-mask; >0.05 to 0.5 mg/m^3 use air purifying respirator, negative-pressure, full-face; >0.5 to 5 mg/m^3 use supplied-air respirator, constant flow/pressure-demand, full-face; $>5 \text{ mg/m}^3$ use a SCBA, pressure-demand, full-face. Use a magenta cartridge (P100). For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, cartridge change schedules, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Silver-white, blue-tinged. Odorless.

Physical State: Solid; lustrous metal or granular powder

Vapor Pressure (kPa): 1 mm Hg at 741 °F (394 °C)

Formula Weight: 112.41

Density: 8.642 at 77 °F (25 °C)

Refractive Index: 1.8 at 578 nm and 20 °C

Boiling Point: 1409 °F (765 °C)

Freezing/Melting Point: 609.8 °F (321 °C)

Ionization Potential (eV): 8.99367 eV

Water Solubility: Insoluble

Other Solubilities: Dissolved by acids; ammonium nitrate solution

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Cadmium is stable at room temperature in closed containers under normal storage and handling conditions. It slowly oxidizes in air to form cadmium oxide. Finely divided material is pyrophoric, i.e., it may ignite or explode spontaneously in air. Hazardous polymerization cannot occur. Avoid creation of dust clouds, contact with chemical incompatibles, heat, and sources of ignition.

Storage Incompatibilities: Include acids (reacts readily with dilute nitric acid, slowly with hydrochloric acid); explodes on contact with hydrazoic acid; violent or explosive reaction when heated with ammonium nitrate; tellurium; zinc; ammonia; sulfur; selenium; nitryl fluoride; oxidizing agents; metals.

Hazardous Decomposition Products: Thermal oxidative decomposition of cadmium can produce toxic fumes of cadmium and cadmium oxide.

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral, LD₅₀: 2330 mg/kg.

Mouse, oral, LD₅₀: 890 mg/kg.

Acute Inhalation Effects:

Rat, inhalation, LC₅₀: 25 mg/m³/30 minutes produced dyspnea.

Human, inhalation, LC_{Lo}: 39 mg/m³/20 minutes produced cardiac changes; respiratory depression.

Acute Skin Effects:

Rabbit, subcutaneous, LD_{Lo}: 6 mg/kg produced toxic effects: Effects on newborn - reduced weight gain and behavioral.

Other Effects:

Reproductive Effects: Rat, female, oral, 23 mg/kg administered on gestational days 1 - 22 produced specific developmental abnormalities - blood and lymphatic system (including spleen and marrow).

Rat, female, oral, 21.5 mg/kg administered to multigenerations produced toxic effects: Effects on fertility - preimplantation mortality; Effects on newborn - germ cell effects in offspring.

Rat, male, oral, 155 mg/kg administered 13 weeks prior to mating produced toxic effects: Effects on newborn - reduced weight gain and behavioral.

Mouse, micronucleus test, cell type - embryo: 6 µmol/L induced mutation.

Hamster, cytogenic analysis, cell type - ovary: 1 µmol/L induced mutation.

Tumorigenic Effects - Woman, inhalation, 129 µg/m³/20 years, continuous produced toxic effects: carcinogenic by RTECS criteria; Lung, thorax or respiration - tumors.

Human, inhalation, TC_{Lo}: 88 µg/m³/8.6 years produced proteinuria.

Rat, oral, 546 mg/kg administered for 26 weeks continuously produced toxic effects: changes in serum composition; transaminases; weight loss or decreased weight gain.

Rat, oral, 1512 mg/kg administered for 48 weeks continuously produced toxic effects: changes to liver, kidneys, ureter and bladder.

Rat, subcutaneous, 3372 µg/kg produced toxic effects: carcinogenic by RTECS criteria, tumors at site of application.

See RTECS EU9800000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.

Ecotoxicity: *Dreissena polymorpha*, zebra mussels, chronic LC₅₀: 130 mcg/L; *Rivulus marmoratus*, mangrove fish, LC₅₀ in fresh water: 2.96 mg/L; Steelhead trout, LC₅₀: 0.0009 ppm for 96 hours; *Daphnia magna*, 0.1 ppm lethal.

Section 13 - Disposal Considerations

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Cadmium compounds

ID: UN2570

Hazard Class: 6.1 - Poisonous materials

Packing Group: I - Great Danger

Symbols:

Label Codes: 6.1 - Poison or Poison Inhalation Hazard if inhalation hazard, Zone A or B

Special Provisions: IB7, IP1

Packaging: Exceptions: None **Non-bulk:** 211 **Bulk:** 242

Quantity Limitations: Passenger aircraft/rail: 5 kg **Cargo aircraft only:** 50 kg

Vessel Stowage: Location: A **Other:**



Shipping Name and Description: Cadmium compounds**ID:** UN2570**Hazard Class:** 6.1 - Poisonous materials**Packing Group:** II - Medium Danger**Symbols:****Label Codes:** 6.1 - Poison or Poison Inhalation Hazard *if inhalation hazard, Zone A or B***Special Provisions:** IB8, IP2, IP4**Packaging:** **Exceptions:** None **Non-bulk:** 212 **Bulk:** 242**Quantity Limitations:** **Passenger aircraft/rail:** 25 kg **Cargo aircraft only:** 100 kg**Vessel Stowage:** **Location:** A **Other:****Shipping Name and Description:** Cadmium compounds**ID:** UN2570**Hazard Class:** 6.1 - Poisonous materials**Packing Group:** III - Minor Danger**Symbols:****Label Codes:** 6.1 - Poison or Poison Inhalation Hazard *if inhalation hazard, Zone A or B***Special Provisions:** IB8, IP3**Packaging:** **Exceptions:** 153 **Non-bulk:** 213 **Bulk:** 240**Quantity Limitations:** **Passenger aircraft/rail:** 100 kg **Cargo aircraft only:** 200 kg**Vessel Stowage:** **Location:** A **Other:**

Section 15 - Regulatory Information

EPA Regulations:**RCRA 40 CFR:** Listed**CERCLA 40 CFR 302.4:** Listed per CWA Section 307(a) 10 lb (4.535 kg)**SARA 40 CFR 372.65:** Listed**SARA EHS 40 CFR 355:** Not listed**TSCA:** Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: 3-Amino-9-ethylcarbazole

CAS Number: 132-32-1

Chemical Formula: C₁₄H₁₄N₂

EINECS Number: 205-057-7

ACX Number: X1005773-9

Synonyms: 3-AMINO-N-ETHYLCARBAZOL; 3-AMINO-9-ETHYLCARBAZOLE; 3-AMINO-N-ETHYLCARBAZOLE; 9H-CARBAZOL-3-AMINE,9-ETHYL-; CARBAZOLE,3-AMINO-9-ETHYL-

General Use: Used in manufacture of dyes (pigment Violet 23 and Direct Blue 108), as an histochemical indicator for peroxidase activity, and as a biological stain.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
3-Amino-9-ethylcarbazole	132-32-1	ca 100% wt

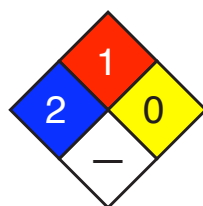
may be dissolved in ethanol or ethyl ether.

OSHA PEL

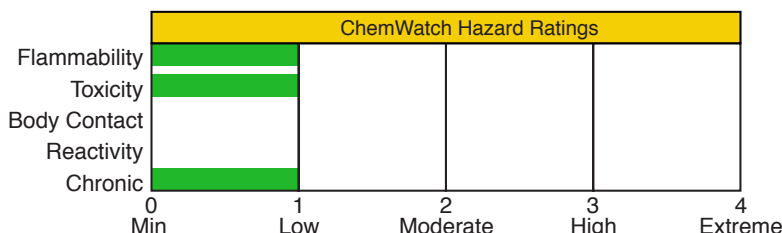
NIOSH REL

ACGIH TLV

Section 3 - Hazards Identification



Fire Diamond



HMIS	
2	Health
1	Flammability
0	Reactivity

ANSI Signal Word

Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Crystalline solid. Irritating to eyes/skin/respiratory tract. Toxic by ingestion. Other Acute Effects: nausea, vomiting, headache, coughing, chest pains, breathing difficulty, CNS depression, narcotic effect, heart damage. Potential carcinogen.

Potential Health Effects

Target Organs: Central nervous system (CNS), respiratory system, liver, kidneys

Primary Entry Routes: Inhalation, ingestion, skin and/or eye contact/absorption

Acute Effects

Inhalation: Irritation, coughing, chest pains, breathing difficulty and systemic effects may result from inhalation of 3-amino-9-ethylcarbazole dust.

Eye: Contact may result in irritation.

Skin: Contact may cause irritation.

Ingestion: Nausea, vomiting, and systemic effects including, headache, CNS depression, narcotic effect, and damage to heart can result.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Class B, Justifiably suspected of having carcinogenic potential.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: Potentially carcinogenic.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult a physician or ophthalmologist if pain and/or irritation develops.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat overexposure symptomatically and supportively.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: Not applicable; combustible solid

Autoignition Temperature: None reported.

LEL: None reported.

UEL: None reported.

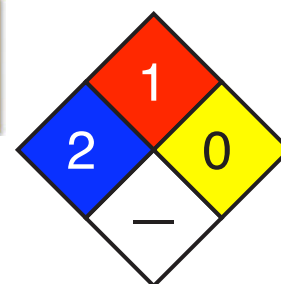
Flammability Classification: Combustible solid

Extinguishing Media: Use carbon dioxide, water spray, dry chemical, or foam.

General Fire Hazards/Hazardous Combustion Products: Heating 3-amino-9-ethylcarbazole to decomposition can produce carbon monoxide, carbon dioxide, nitrogen oxides. May be dissolved in flammable solvents.

Fire-Fighting Instructions: *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

See
DOT
ERG



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). *Do not* touch damaged containers or spilled material unless wearing appropriate protective clothing. Stop leak if you can do it without risk. prevent entry into waterways, sewers, basements or confined areas.

Small Spills: For dry spills, vacuum or carefully scoop up material and deposit in sealed containers. Absorb liquid containing 3- amino-9-ethylcarbazole with vermiculite, earth, sand or similar material.

Large Spills: Dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways. Absorb or cover with dry earth, sand or other noncombustible material and transfer to containers. *Do not* get water inside containers.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: Avoid dust inhalation, and skin and eye contact. Use only with ventilation sufficient to maintain airborne concentrations as low as possible. Wear protective gloves, and clothing (see Sec. 8). Keep away from heat and ignition sources.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed container in cool, well-ventilated area, away from heat, ignition sources and incompatibles (see Sec. 10). Periodically inspect stored materials.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Enclose operations and/or provide local exhaust ventilation at the site of chemical release. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Where possible, transfer 3-amino-9-ethylcarbazole from drums or other storage containers to process containers.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Wear protective eyeglasses, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), use an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Crystalline solid.

Physical State: Crystalline solid

Formula Weight: 210.3

Freezing/Melting Point: 260.6 °F (127 °C)

Water Solubility: < 1 mg/mL at 68 °F (20 °C)

Other Solubilities: 95% ethanol: 1-5 mg/mL at 68 °F (20 °C); acetone: >100 mg/mL at 68 °F (20 °C); DMSO: >100 mg/mL at 68 °F (20 °C).

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: 3-Amino-9-ethylcarbazole is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Heat and incompatibles.

Storage Incompatibilities: Include strong oxidizing agents, acids.

Hazardous Decomposition Products: Thermal oxidative decomposition of 3-amino-9-ethylcarbazole can produce carbon monoxide, carbon dioxide, and nitrogen oxides.

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral, LD₅₀: 144 mg/kg.

Other Effects:

Rat, oral: 33 g/kg/78 weeks, continuous, produced liver, skin and appendage tumors (carcinogenic by RTECS criteria).

Tumorigenicity, mouse, oral: 87 g/kg/ 8 weeks, continuous, produced liver tumors (carcinogenic by RTECS criteria).

See RTECS FE3590000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.

Ecotoxicity: Data not found.

Section 13 - Disposal Considerations

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Dyes, solid, toxic, n.o.s. or Dye intermediates, solid, toxic, n.o.s.

ID: UN3143

Hazard Class: 6.1 - Poisonous materials

Packing Group: I - Great Danger

Symbols: G - Technical Name Required

Label Codes: 6.1 - Poison or Poison Inhalation Hazard if inhalation hazard, Zone A or B



Special Provisions: A5, IB7, IP1, T14, TP2, TP27**Packaging:** Exceptions: None **Non-bulk:** 211 **Bulk:** 242**Quantity Limitations:** Passenger aircraft/rail: 5 kg **Cargo aircraft only:** 50 kg**Vessel Stowage:** Location: A **Other:****Shipping Name and Description:** Dyes, solid, toxic, n.o.s. *or* Dye intermediates, solid, toxic, n.o.s.**ID:** UN3143**Hazard Class:** 6.1 - Poisonous materials**Packing Group:** II - Medium Danger**Symbols:** G - Technical Name Required**Label Codes:** 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B***Special Provisions:** IB8, IP2, IP4**Packaging:** Exceptions: None **Non-bulk:** 212 **Bulk:** 242**Quantity Limitations:** Passenger aircraft/rail: 25 kg **Cargo aircraft only:** 100 kg**Vessel Stowage:** Location: A **Other:****Shipping Name and Description:** Dyes, solid, toxic, n.o.s. *or* Dye intermediates, solid, toxic, n.o.s.**ID:** UN3143**Hazard Class:** 6.1 - Poisonous materials**Packing Group:** III - Minor Danger**Symbols:** G - Technical Name Required**Label Codes:** 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B***Special Provisions:** IB8, IP3**Packaging:** Exceptions: 153 **Non-bulk:** 213 **Bulk:** 240**Quantity Limitations:** Passenger aircraft/rail: 100 kg **Cargo aircraft only:** 200 kg**Vessel Stowage:** Location: A **Other:**

Section 15 - Regulatory Information

EPA Regulations:**RCRA 40 CFR:** Not listed**CERCLA 40 CFR 302.4:** Not listed**SARA 40 CFR 372.65:** Not listed**SARA EHS 40 CFR 355:** Not listed**TSCA:** Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Section 1 - Chemical Product and Company Identification

61

Material Name: Carbon Disulfide

CAS Number: 75-15-0

Chemical Formula: CS₂

Structural Chemical Formula: S=C=S

EINECS Number: 200-843-6

ACX Number: X1001270-7

Synonyms: CARBON BISULFIDE; CARBON BISULPHIDE; CARBON DISULFIDE; CARBON DISULPHIDE; CARBON SULFIDE; CARBON SULPHIDE; CARBONE (SUFURE DE); CARBONE (SULFURE DE); CARBONIO (SOLFURO DI); DITHIOCARBONIC ANHYDRIDE; EPA PESTICIDE CHEMICAL CODE 016401; KOHLENDISULFID (SCHWEFELKOHLENSTOFF); KOOLSTOFDISULFIDE; SCHWEFELKOHLENSTOFF; SOLFURO DI CARBONIO; SULPHOCARBONIC ANHYDRIDE; SULPHURET OF CARBON; WEEVILTOX; WEGLA DWUSIARCZEK

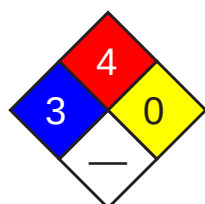
General Use: Used in manufacture of rayon, carbon tetrachloride, xanthogenates, soil disinfectants, electronic vacuum tubes; solvent for phosphorus, sulfur, selenium, bromine, iodine, fats, resins, rubbers. Also used as solvent in gas chromatography.

Section 2 - Composition / Information on Ingredients

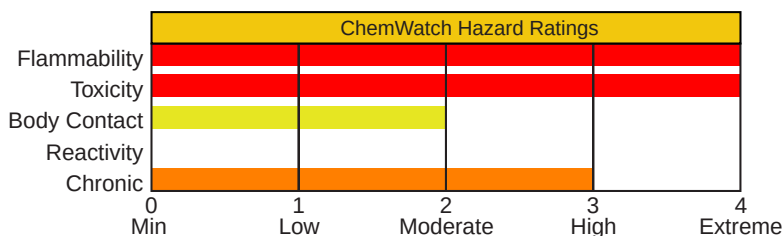
Name	CAS	%
carbon disulfide	75-15-0	>99

OSHA PEL TWA: 20 ppm; Ceiling: 30 ppm; 100 ppm, 30-minute maximum peak.	NIOSH REL TWA: 1 ppm (3 mg/m ³); STEL: 10 ppm (30 mg/m ³); skin.	DFG (Germany) MAK TWA: 5 ppm; PEAK: 10 ppm; skin.
ACGIH TLV TWA: 10 ppm; skin.	IDLH Level 500 ppm.	

Section 3 - Hazards Identification



Fire Diamond



ANSI Signal Word

Danger!

HMIS	
③	Health
④	Flammability
①	Reactivity



Corrosive



Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; chloroform-like odor. Corrosive. Other Acute Effects: cardiac/CNS damage, headache, dizziness, convulsions. Chronic Effects: psychosis, liver damage, eye effects, peripheral neuropathies, gastric disturbances, reproductive effects. Highly flammable.

Potential Health Effects

Target Organs: skin, central nervous system (CNS), peripheral nervous system, cardiovascular system, eyes, liver, kidneys

Primary Entry Routes: inhalation, skin contact/absorption

Acute Effects

Inhalation: The vapor is highly discomforting to the upper respiratory tract and lungs and may be harmful if inhaled. The material may accentuate any pre-existing skin condition.

Acute inhalation produces rapid onset of both local irritation and central nervous system symptoms ranging from pharyngitis, nausea, vomiting, dizziness, fatigue, headache, mood changes, lethargy and blurred vision, to agitation, uncontrollable anger, suicidal tendencies, delirium, hallucinations, convulsions, coma and death.

Eye: The liquid is extremely discomforting to the eyes and is capable of causing pain and severe conjunctivitis.

Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.

Skin: The liquid is extremely discomforting to the skin and is capable of causing allergic skin reactions.

Toxic effects may result from skin absorption.

Concentrated solutions of carbon disulfide may cause skin pain, erythema, and exfoliation. Several minutes of contact may cause blistering with second and third degree burns. May be directly toxic to the cutaneous nerves. Skin sensitization may occur.

Ingestion: The liquid is highly discomforting to the gastrointestinal tract and may be fatal if swallowed in large quantity.

Ingestion of small amounts may result in numbness of the lips, nausea, vomiting, dyspnea, dizziness, spasmodic tremor, hyperactive tendon reflexes, hyperesthesia, cardiac arrhythmias, hallucinations, prostration, peripheral vascular collapse, hypothermia, cyanosis, mydriasis, convulsions, coma, and death within a few hours from respiratory paralysis. Non-fatal exposures may produce delayed effects including motor agitation, disorientation, psychic disturbances, narcosis, delirium, areflexia, mydriasis, and permanent damage to the central and peripheral nervous systems.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: Long-term exposure has caused serious damage to the central nervous system (degeneration of the peripheral nerves).

Concentrations as low as 20 ppm may produce neurological damage - women are apparently more susceptible to the neurological effects of carbon disulfide. Neurological effects may include headache, apprehension, lethargy, sleepiness, hearing and position sense loss, paresthesias, muscle pain, tremors, ataxia, staggering gait, weakness, loss of lower extremity reflexes, and paralysis. Visual disturbances include decreased visual acuity, impaired recognition of red and green, nystagmus, diplopia, disturbed pupillary reaction to light - optic nerve atrophy may also occur.

A decrease in corneal reflex may be an early indication of chronic intoxication.

Psychiatric symptoms may include loss of memory, nightmares leading to loss of sleep, mental deterioration, acoustic and visual hallucinations, rapid mood changes ranging from irritability to manic-depressive psychoses, suicidal tendencies. Disturbances to the libido and impotence (with effects on sperm) have also been recorded. Menstrual and ovarian function disorders and an increased risk of spontaneous abortion may also occur.

Liver damage may be indicated by palpable, tender liver and minor derangement of liver function. Chronic renal dysfunction may occur at concentrations not sufficiently great to produce neurological damage.

Gastric or duodenal ulcers may also be produced as a result of chronic exposure.

Coronary heart disease has been significantly linked to exposure to carbon disulfide. A series of studies performed in Finland showed a significant excess mortality from cardiovascular heart disease in workers exposed to carbon disulfide for at least 5 years to concentrations estimate to range from 20-40 ppm in the 1950s and 10-30 ppm in the 1960s. Most workers however had been exposed repeatedly to far higher concentrations at various times.

Nutritional factors may account for variations in response shown amongst workers. Experimental rabbit diets reinforced with a high mineral mixture, especially copper and zinc, permitted daily exposures at 1100 ppm CS₂ without the observed effects seen in controls (body weight loss, serum lipoprotein and total cholesterol increase, adrenal hypertrophy and pathological changes in the brain and spinal cord).

A daily 4-hour exposure at concentrations exceeding 150 ppm produces chronic intoxication after a few months; 100-150 ppm is thought to produce chronic poisoning after a year or more whilst 50-100 ppm produce sporadic cases of mild intoxication.

Personnel with pre-existing central nervous system, gastrointestinal tract, liver, kidneys, skin and blood diseases may be potentially more susceptible to symptom of exposure and should be excluded from exposure.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

See
DOT
ERG

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

If more than 15 minutes from a hospital, induce vomiting, preferably using Ipecac Syrup APF.

Note: DO NOT INDUCE VOMITING in an unconscious person.

After first aid, get appropriate in-plant, paramedic, or community medical support.

- Note to Physicians:**
1. Carbon disulfide intoxication results in severe debilitating CNS symptoms (irritability, mania, hallucinations, tremors, memory loss).
 2. Chronic industrial exposures may cause neuropsychiatric changes, peripheral neuropathies and accelerated atherogenic changes.
 3. Peak blood concentrations appear 2 hours after inhalation. Plasma elimination half-life is about 1 hour. Metabolic products seen in urine include thiourea, 2-mercapto-2-thiazolin-5-one and 2-thiazolidine-4- carboxylic acid (TTCA). The iodine-azide test identifies these.
 4. Initial management of severe inhalation poisoning requires careful attention to airway, breathing and circulation. Treatment involves symptomatic care.

BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

<u>Determinant</u>	<u>Index</u>	<u>Sampling Time</u>	<u>Comments</u>
2-thiothiazolidine	5 mg/gm	End of shift	
4-carboxylic acid	creatinine.		

NOTE: Preplacement and periodic medical examinations should be concerned especially with skin, eyes, central and peripheral nervous system, cardio-vascular disease, as well as liver and kidney function. Electrocardiograms should be taken.

Section 5 - Fire-Fighting Measures

Flash Point: 30 °C Closed Cup

Autoignition Temperature: 90 °C

LEL: 1.3% v/v

UEL: 50% v/v

Extinguishing Media: Water spray or fog; foam, dry chemical powder, or BCF (where regulations permit).
Carbon dioxide.

Note: Water may be ineffective except as a blanket. Foam is ineffective.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.

Severe fire hazard when exposed to heat, flame and/or oxidizers.

Vapor forms an explosive mixture with air.

Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.

Heating may cause expansion/decomposition with violent rupture of containers.

On combustion, may emit toxic fumes of carbon monoxide (CO). Other combustion products include sulfur oxides (SO_x).

WARNING: Vapors may be ignited by contact with an ordinary light bulb, a warm steam pipe or a hot exhaust pipe.

Fire Incompatibility: WARNING: May decompose violently or explosively on contact with other substances.

This substance is one of the relatively few compounds which are described as "endothermic" i.e. heat is absorbed into the compound, rather than released from it, during its formation.

The majority of endothermic compounds are thermodynamically unstable and may decompose explosively under various circumstances of initiation.

Many but not all endothermic compounds have been involved in decompositions, reactions and explosions and, in general, compounds with significantly positive values of standard heats of formation, may be considered suspect on stability grounds.

Explosively reactive with azides or organic amines.

Reacts with zinc with incandescence.

Avoid contact with chemically active metals (sodium, potassium, aluminum, magnesium) and strong oxidizers.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

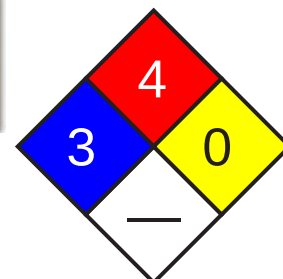
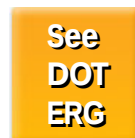
If safe to do so, switch off electrical equipment until vapor fire hazard is removed.

Cool fire-exposed containers with water spray from a protected location.

Do not approach containers suspected to be hot.

Avoid spraying water onto liquid pools.

If safe to do so, remove containers from path of fire.



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Environmental hazard - contain spillage. Clean up all spills immediately.

Avoid breathing vapors and contact with skin and eyes.

Control personal contact by using protective equipment.

Shut off all possible sources of ignition and increase ventilation.

Wipe up and absorb small quantities with vermiculite or other absorbent material.

Allow absorbed spillage to evaporate in an open top container, away from habitation.

Large Spills: Clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

Shut off all possible sources of ignition and increase ventilation.

No smoking or bare lights within area.

Stop leak if safe to do so.

Use extreme caution to avoid a violent reaction.

Any electric cleaning equipment must be explosion proof.

Absorb or cover spill with sand, earth, inert material or vermiculite.

Water spray or fog may be used to disperse vapor.

Collect recoverable product into labeled containers for recycling.

Collect, using a spark-free shovel, and seal in labeled drums for disposal.

If contamination of drains or waterways occurs, advise emergency services.

After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: Atmosphere should be regularly checked to ensure safe working conditions are maintained.

Use good occupational work practices.

Avoid breathing vapors and contact with skin and eyes. Wear protective clothing when risk of exposure occurs. Avoid smoking, bare lights or ignition sources. Avoid generation of static electricity.

Avoid thermal shock (wait for surfaces to cool).

Use in a well-ventilated area. Local exhaust ventilation usually required.

Vapor may travel a considerable distance to source of ignition.

Use spark-free tools when handling. Ground all lines and equipment.

Prevent concentration in hollows and sumps. DO NOT enter confined spaces where vapor may have collected.

Avoid contact with incompatible materials. Avoid physical damage to containers. Keep containers securely sealed.

Always wash hands with soap and water after handling. Work clothes should laundered separately.

Recommended Storage Methods: Check that containers are clearly labeled.

Packaging as recommended by manufacturer.

Glass container.

Steel drum.

Metal can.

Store in metal drums or safety cans.

Plastic containers may only be used if approved for flammable liquids.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Local exhaust ventilation usually required.

If risk of overexposure exists, wear NIOSH-approved respirator.

Correct fit is essential to obtain adequate protection. NIOSH-approved self contained breathing apparatus (SCBA) may be required in some situations.

Provide adequate ventilation in warehouse or closed storage area.

Personal Protective Clothing/Equipment:

Eyes: Chemical goggles. Full face shield.

DO NOT wear contact lenses.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Impervious, gauntlet length gloves; Viton gloves.

PVA gloves.

PVC boots.

Safety footwear.

Respiratory Protection:

Exposure Range >20 to 200 ppm: Air Purifying, Negative Pressure, Half Mask

Exposure Range >200 to <500 ppm: Air Purifying, Negative Pressure, Full Face
 Exposure Range 500 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
 Cartridge Color: black
Other: Overalls. PVC apron. PVC protective suit may be required if exposure severe.
 Eyewash unit. Ensure there is ready access to a safety shower.

Glove Selection Index:

PE/EVAL/PE Best selection
 PVA Best selection
 VITON/CHLOROBUTYL Best selection
 VITON Best selection
 TEFLON-FEP Best selection
 NITRILE Poor to dangerous choice for other than short-term immersion
 CPE Poor to dangerous choice for other than short-term immersion
 NEOPRENE Poor to dangerous choice for other than short-term immersion
 BUTYL Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, colorless to yellow, mobile liquid with a strong disagreeable odor; nearly odorless when pure. Miscible with anhydrous methanol, ethanol, ether, benzene, chloroform, carbon tetrachloride, oils.

Physical State: Liquid

pH: Not applicable

Odor Threshold: 0.0243 to 23.1 mg/m³

pH (1% Solution): Not applicable.

Vapor Pressure (kPa): 40 at 20 °C

Boiling Point: 46.5 °C (116 °F) at 760 mm Hg

Vapor Density (Air=1): 2.67

Freezing/Melting Point: -111.5 °C (-168.7 °F)

Formula Weight: 76.14

Volatile Component (% Vol): 100

Specific Gravity (H₂O=1, at 4 °C): 1.26 at 20 °C

Water Solubility: 0.3% by weight

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Long term storage.

Presence of heat source and ignition source.

Stable under normal storage conditions. Hazardous polymerization will not occur.

Storage Incompatibilities: WARNING: May decompose violently or explosively on contact with other substances.

This substance is one of the relatively few compounds which are described as "endothermic" i.e. heat is absorbed into the compound, rather than released from it, during its formation.

The majority of endothermic compounds are thermodynamically unstable and may decompose explosively under various circumstances of initiation.

Many but not all endothermic compounds have been involved in decompositions, reactions and explosions and, in general, compounds with significantly positive values of standard heats of formation, may be considered suspect on stability grounds.

Avoid reaction with oxidizing agents.

Segregate from, azides, organic amines and chemically active metals.

Section 11 - Toxicological Information

Toxicity

Oral (human) LD₅₀: 14 mg/kg

Oral (human) TC_{Lo}: 40 mg/m³

Oral (rat) LD₅₀: 3188 mg/kg

Inhalation (human) LC_{Lo}: 4000 ppm/30 min

Inhalation (human) LC_{Lo}: 2000 ppm/5 min

Inhalation (rat) LC₅₀: 25000 mg/m³/2 h

Fatty liver degeneration, paternal effects, effects on fertility, fetotoxicity, effects on newborn recorded.

NOTE: Substance has been shown to be mutagenic in various assays, or belongs to a family of chemicals producing damage or change to cellular DNA. Exposure to the material for prolonged periods may cause physical defects in the developing embryo (teratogenesis).

Irritation

Nil reported

See RTECS FF 6650000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released on land, it will be primarily lost by volatilization. It may also readily leach into the ground where it may biodegrade. If released into water, it will be primarily lost due to volatilization (half-life 2.6 hr in a model river). Adsorption to sediment and bioconcentration in fish should not be significant. In the atmosphere it degrades by reacting with atomic oxygen and photochemically produced hydroxyl radicals (half-life 6-9 days). The soil may be a natural sink for the chemical by adsorbing and subsequently biodegrading it.

Ecotoxicity: TL_m Mosquitofish 162-135 mg/l/24-96 hr /Conditions of bioassay not specified

Henry's Law Constant: 1.44×10^{-2}

BCF: estimated at 7.9

Octanol/Water Partition Coefficient: $\log K_{ow} = 0.852$

Soil Sorption Partition Coefficient: K_{oc} = estimated at 63

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options.

Follow applicable federal, state, and local regulations.

Evaporate or incinerate residue at an approved site.

Recycle containers if possible, or dispose of in an authorized landfill.

Ensure damaged or non-returnable drums are gas-free before disposal.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Carbon disulfide

ID: UN1131

Hazard Class: 3 - Flammable and combustible liquid

Packing Group: I - Great Danger

Symbols:

Label Codes: 3 - Flammable Liquid, 6.1 - Poison or Poison Inhalation Hazard if inhalation hazard, Zone A or B

Special Provisions: B16, T14, TP2, TP7, TP13

Packaging: Exceptions: None **Non-bulk:** 201 **Bulk:** 243

Quantity Limitations: Passenger aircraft/rail: Forbidden **Cargo aircraft only:** Forbidden

Vessel Stowage: Location: D **Other:** 18, 40, 115



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed P022

CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001 100 lb (45.35 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Listed

RQ: 100 lb

TPQ: 10000 lb

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Chlorobenzene

CAS Number: 108-90-7

Chemical Formula: C₆H₅Cl

Structural Chemical Formula: C₆H₅Cl

EINECS Number: 203-628-5

ACX Number: X1001545-9

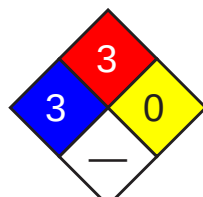
Synonyms: BENZENE CHLORIDE; BENZENE,CHLORO-; CHLOORBENZEEN; CHLORBENZENE; CHLORBENZOL; CHLOROBENZEN; CHLOROBENZENE; CHLOROBENZENU; CHLOROBENZOL; CLOROBENZENE; CP 27; EPA PESTICIDE CHEMICAL CODE 056504; I P CARRIER T 40; MCB; MONOCHLOORBENZEEN; MONOCHLORBENZENE; MONOCHLORBENZOL; MONOCHLOROBENZENE; MONOCLOROBENZENE; PHENYL CHLORIDE; TETROSIN SP

General Use: Used in textile processing as a fiber swelling agent and a dye carrier; as an extractant in the manufacture of diisocyanates, rubber, perfumes and pharmaceuticals; and in the manufacture of phenol, aniline and DDT. Also a tar and grease remover, a solvent for paints and a heat transfer medium.

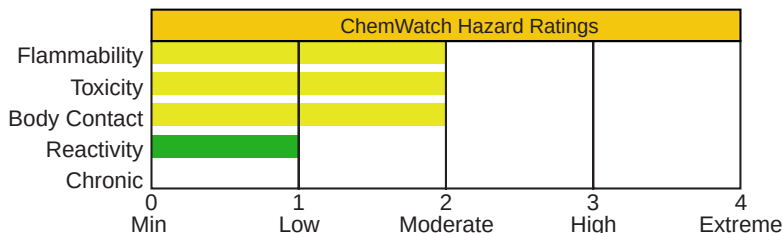
Section 2 - Composition / Information on Ingredients

Name	CAS	%
chlorobenzene	108-90-7	>95
OSHA PEL TWA: 75 ppm; 350 mg/m ³ .	NIOSH REL	DFG (Germany) MAK TWA: 10 ppm; PEAK: 20 ppm.
ACGIH TLV TWA: 10 ppm.	IDLH Level 1000 ppm.	
EU OEL TWA: 23 mg/m ³ (5 ppm); STEL: 70 mg/m ³ (15 ppm).		

Section 3 - Hazards Identification



Fire Diamond



HMIS	
2	Health
3	Flammability
0	Reactivity

ANSI Signal Word

Warning!



Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless, volatile liquid; almond-like odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: dizziness, drowsiness, cyanosis, spastic contractions of extremities, unconsciousness. Chronic Effects: skin burns; lung/liver/kidney damage. Flammable.

Potential Health Effects

Target Organs: respiratory system, eyes, skin, central nervous system (CNS), liver

Primary Entry Routes: inhalation, ingestion, eye contact, skin contact

Acute Effects

Inhalation: The vapor is discomforting to the upper respiratory tract and may be harmful if inhaled.

Headaches and upper respiratory tract and eye irritation were reported in a worker exposed to the substance contained in a glue preparation.

Inhalation of 200 ppm may produce mucous membrane irritation and coughing whilst higher concentrations produce central nervous system depression with headache, dizziness, drowsiness, somnolence, transient anesthesia, and incoherence, cyanosis from methemoglobinemia, spastic contractions of the extremities, rapid respiration, weak and irregular pulse, burgundy-red urine, loss of consciousness, coma and respiratory and circulatory collapse.

Central nervous system (CNS) depression may include nonspecific discomfort, symptoms of giddiness, headache, dizziness, nausea, anesthetic effects, slowed reaction time, slurred speech and may progress to unconsciousness. Serious poisonings may result in respiratory depression and may be fatal.

The substance and/or its metabolites may bind to hemoglobin inhibiting normal uptake of oxygen. This condition, known as "methemoglobinemia", is a form of oxygen starvation (anoxia). Symptoms include cyanosis (a bluish discoloration to skin and mucous membranes) and breathing difficulties. Symptoms may not be evident until several hours after exposure. At about 15% concentration of blood methemoglobin there is observable cyanosis of the lips, nose and earlobes. Symptoms may be absent although euphoria, flushed face and headache are commonly experienced. At 25-40%, cyanosis is marked but little disability occurs other than that produced on physical exertion. At 40-60%, symptoms include weakness, dizziness, lightheadedness, increasingly severe headache, ataxia, rapid shallow respiration, drowsiness, nausea, vomiting, confusion, lethargy and stupor.

Above 60% symptoms include dyspnea, respiratory depression, tachycardia or bradycardia, and convulsions. Levels exceeding 70% may be fatal.

Narcosis may also result.

Rats exposed for 2 hours at 1200 ppm showed definite narcosis but 220-660 ppm could be tolerated without obvious clinical signs of sedation. Central nervous system depression was seen at 5850 ppm.

Eye: The vapor is discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

Skin: The liquid may produce skin discomfort following prolonged contact.

Defatting and/or drying of the skin may lead to dermatitis. Toxic effects may result from skin absorption.

Prolonged exposure may cause chemical burns.

Ingestion: The liquid is discomforting to the gastrointestinal tract and may be harmful if swallowed in large quantity. Ingestion may produce nausea, loss of consciousness and possibly coma.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A3, Animal carcinogen; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Exposure to high levels or prolonged exposure may cause liver damage, chronic respiratory disease and changes to the kidney (urine may be burgundy red).

Workers exposed to chlorobenzene vapors from 1-2 years reported headache, dizziness, somnolence, and dyspeptic disorders. Other symptoms included acroparaesthesia, spastic contractions of the finger muscles, hypesthesia, spastic contractions of the gastrocnemius muscle and vasovegetative instability.

Repeated exposure of rats, rabbits and guinea pigs to chlorobenzene at 1000 ppm, 7 hours/day, 5 days/week over 44 days resulted in lung, liver and kidney changes.

Male rats receiving high doses during chronic gavage studies showed an increase in the occurrence of neoplastic nodules of the liver.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

In case of burns: Quickly immerse affected area in cold running water for 10 to 15 minutes.

Bandage lightly with a sterile dressing. Treat for shock if required.

Lay patient down. Keep warm and rested. Transport to hospital or doctor.

Ingestion: Contact a Poison Control Center. DO NOT induce vomiting. Observe the patient carefully. Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious. Give water (or milk) to rinse out mouth. Then provide liquid slowly and as much as casualty can comfortably drink. Transport to hospital or doctor without delay.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically.

For ingestion, consider gastric lavage.

Chlorobenzene administered orally is mainly excreted in the urine with 32% appearing in the first 24 hours mostly as metabolites (4-chlorophenylmercapturic acid, chlorophenols, chlorocatechols and mandelic acid) Periodic medical

See
DOT
ERG

examinations are recommended for occupationally exposed workers. Persons with pre-existing skin disorders or impaired liver, kidney or pulmonary function may be more susceptible to the effects of this substance.

Section 5 - Fire-Fighting Measures

Flash Point: 29.2 °C Closed Cup

Autoignition Temperature: 638 °C

LEL: 1.8% v/v

UEL: 9.6% v/v

Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.

Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.

Moderate fire hazard when exposed to heat or flame.

Vapor forms an explosive mixture with air.

Moderate explosion hazard when exposed to heat or flame.

Vapor may travel a considerable distance to source of ignition.

Heating may cause expansion or decomposition leading to violent rupture of containers.

On combustion, may emit toxic fumes of carbon monoxide (CO).

Other combustion products include hydrogen chloride and phosgene.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

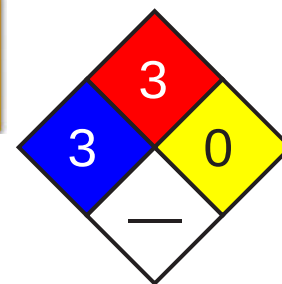
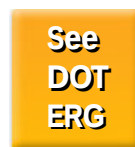
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

Cool fire-exposed containers with water spray from a protected location.

Do not approach cylinders suspected to be hot.

If safe to do so, switch off electrical equipment until vapor fire hazard is removed.

Fight fire from a safe distance, with adequate cover.



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Environmental hazard - contain spillage.

Remove all ignition sources. Clean up all spills immediately.

Avoid breathing vapors and contact with skin and eyes.

Control personal contact by using protective equipment.

Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Wash spill site with soda solution.

Large Spills: Pollutant - Clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent by any means available, spillage from entering drains or watercourse.

No smoking, bare lights or ignition sources. Increase ventilation.

Stop leak if safe to do so.

Water spray or fog may be used to disperse/absorb vapor.

Contain spill with sand, earth or vermiculite.

Use only spark-free shovels and explosion proof equipment.

Collect recoverable product into labeled containers for recycling.

Absorb remaining product with sand, earth or vermiculite.

Collect solid residues and seal in labeled drums for disposal.

Wash area and prevent runoff into drains.

If contamination of drains or waterways occurs, advise emergency services.

After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).



Section 7 - Handling and Storage

Handling Precautions: Use good occupational work practices.

Avoid breathing vapors and contact with skin and eyes.

Avoid contact with incompatible materials.

Avoid all ignition sources.

Avoid sources of heat.

Avoid physical damage to containers.
 Keep containers securely sealed when not in use.
 Use in a well-ventilated area.
 Ground and secure containers when dispensing or pouring.
 Prevent concentration in hollows and sumps. DO NOT enter confined spaces until atmosphere has been checked.
 Vapor may travel a considerable distance to source of ignition.
 Avoid generation of static electricity.
 Always wash hands with soap and water after handling. Work clothes should be laundered separately.

Recommended Storage Methods: Check that containers are clearly labeled.
 Packaging as recommended by manufacturer.
 Glass container.
 Plastic containers may only be used if approved for flammable liquids.
 Metal drum.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: General exhaust is adequate under normal operating conditions.

Local exhaust ventilation may be required in specific circumstances.

If risk of overexposure exists, wear NIOSH-approved respirator.

Correct fit is essential to obtain adequate protection.

Provide adequate ventilation in warehouse or closed storage areas.

Personal Protective Clothing/Equipment:

Eyes: Chemical goggles. Safety glasses.

Full face shield.

DO NOT wear contact lenses.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Impervious gloves; Viton gloves.

Neoprene gloves.

Protective footwear.

Safety footwear.

Respiratory Protection:

Exposure Range >75 to 750 mg/m³: Air Purifying, Negative Pressure, Half Mask

Exposure Range >750 to <1000 mg/m³: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Exposure Range 1000 to unlimited mg/m³: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Cartridge Color: black

Other: Ensure there is ready access to a safety shower. Eyewash unit.

Impervious apron.

Overalls.

Laboratory coat.

Impervious protective clothing.

If gas concentrations are high, full-face air supplied breathing apparatus.

Barrier cream.

Skin cleansing cream.

Glove Selection Index:

VITON Best selection

TEFLON Best selection

PVA Satisfactory; may degrade after 4 hours continuous immersion

NITRILE Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: A clear, colorless, volatile, flammable liquid with a faint, almond- like, aromatic odor. It is a very refractive liquid (1.528); freely miscible with in alcohol, benzene, chloroform and ether. Environmental pollutant.

Physical State: Liquid

Odor Threshold: 0.98 to 280 mg/m³

Vapor Pressure (kPa): 1.2 at 20 °C

Vapor Density (Air=1): 3.9

Formula Weight: 112.56

Specific Gravity (H₂O=1, at 4 °C): 1.11

pH: Not applicable

pH (1% Solution): Not applicable.

Boiling Point: 132 °C (270 °F)

Freezing/Melting Point: -45.6 °C (-50.08 °F)

Volatile Component (% Vol): approx. 100

Water Solubility: 0.05% by weight

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Hazardous polymerization will not occur. Stable under normal storage conditions.

Storage Incompatibilities: Avoid reaction with oxidizing agents.

Avoid dimethyl sulfoxide and silver perchlorate (forms shock-sensitive solvated salts). Also avoid extreme humidity.

Section 11 - Toxicological Information

Toxicity

Oral (rat) LD₅₀: >2290 mg/kg

Oral (rat) LD₅₀: 1100 mg/kg

Inhalation (rat) LC_{Lo}: 9000 ppm

Mammalian somatic cell mutagen

Irritation

Nil reported

See RTECS CZ 0175000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Once released it will decrease in concentration due to dilution and photooxidation. Releases into water and onto land will decrease in concentration due to vaporization into the atmosphere and slow biodegradation in the soil or water. It would be expected to percolate into the ground water if soil is sandy and poor in organic matter. Little bioconcentration is expected into fish and food products.

Ecotoxicity: LC₅₀ Poecilia reticulata (guppy) 19 ppm/14 days /Conditions of bioassay not specified; LC₅₀ Pimephales promelas (fathead minnow) 16.9 mg/l/96 hr (confidence limit 13.8 - 20.6 mg/l), flow-through bioassay with measured concentrations, 25.7 °C, dissolved oxygen 6.2 mg/l, hardness 43.8 mg/l calcium carbonate, alkalinity 43.4 mg/l calcium carbonate; LD₅₀ Salmo gairdneri (rainbow trout) 1.8 mg/kg/24 hr /Conditions of bioassay not specified

Henry's Law Constant: calculated at 3.56×10^{-3}

BCF: fish 1 to 2

Biochemical Oxygen Demand (BOD): 0.3 lb/lb, 5 days

Octanol/Water Partition Coefficient: log K_{ow} = 2.18 to 2.84

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options.

Follow applicable federal, state, and local regulations.

Bury or incinerate residue at an approved site.

Recycle containers if possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Chlorobenzene

ID: UN1134

Hazard Class: 3 - Flammable and combustible liquid

Packing Group: III - Minor Danger

Symbols:

Label Codes: 3 - Flammable Liquid

Special Provisions: B1, IB3, T2, TP1

Packaging: Exceptions: 150 Non-bulk: 203 Bulk: 242

Quantity Limitations: Passenger aircraft/rail: 60 L Cargo aircraft only: 220 L

Vessel Stowage: Location: A Other:



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U037 Toxic Waste

CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Chromium **CAS Number:** 7440-47-3
Chemical Formula: Cr
Structural Chemical Formula: Cr
EINECS Number: 231-157-5
ACX Number: X1002501-1
Synonyms: CHROM; CHROME; CHROMIUM; CHROMIUM METAL
General Use: Used in the manufacture of chrome-steel or chrome-nickel-steel alloys (stainless steel); for greatly increasing resistance and durability of metals; for chrome-plating of other metals.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
chromium	7440-47-3	> 99.5

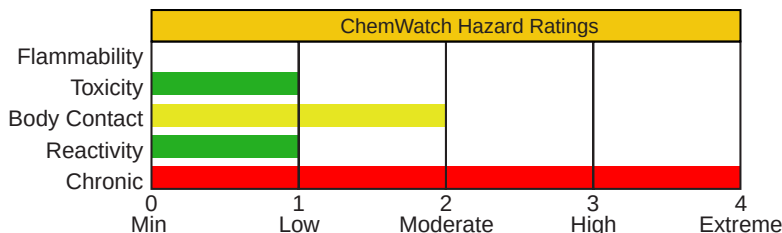
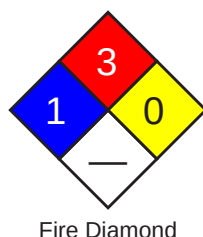
OSHA PEL
 TWA: 1 mg/m³.

NIOSH REL
 TWA: 0.5 mg/m³.

ACGIH TLV
 TWA: 0.5 mg/m³.

IDLH Level
 250 mg/m³ (as Cr).

Section 3 - Hazards Identification



HMIS	
1	Health
3	Flammability
0	Reactivity

ANSI Signal Word

Warning!



☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Steel-gray, lustrous metal powder; odorless. Irritating to eyes/skin/respiratory tract. Chronic Effects: lung fibrosis. Flammable. Explosive in air.

Potential Health Effects

Target Organs: respiratory system

Primary Entry Routes: inhalation, skin absorption, ingestion

Acute Effects

Inhalation: The dust may be discomforting to the upper respiratory tract and may be harmful if inhaled.

Chrome fume is irritating to the respiratory tract and lungs.

Toxic effects result from over-exposure.

Asthmatic conditions may result as a consequence of the sensitizing action of chrome VI compounds.

Eye: The dust may produce eye discomfort and abrasive eye inflammation.

Skin: The material may be mildly discomforting to the skin and is capable of causing skin reactions which may lead to dermatitis.

Chrome fume, as the chrome VI oxide, is corrosive to the skin and may aggravate pre-existing skin conditions such as dermatitis and eczema.

As a potential skin sensitizer, the fume may cause dermatoses to appear suddenly and without warning. Absorption of chrome VI compounds through the skin can cause systemic poisoning effecting the kidneys and liver.

Ingestion: The material is moderately discomforting to the gastrointestinal tract and may be harmful if swallowed in large quantity.

Carcinogenicity: NTP - Listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Not listed; MAK - Not listed.

Chronic Effects: Metallic dusts generated by the industrial process give rise to a number of potential health problems. The larger particles, above 5 micron, are nose and throat irritants. Smaller particles however, may cause lung deterioration. Particles of less than 1.5 micron can be trapped in the lungs and, dependent on the nature of the particle, may give rise to further serious health consequences.

Chromium(III) is considered an essential trace nutrient serving as a component of the "glucose tolerance factor" and a cofactor for insulin action. High concentrations of chromium are also found in RNA. Trivalent chromium is the most common form found in nature.

Chronic inhalation of trivalent chromium compounds produces irritation of the bronchus and lungs, dystrophic changes to the liver and kidney, pulmonary edema, and adverse effects on macrophages. Intratracheal administration of chromium(III) oxide, in rats, increased the incidence of sarcomas, and tumors and reticulum cell sarcomas of the lung. There is inadequate evidence of carcinogenicity of chromium(III) compounds in experimental animals and humans (IARC).

Chronic exposure to hexavalent chromium compounds reportedly produces skin, eye and respiratory tract irritation, yellowing of the eyes and skin, allergic skin and respiratory reactions, diminished sense of smell and taste, blood disorders, liver and kidney damage, digestive disorders and lung damage. There is sufficient evidence of carcinogenicity of chromium(VI) compounds in experimental animals and humans to confirm these as Class 1 carcinogens (IARC).

Exposure to chromium during chrome production and in the chrome pigment industry is associated with cancer of the respiratory tract. A slight increase in gastrointestinal cancer following exposure to chromium compounds has also been reported. The greatest risk is attributed to exposure to acid-soluble, water-insoluble hexavalent chromium which occurs in roasting and refining processes. Animal studies support the idea that the most potent carcinogenic compounds are the slightly soluble hexavalent compounds.

The cells are more active in the uptake of the hexavalent forms compared to trivalent forms and this may explain the difference in occupational effect. It is the trivalent form, however, which is metabolically active and binds with nucleic acid within the cell suggesting that chromium mutagenesis first requires biotransformation of the hexavalent form by reduction.

Hexavalent chromes produce chronic ulceration of skin surfaces (quite independent of other hypersensitivity reactions exhibited by the skin).

Water-soluble chromium(VI) compounds come close to the top of any published "hit list" of contact allergens (eczematogens) producing positive results in 4 to 10% of tested individuals. On the other hand only chromium(III) compounds can bind to high molecular weight carriers such as proteins to form a complete allergen (such as a hapten). Chromium(VI) compounds cannot.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Encourage patient to blow nose to ensure clear breathing passages. Rinse mouth with water. Consider drinking water to remove dust from throat.

Seek medical attention if irritation or discomfort persist.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Long term exposure to high dust concentrations may cause changes in lung function i.e. pneumoconiosis; caused by particles less than 0.5 micron penetrating and remaining in the lung. Prime symptom is breathlessness; lung shadows show on X-ray.

Section 5 - Fire-Fighting Measures

Flash Point: Noncombustible Solid

Autoignition Temperature: 580 °C (cloud)

LEL: Not applicable

UEL: Not applicable

Extinguishing Media: Sand, dry powder extinguishers or other inerts should be used to smother dust fires.

These are the only suitable means for extinguishing metal dust fires.

Do NOT use water.

General Fire Hazards/Hazardous Combustion Products: Sand, dry powder extinguishers or other inerts should be used to smother dust fires.

These are the only suitable means for extinguishing metal dust fires.

Do NOT use water.

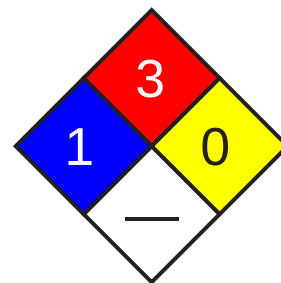
Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

Cool fire-exposed containers with water spray from a protected location.

If safe to do so, remove containers from path of fire.



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Clean up all spills immediately. Avoid contact with skin and eyes.

Wear impervious gloves and safety glasses.

Remove all ignition sources.

Use dry clean-up procedures and avoid generating dust.

Vacuum up or sweep up.

Place spilled material in clean, dry, sealable, labeled container.

Large Spills: Clear area of personnel.

Contact fire department and tell them location and nature of hazard.

Control personal contact by using protective equipment.

Prevent, by any means available, spillage from entering drains or water ways.

Moderate hazard.

No smoking, bare lights or ignition sources. Increase ventilation.

Stop leak if safe to do so.

Avoid generating dust.

Collect recoverable product into labeled containers for recycling.

Collect residues and seal in labeled drums for disposal.

Wash area down with large quantity of water and prevent runoff into drains.

After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Limit all unnecessary personal contact.

Wear protective clothing when risk of exposure occurs.

Use in a well-ventilated area. When handling DO NOT eat, drink or smoke.

Always wash hands with soap and water after handling.

Avoid physical damage to containers. Use good occupational work practices.

Observe manufacturer's storing and handling recommendations.

Recommended Storage Methods: Packaging as recommended by manufacturer.

Check that containers are clearly labeled.

Store in metal drums or safety cans.

Plastic container.

Metal can.

Metal drum.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Metal dusts must be collected at the source of generation as they are potentially explosive.

1. Vacuum cleaners, of flame-proof design, should be used to minimize dust accumulation.
2. Metal spraying and blasting should, where possible, be conducted in separate rooms. This minimizes the risk of supplying oxygen, in the form of metal oxides, to potentially reactive finely divided metals such as aluminum, zinc, magnesium or titanium.
3. Work-shops designed for metal spraying should possess smooth walls and a minimum of obstructions, such as ledges, on which dust accumulation is possible.
4. Wet scrubbers are preferable to dry dust collectors.
5. Bag or filter-type collectors should be sited outside the workrooms and be fitted with explosion relief doors.
6. Cyclones should be protected against entry of moisture as reactive metal dusts are capable of spontaneous combustion in humid or partially wetted state.
7. Local exhaust systems must be designed to provide a minimum capture velocity at the fume source, away from the worker, of 0.5 meter/sec.

Special ventilation requirements apply for processes which result in the generation of barium, chromium, lead, or nickel fume and in those processes which generate ozone.

The use of mechanical ventilation by local exhaust systems is required as a minimum in all circumstances (including outdoor work).

(In confined spaces always check that oxygen has not been depleted by excessive rusting of steel or snowflake corrosion of aluminum). Local exhaust systems must be designed to provide a minimum capture velocity at the fume source, away from the worker, of 0.5 meter/sec.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; or as required, chemical goggles.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: PVC gloves; Safety footwear.

Rubber gloves.

Respiratory Protection:

Exposure Range >1 to 10 mg/m³: Air Purifying, Negative Pressure, Half Mask

Exposure Range >10 to 100 mg/m³: Air Purifying, Negative Pressure, Full Face

Exposure Range >100 to <250 mg/m³: Supplied Air, Constant Flow/Pressure Demand, Half Mask

Exposure Range 250 to unlimited mg/m³: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Cartridge Color: dust/mist filter (use P100 or consult supervisor for appropriate dust/mist filter)

Other: Overalls. Eyewash unit.

Section 9 - Physical and Chemical Properties

Appearance/General Info: A hard, brittle, lustrous, steel-grey metal which is very resistant to corrosion. Soluble in dilute sulphuric and hydrochloric acids. Welding flux grades typical sieve analysis (cumulative retention %): - 200 um 0, 150 um 10-40, 100 50-80, 75 um 80-95, 63 um 90-96, 43 um 97-100.

Physical State: Divided solid

Vapor Pressure (kPa): 0.13 at 1616 °C

Vapor Density (Air=1): 1.79

Formula Weight: 52.00

Specific Gravity (H₂O=1, at 4 °C): 7.2

Evaporation Rate: Not applicable

pH: Not applicable

pH (1% Solution): Not applicable.

Boiling Point: 2642 °C (4788 °F)

Freezing/Melting Point: 1900 °C (3452 °F)

Volatile Component (% Vol): Nil

Decomposition Temperature (°C): Not applicable

Water Solubility: Insoluble in water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Segregate from strong oxidizers, nitric oxide, potassium chlorate, sulfur dioxide, acids and strong alkalis.

Section 11 - Toxicological Information

No relevant toxicological data found at time of research.

See RTECS GB 4200000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.

Ecotoxicity: No data found.

BCF: snails 1 x10⁶

Biochemical Oxygen Demand (BOD): 62.5 lb/lb, 5 days

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options. Follow applicable federal, state, and local regulations.

Bury residue in an authorized landfill.

Recycle containers if possible, or dispose of in an authorized landfill.

Section 14 - Transport Information**DOT Hazardous Materials Table Data (49 CFR 172.101):**

Shipping Name and Description: None

Section 15 - Regulatory Information**EPA Regulations:**

RCRA 40 CFR: Listed

CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 5000 lb (2268 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

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Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Chrysene **CAS Number:** 218-01-9
Chemical Formula: C₁₈H₁₂
EINECS Number: 205-923-4
ACX Number: X1001743-5
Synonyms: BENZO (A) PHENANTHRENE; BENZO[A]PHENANTHRENE; 1,2-BENZOPHENANTHRENE; BENZO(A)PHENANTHRENE; 1,2-BENZPHENANTHRENE; BENZ(A)PHENANTHRENE; CHRYSENE; COAL TAR PITCH VOLATILES: CHRYSENE; 1,2,5,6-DIBENZONAPHTHALENE
Derivation: Distilled from coal tar, coal tar pitch. A small amount is produced from the distillation or pyrolysis of many fats and oils. By heating hydrogen and acetylene. Chrysene is not produced commercially in the U.S. (except as a laboratory research chemical).
General Use: Used in organic synthesis; as a research chemical. Occurs in cigarette smoke.

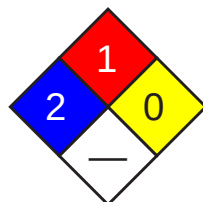
Section 2 - Composition / Information on Ingredients

Name	CAS	%
No data found.		

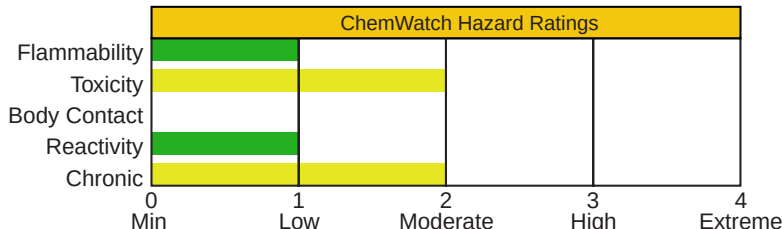
OSHA PEL **NIOSH REL**
 TWA: 0.2 mg/m³.

ACGIH TLV
 Exposure by all routes should be carefully controlled to levels as low as possible.

Section 3 - Hazards Identification



Fire Diamond



HMIS	
2	Health
1	Flammability
0	Reactivity

ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless to white crystals with reddish-blue fluorescence. May be irritating to eyes/skin/respiratory tract. Also causes: may be absorbed through skin. May be cancer-causing in humans. Combustible.

Potential Health Effects

Target Organs: Eyes, skin, respiratory system

Primary Entry Routes: Skin absorption

Acute Effects There is no human evidence available for the acute health effects of chrysene alone. There is, however, considerable data indicating that it is carcinogenic in humans. Based on the chemical properties of chrysene, as a polynuclear aromatic hydrocarbon, the following acute effects may occur.

Inhalation: May cause irritation.

Eye: . May cause irritation.

Skin: May cause irritation or be absorbed.

Ingestion: None reported.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A3, Animal carcinogen; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Class A2, Unmistakably carcinogenic in animal experimentation only.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: Animal data indicate that chronic exposure to chrysene and other coal tar pitch volatiles probably causes cancer. May also cause respiratory, skin, or eye irritation; cough, bronchitis, photosensitivity, "coal tar warts" (precancerous lesions enhanced by UV light exposure), erythema (skin inflammation), dermal burns, acneiform lesions, hematuria (blood in urine). May alter genetic material. Exposure to PAH's is believed to cause leukoplakia (precancerous patches on the tongue), lip and oral cavity cancers, and bladder cancer.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult a physician or ophthalmologist if pain, irritation, swelling, or photophobia persist.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For high exposures, medical surveillance (skin, mouth, GI tract, respiratory system) may be necessary.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: Combustible solid

Autoignition Temperature: None reported.

LEL: None reported.

UEL: None reported.

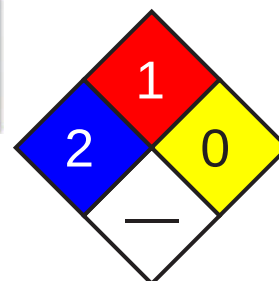
Flammability Classification: Combustible solid

Extinguishing Media: Use water spray, carbon dioxide, dry chemical powder or appropriate foam.

General Fire Hazards/Hazardous Combustion Products: Acrid smoke and fumes, including carbon monoxide and carbon dioxide.

Fire-Fighting Instructions: *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

See
DOT
ERG



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources. Isolate and ventilate area, deny entry, stay upwind. Tag container as defective and return to supplier. Use spark-proof tools and explosion-proof equipment.

Small Spills: *Do not* sweep! Carefully scoop up or vacuum (with a HEPA filter). Absorb liquid spill with an inert, noncombustible absorbent such as sand or vermiculite.

Large Spills: Large spills of chrysene are unlikely. *Do not* release into sewers or waterways.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: Avoid dust inhalation and skin and eye contact. Use only with adequate ventilation to maintain concentrations at nonhazardous levels (see Sec. 2). Wear personal protective clothing and equipment to prevent contact with skin and eyes (see Sec. 8). Practice good personal hygiene procedures to prevent inadvertently ingesting this material.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed containers in a cool, well-ventilated area away from heat, ignition sources, and incompatibles.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose operations to avoid dust dispersion into the work area. Ventilate at the site of chemical release. To prevent static sparks, electrically ground and bond all containers and equipment. Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PEL (see Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Educate workers about the health and safety hazards associated with this material. Train in work practices which minimize exposure. Consider preplacement and periodic medical exams with emphasis on the skin and lungs.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Air purifying respirators may be adequate for handling small amounts of chrysene in a laboratory setting. For unlimited exposure ranges, wear a pressure-demand, full-face SCBA. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder clothing separately before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless to white rhombic plates with reddish-blue fluorescence.

Physical State: Solid

Vapor Pressure (kPa): 6.3×10^{-7} mm Hg; 6.3×10^{-9} mm Hg at 68 °F (20 °C)

Formula Weight: 228.28

Specific Gravity (H₂O=1, at 4 °C): 1.274 at 20 °C/4 °C

Refractive Index: 2610

Boiling Point: 838 °F (448 °C); sublimes easily in a vacuum

Freezing/Melting Point: 489 °F (254 °C) to 496 °F (258 °C)

Ionization Potential (eV): 7.59 +/- 0.2 eV

Water Solubility: Insoluble (0.0018 mg/kg)

Other Solubilities: Slightly soluble in 95% ethanol, acetone, carbon disulfide, ether, glacial acetic acid. Soluble in hot benzene, toluene.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Chrysene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Avoid contact with chemical incompatibles, heat and ignition sources.

Storage Incompatibilities: Include strong oxidizers.

Hazardous Decomposition Products: Thermal oxidative decomposition of chrysene can produce acrid smoke and fumes, including carbon monoxide and carbon dioxide.

Section 11 - Toxicological Information

Acute Skin Effects:

Mouse, skin: 192 µmol/kg produced DNA adducts.

Mouse, skin, TD_{Lo}: 3600 µg/kg.

Other Effects:

Tumorigenicity, mouse, skin: 23 mg/kg; toxic effects: tumorigenic - neoplastic by RTECS criteria; skin and appendages - tumors.

Human, lymphocyte: 6 µmol/L produced mutation.

Mouse, intraperitoneal, LD₅₀: >320 mg/kg.

Tumorigenic Effects: Mouse, skin, 3600 mg/kg for 30 weeks, intermittent; toxic effects: tumorigenic - equivocal tumorigenic agent by RTECS criteria; skin and appendages - tumors.

Hamster, intraperitoneal: 900 mg/24 hr induced sister chromatid exchange.

Bacteria, *S typhimurium*: 5 mg/plate (-S9) produced mutation.

See RTECS GC0700000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to water, it will adsorb very strongly to sediments and particulate matter, but will not hydrolyze or appreciably evaporate. It will bioconcentrate in species which lack microsomal oxidase. Calculated BCF: 4,230. K_{ow} indicates bioaccumulation, which could cause food-chain contamination. It will not hydrolyze or appreciably evaporate from soils or surfaces. The estimated biodegradation half-life in soil is 7 years. The estimated half-life of any gas phase in the atmosphere is 1.25 hours as a result of reaction with photochemically produced hydroxyl radicals. It will be subject to near-surface, direct photolysis with a half-life of 4.4 hours computed for exposure to sunlight at mid-day in midsummer at latitude 40°N. If released to air, it will be subject to direct photolysis, although adsorption to particulates may affect the rate of this process. If released to soil it will be expected to adsorb very strongly to the soil and will not be expected to leach appreciably to groundwater.

Ecotoxicity: *Anabaena flos-aquae* (algae), 2 weeks, EC_{35} growth: ± 0.002 mg/L. *Daphnia magna* (crustaceans), 2 hr, LC_{50} : 1.9 mg/L. *Rana pipiens* (amphibians), 24 hr, LC_{50} : >6.7 mg/L. *Neanthes arenaceodentata* (fishes), 96 hr, LC_{50} : >1 mg/L.

Henry's Law Constant: 9.4×10^{-8}

Octanol/Water Partition Coefficient: $\log K_{ow} = 5.61$ to 5.91

Section 13 - Disposal Considerations

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations. One method is to dissolve or mix the material with a combustible solvent and burn in an incinerator equipped with an afterburner and scrubber. Handle empty containers carefully as hazardous residues may still remain. Triple rinse containers and dispose of wash wastewater appropriately.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Environmentally hazardous substances, solid, n.o.s.

ID: UN3077

Hazard Class: 9 - Miscellaneous hazardous material

Packing Group: III - Minor Danger

Symbols: G - Technical Name Required

Label Codes: 9 - Class 9

Special Provisions: 8, 146, B54, IB8, N20

Packaging: Exceptions: 155 **Non-bulk:** 213 **Bulk:** 240

Quantity Limitations: Passenger aircraft/rail: No limit **Cargo aircraft only:** No limit

Vessel Stowage: Location: A **Other:**



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U050 Toxic Waste

CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

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Section 1 - Chemical Product and Company Identification

61

Material Name: cis-Acetylene Dichloride

CAS Number: 156-59-2

Chemical Formula: C₂H₂Cl₂

Structural Chemical Formula: CHCl=CHCl

EINECS Number: 205-859-7

ACX Number: X1007815-0

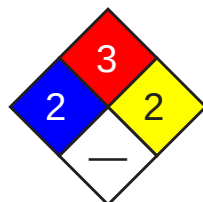
Synonyms: ACETALYNE DICHLORIDE; CIS-ACETYLENE DICHLORIDE; CIS-1,2-DICHLOROETHYLENE; CIS-1,2-DICHLOROETHENE; (Z)-1,2-DICHLOROETHYLENE; 1,2-CIS-DICHLOROETHYLENE; CIS-1,2-DICHLOROETHYLENE; CIS-DICHLOROETHYLENE; ETHENE,1,2-DICHLORO-, (Z)-; ETHYLENE,1,2-DICHLORO-, (Z)-

General Use: solvent for waxes, resins, fats, phenol, camphor, acetyl cellulose, organic materials and heat-sensitive substances such as caffeine; in rubber manufacture, as a refrigerant, as an additive to dye and lacquer solutions, in retarding fermentation, in organic synthesis, in medicines, in dye extraction, in chlorination reactions and in the manufacture of artificial pearls; a constituent of perfumes and thermoplastics

Section 2 - Composition / Information on Ingredients

Name	CAS	%
cis-acetylene dichloride	156-59-2	>98
OSHA PEL TWA: 200 ppm; 790 mg/m ³ .	NIOSH REL	DFG (Germany) MAK TWA: 200 ppm; PEAK: 400 ppm.
ACGIH TLV TWA: 200 ppm.		

Section 3 - Hazards Identification



Fire Diamond

	ChemWatch Hazard Ratings				
Flammability	3	2	1	0	4
Toxicity	2	1	0	0	3
Body Contact	2	1	0	0	3
Reactivity	2	1	0	0	3
Chronic	2	1	0	0	3
	0 Min	1 Low	2 Moderate	3 High	4 Extreme

ANSI Signal Word

Warning!

HMIS	
2	Health
3	Flammability
2	Reactivity



Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; sweetish odor. Irritating to eyes/skin/respiratory tract. Harmful. Other Acute Effects: narcotic effect. Flammable.

Potential Health Effects

Target Organs: eyes, skin, respiratory system, nervous system, liver, kidneys

Primary Entry Routes: inhalation of vapor, skin/eye contact

Acute Effects

Inhalation: There is a single report of an industrial poisoning, a fatality caused by the inhalation of a vapor in a small enclosure. Acute intoxication by halogenated aliphatic hydrocarbons appears to take place over two stages. Signs of a reversible narcosis are evident in the first stage and in the second stage signs of injury to organs may become evident, a single organ alone is (almost) never involved. Depression of the central nervous system is the most outstanding effect of most halogenated aliphatic hydrocarbons. Inebriation and excitation, passing into narcosis, is a typical reaction. In severe acute exposures there is always a danger of death from respiratory failure or cardiac arrest due to a tendency to make the heart more susceptible to catecholamines (adrenalin). The most important effects of exposure are narcosis and irritation of the central nervous system. Liver responses may occur after repeated narcotic doses and involves fatty liver degeneration. Vapor exposure may produce central nervous system depression or in milder exposures, nausea, vomiting, weakness, tremor and epigastric cramps. Recovery is usually rapid.

Eye: The vapor when concentrated has pronounced eye irritation effect; this gives some warning of high vapor concentrations. If eye irritation occurs seek to reduce exposure with available control measures, or evacuate area. Exposure to the trans isomer at 2200 ppm caused burning of the eyes, vertigo, nausea. Reversible corneal clouding has been described in exposures to acetylene dichloride.

Skin: The liquid may produce skin discomfort following prolonged contact. Defatting and/ or drying of the skin may lead to dermatitis.

Ingestion: The liquid is discomforting to the gastrointestinal tract and toxic if swallowed. Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: The material may accumulate in the human body and progressively cause tissue damage.

Section 4 - First Aid Measures

Inhalation: • If fumes or combustion products are inhaled, remove to fresh air.

- Lay patient down. Keep warm and rested.
- If breathing is shallow or has stopped, ensure clear airway and apply resuscitation, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital or doctor.

See
DOT
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Eye Contact: • Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Transport to hospital or doctor without delay.

• Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: • Immediately remove all contaminated clothing, including footwear (after rinsing with water).

- Wash affected areas thoroughly with water (and soap if available).
- Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center. Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treatment should follow that practiced in carbon tetrachloride exposures:

- Acute exposures to carbon tetrachloride present, initially, with CNS depression followed by hepatic and renal dysfunction.
- Respiratory depression and cardiac dysrhythmias are an immediate threat to life.
- Since a major fraction of absorbed carbon tetrachloride is exhaled in first hour, good tidal volumes should be maintained in severely poisoned patients; hyperventilation may be an additional therapeutic modality.
- Ipecac syrup, lavage, activated charcoal or catharsis may all be used in the first 4 hours.
- Since reactive metabolites may cause hepatorenal toxicity, administration of N-acetyl-L-cysteine may reduce complications. Experience with this therapy is limited.

Section 5 - Fire-Fighting Measures

Flash Point: 2.2 to 3.9 °C Closed Cup

Autoignition Temperature: 460 °C

LEL: 9.7% v/v

UEL: 12.8% v/v

Extinguishing Media: Foam. Dry chemical powder. BCF (where regulations permit). Carbon dioxide. Water spray or fog - Large fires only.

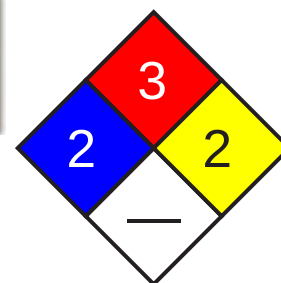
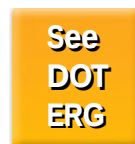
General Fire Hazards/Hazardous Combustion Products: • Liquid and vapor are highly flammable.

- Severe fire hazard when exposed to heat, flame and/or oxidizers.
- Vapor forms an explosive mixture with air.
- Severe explosion hazard, in the form of vapor, when exposed to flame or spark.
- Vapor may travel a considerable distance to source of ignition.
- Heating may cause expansion/decomposition with violent rupture of containers.
- On combustion, may emit toxic fumes of carbon monoxide (CO). Other combustion products include hydrogen chloride and phosgene.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e., nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: • Contact fire department and tell them location and nature of hazard.

- May be violently or explosively reactive.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or waterways.
- Consider evacuation (or protect in place).
- Fight fire from a safe distance, with adequate cover.
- If safe, switch off electrical equipment until vapor fire hazard removed.
- Use water delivered as a fine spray to control the fire and cool adjacent area.
- Avoid spraying water onto liquid pools.
- Do not approach containers suspected to be hot.
- Cool fire-exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: • Remove all ignition sources.

- Clean up all spills immediately.
- Avoid breathing vapors and contact with skin and eyes.
- Control personal contact by using protective equipment.
- Contain and absorb small quantities with vermiculite or other absorbent material.
- Wipe up.
- Collect residues in a flammable waste container.

Large Spills: • Clear area of personnel and move upwind.

- Contact fire department and tell them location and nature of hazard.
- May be violently or explosively reactive.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or waterways.
- No smoking, bare lights or ignition sources.
- Increase ventilation.
- Stop leak if safe to do so.
- Water spray or fog may be used to disperse/absorb vapor.
- Contain spill with sand, earth or vermiculite.
- Use only spark-free shovels and explosion proof equipment.
- Collect recoverable product into labeled containers for recycling.
- Absorb remaining product with sand, earth or vermiculite.
- Collect solid residues and seal in labeled drums for disposal.
- Wash area and prevent runoff into drains.
- If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).



Section 7 - Handling and Storage

Handling Precautions: • Avoid all personal contact, including inhalation.

- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.

- DO NOT enter confined spaces until atmosphere has been checked.
 - Avoid smoking, bare lights or ignition sources.
 - Avoid contact with incompatible materials.
 - When handling, DO NOT eat, drink or smoke.
 - Keep containers securely sealed when not in use.
 - Avoid physical damage to containers.
 - Always wash hands with soap and water after handling.
 - Work clothes should be laundered separately.
 - Follow good occupational work practices.
 - Observe manufacturer's storage and handling recommendations.
 - Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
- Recommended Storage Methods:** Check that containers are clearly labeled. Packaging as recommended by manufacturer. DO NOT use aluminum or galvanized containers.
- Regulatory Requirements:** Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Local exhaust ventilation usually required. If risk of overexposure exists, wear NIOSH-approved respirator. Provide adequate ventilation in warehouse or closed storage area.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields or, as required, chemical goggles. Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Butyl rubber gloves. Neoprene gloves.

Respiratory Protection: Respirator protection may be required. Consult your supervisor.

Other: • Overalls.

• Barrier cream.

• Eyewash unit.

Glove Selection Index:

VITON Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless liquid with pleasant chloroform-like odor.

Physical State: colorless liquid

Specific Gravity (H₂O=1, at 4 °C): 1.2837 at 20 °C/4 °C

Odor Threshold: 0.085 ppm

Vapor Pressure (kPa): 200 mm Hg at 25 °C

Boiling Point: 60.3 °C (141 °F) at 760 mm Hg

Vapor Density (Air=1): 3.34

Freezing/Melting Point: -80.5 °C (-112.9 °F)

Formula Weight: 96.94

Water Solubility: 1 to 5 mg/mL at 16 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid reaction with oxidizing agents. Acetylene dichloride in contact with solid caustic alkalis or their concentrated solutions will form chloroacetylene which ignites in air. Haloalkenes are highly reactive.

Section 11 - Toxicological Information

Toxicity

Inhalation (mouse) LC₅₀: 65000 mg/m³/2 hr

Rat liver cell mutagen in vitro

Irritation

Nil reported

See RTECS KV9420000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released on soil, it should evaporate and/or leach into the groundwater where very slow biodegradation should occur. If released into water, it will be lost mainly through volatilization (half life 3 hr in a model river). Biodegradation, adsorption to sediment, and bioconcentration in aquatic organisms should not be significant. In the atmosphere it will be lost by reaction with photochemically produced hydroxyl radicals (half life 8 days) and scavenged by rain. Because it is relatively long lived in the atmosphere, considerable dispersal from source areas should occur.

Ecotoxicity: LC₅₀ Lepomis macrochirus (bluegill) 135,000 ug/l/96 hr in a static unmeasured bioassay

Henry's Law Constant: estimated at 0.00337

BCF: calculated at 15

Octanol/Water Partition Coefficient: $\log K_{ow} = 1.86$

Soil Sorption Partition Coefficient: $K_{oc} = 49$

Section 13 - Disposal Considerations

Disposal: • Consult manufacturer for recycling options and recycle where possible.

- Follow applicable local, state, and federal regulations.
- Incinerate residue at an approved site.
- Recycle containers if possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: 1,2-Dichloroethylene

ID: UN1150

Hazard Class: 3 - Flammable and combustible liquid

Packing Group: II - Medium Danger

Symbols:

Label Codes: 3 - Flammable Liquid

Special Provisions: IB2, T7, TP2

Packaging: Exceptions: 150 **Non-bulk:** 202 **Bulk:** 242

Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L

Vessel Stowage: **Location:** B **Other:**



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Not listed

CERCLA 40 CFR 302.4: Not listed

SARA 40 CFR 372.65: Not listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Copper

CAS Number: 7440-50-8

Chemical Formula: Cu

Structural Chemical Formula: Cu

EINECS Number: 231-159-6

ACX Number: X1002511-7

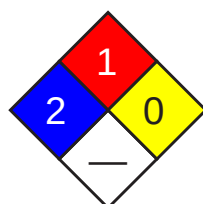
Synonyms: ALLBRI NATURAL COPPER; ANAC 110; ARWOOD COPPER; BRONZE POWDER; C.I. 77400; C.I. PIGMENT METAL 2; CDA 101; CDA 102; CDA 110; CDA 122; CE 1110; COPPER; COPPER BRONZE; COPPER M 1; COPPER METAL DUSTS; COPPER METAL FUMES; COPPER POWDER; COPPER SLAG-AIRBORNE; COPPER SLAG-MILLED; COPPER-AIRBORNE; COPPER, METALLIC POWDER; COPPER-MILLED; CU M3; CUPRUM; E 115 (METAL); EPA PESTICIDE CHEMICAL CODE 022501; 1721 GOLD; GOLD BRONZE; KAFAR COPPER; M 1; M 3; M 4; M1 (COPPER); M2 (COPPER); M3 (COPPER); M3R; M3S; M4 (COPPER); OFHC CU; RANEY COPPER

General Use: Manufacture of bronzes, brass, other copper alloys, electrical conductors, ammunition, copper salts, works of art, catalyst, oxygen scavenger.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
copper	7440-50-8	>99
OSHA PEL TWA: 1 mg/m ³ .	NIOSH REL TWA: 1 mg/m ³ .	DFG (Germany) MAK TWA: 1 mg/m ³ ; PEAK: 2 mg/m ³ ; measured as inhalable fraction of the aerosol.
ACGIH TLV TWA: 0.2 mg/m ³ ; fume, as Cu; TWA: 1 mg/m ³ ; dusts and mists, as Cu.	IDLH Level 100 mg/m ³ (as Cu).	

Section 3 - Hazards Identification



Fire Diamond

	ChemWatch Hazard Ratings			
Flammability				
Toxicity				
Body Contact				
Reactivity				
Chronic				
	0 Min	1 Low	2 Moderate	3 High
				4 Extreme

HMIS	
2	Health
0	Flammability
0	Reactivity

ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Red/brown-colored powder; odorless. Irritating. Other Acute Effects: skin discoloration, nausea, vomiting, abdominal pain, diarrhea, metal fume fever. Chronic Effects: respiratory disease, dermatitis.

Potential Health Effects

Target Organs: respiratory system, skin, eyes, liver, kidneys

Primary Entry Routes: inhalation, ingestion

Acute Effects

Inhalation: The dust may be discomforting to the upper respiratory tract.

Persons with impaired respiratory function, airway diseases, and conditions such as emphysema or chronic bronchitis may incur further disability if excessive concentrations of particulate are inhaled.

Copper poisoning following exposure to copper dusts and fume may result in headache, cold sweat and weak pulse. Capillary, kidney, liver and brain damage are the longer term manifestations of such poisoning. Inhalation of freshly formed metal oxide particles sized below 1.5 microns and generally between 0.02 to 0.05 microns may result in "metal fume fever". Symptoms may be delayed for up to 12 hours and begin with the sudden onset of thirst, and a sweet, metallic or foul taste in the mouth.

Other symptoms include upper respiratory tract irritation accompanied by coughing and a dryness of the mucous membranes, lassitude and a generalized feeling of malaise. Mild to severe headache, nausea, occasional vomiting, fever or chills, exaggerated mental activity, profuse sweating, diarrhea, excessive urination and prostration may also occur. Tolerance to the fumes develops rapidly, but is quickly lost. All symptoms usually subside within 24-36 hours following removal from exposure.

Nasal ulcerations with resultant nose-bleed may occur following inhalation of fine dusts.

Eye: Particulate/dust is regarded as discomforting and abrasive to the eyes.

Skin: The material may be slightly discomforting and abrasive to the skin.

Ingestion: The material may be mildly discomforting to the gastrointestinal tract if swallowed in large quantity.

Large oral doses may cause nausea, vomiting, abdominal pain, metallic taste and diarrhea. If vomiting does not occur immediately, systematic copper poisoning may occur; capillary damage, headache, cold sweat, weak pulse, kidney and liver damage may be the result of poisoning.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic exposure to copper dusts may result in runny nose, irritation of mucous membranes and atrophic changes with resultant dementia.

Pre-existing skin, kidney, liver and pulmonary disorders may be aggravated by exposure.

Chronic copper poisoning is rarely recognized in man although in one instance, at least, symptoms more commonly associated with exposures to mercury, namely infantile acrodynia (pink disease), have been described.

Tissue damage of mucous membranes may follow chronic dust exposure.

A hazardous situation is exposure of a worker with the rare hereditary condition (Wilson's disease or hereditary hepatolenticular degeneration) to copper exposure which may cause liver, kidney, CNS, bone and sight damage and is potentially lethal.

Hemolytic anemia (a result of red-blood cell damage) is common in cows and sheep poisoned by copper derivatives.

Overdosing of copper feed supplements has resulted in pigmentary cirrhosis of the liver.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Encourage patient to blow nose to ensure clear breathing passages. Rinse mouth with water. Consider drinking water to remove dust from throat.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush with fresh running water.

Ensure irrigation under the eyelids by occasionally lifting upper and lower lids. If pain persists or recurs seek medical attention.

Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Copper, magnesium, aluminum, antimony, iron, manganese, nickel (and their compounds) in welding, galvanizing or smelting operations all give rise to thermally produced particulates of smaller dimension than might be produced if the metals are divided mechanically. Where insufficient ventilation or respiratory protection is available these particulates may produce "metal fume fever" in the worker.

1. Onset occurs in 4-6 hours generally on the evening following exposure.

Tolerance develops in workers but may be lost over the weekend. (Monday Morning Fever).

2. Pulmonary function tests may indicate reduced lung volumes, small airway obstruction and decreased carbon monoxide diffusing capacity but these abnormalities resolve after several months.

3. Although mildly elevated urinary levels of heavy metal may occur they do not correlate with clinical effects.

4. The general approach to treatment is recognition of the disease, supportive care and prevention of exposure.

5. Seriously symptomatic patients should receive chest x-rays, have arterial blood gases determined and be observed for the development of tracheobronchitis and pulmonary edema.

Section 5 - Fire-Fighting Measures

Flash Point: Noncombustible, except as a powder

Autoignition Temperature: Not applicable

Extinguishing Media: Sand, dry powder extinguishers or other inerts should be used to smother dust fires.

These are the only suitable means for extinguishing metal dust fires.

Do NOT use water.

General Fire Hazards/Hazardous Combustion Products: Does not burn.

Metal powders, while generally regarded as noncombustible, may burn when metal is finely divided and energy input is high. Metal dust fires are slow moving but intense and difficult to extinguish. DO NOT disturb burning dust. Explosion may result if dust is stirred into a cloud, by providing oxygen to a large surface of hot metal. DO NOT use water or foam as generation of explosive hydrogen may result.

Fire Incompatibility: Avoid contact with acetylene, ammonium nitrate, barium bromate, chlorate and iodate, bromates, phosphorus, potassium chlorate, potassium iodate, potassium peroxide, sodium azide, sodium chlorate and iodate, sodium peroxide, sulfur and chlorates.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

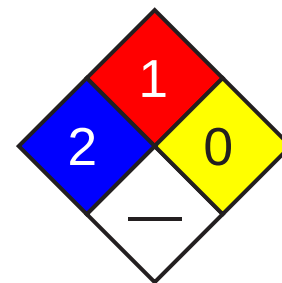
Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

Cool fire-exposed containers with water spray from a protected location.

Do not approach containers suspected to be hot.

If safe to do so, remove containers from path of fire.

Equipment should be thoroughly decontaminated after use.



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Clean up all spills immediately. Avoid contact with skin and eyes.

Wear impervious gloves and safety glasses.

Use dry clean-up procedures and avoid generating dust.

Vacuum up or sweep up.

Place spilled material in clean, dry, sealable, labeled container.

Large Spills: Clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

Control personal contact by using protective equipment and dust respirator.

Prevent spillage from entering drains, sewers or waterways.

Avoid generating dust. Sweep, shovel up. Recover product wherever possible.

Put residues in labeled plastic bags or other containers for disposal.

If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Limit all unnecessary personal contact.

Wear protective clothing when risk of exposure occurs.

Use in a well-ventilated area. When handling DO NOT eat, drink or smoke.

Always wash hands with soap and water after handling.

Avoid physical damage to containers. Use good occupational work practices.

Observe manufacturer's storing and handling recommendations.

Recommended Storage Methods: Packaging as recommended by manufacturer.

Check that containers are clearly labeled.

Glass container.

Plastic drum.

Polyethylene or polypropylene container.

Metal can.

Metal drum.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: General exhaust is adequate under normal operating conditions.

If risk of overexposure exists, wear NIOSH-approved respirator.

Correct fit is essential to obtain adequate protection.

Provide adequate ventilation in warehouse or closed storage areas.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses; safety glasses with side shields; chemical goggles.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: No special equipment needed when handling small quantities.

OTHERWISE: Wear chemical protective gloves, eg. PVC.

Respiratory Protection:

Exposure Range >0.1 to 1 mg/m³: Air Purifying, Negative Pressure, Half Mask

Exposure Range >1 to 10 mg/m³: Air Purifying, Negative Pressure, Full Face

Exposure Range >10 to 100 mg/m³: Supplied Air, Constant Flow/Pressure Demand, Full Face

Exposure Range >100 to unlimited mg/m³: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Cartridge Color: magenta (P100)

Note: as a fume; if exposure is as a dust, respirator recommendations are different

Other: No special equipment needed when handling small quantities.

OTHERWISE: Overalls. Barrier cream. Eyewash unit.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Reddish metallic solid with high electrical conductivity. Odorless.

Physical State: Divided solid

pH (1% Solution): Not applicable.

Vapor Pressure (kPa): 0.13 at 1628 °C

Boiling Point: 2595 °C (4703 °F)

Formula Weight: 63.5

Freezing/Melting Point: 1083 °C (1981.4 °F)

Specific Gravity (H₂O=1, at 4 °C): 8.94

Volatile Component (% Vol): Not applicable

Evaporation Rate: Not applicable

Decomposition Temperature (°C): Not applicable

pH: Not applicable

Water Solubility: Insoluble in water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid storage with acetylene, ammonium nitrate, bromates, chlorates, chlorine, chlorine plus oxygen difluoride, chlorine trifluoride, ethylene oxide, fluorine, hydrazine, mononitrate, hydrozoic acid, hydrogen peroxide, hydrogen sulfide, iodates, lead azide, phosphorus, nitric acid, potassium peroxide, sodium azide, sodium peroxide, sulfur plus chlorates, and 1-bromo-2-propylene.

Section 11 - Toxicological Information

Toxicity

Oral (human) TD_{Lo}: 0.12 mg/kg

Irritation

Nil Reported

See RTECS GL 5325000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.

Ecotoxicity: No data found.

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible or consult manufacturer for recycling options. Follow applicable federal, state, and local regulations.

Bury residue in an authorized landfill.

Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: None

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Not listed

CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 5000 lb (2268 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Copper Sulfate

CAS Number: 7758-98-7

Chemical Formula: CuO_4S ; $\text{CuH}_{10}\text{O}_9\text{S}$

Structural Chemical Formula: CuSO_4 ; $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

EINECS Number: 231-847-6

ACX Number: X1002517-9

Synonyms: ALL CLEAR ROOT DESTROYER; AQUA MAID PERMANENT ALGAECIDE; AQUATRONICS SNAIL-A-CIDE DRI-PAC SNAIL POWDER; BCS COPPER FUNGICIDE; BLUE COPPER; BLUE COPPER AS; BLUE COPPERAS; BLUE STONE; BLUE VICKING; BLUE VITRIOL; BLUESTONE; BONIDE ROOT DESTROYER; CALCANTHITE; COPPER MONOSULFATE; COPPER SULFATE; COPPER SULFATE (1:1); COPPER(2+) SULFATE; COPPER(2+) SULFATE (1:1); COPPER SULFATE (CUSO_4) PENTAHYDRATE; COPPER SULFATE PENTAHYDRATE; COPPER(2+) SULFATE PENTAHYDRATE; COPPER SULFATE POWDER; COPPER SULPHATE; COPPER(II) SULFATE; COPPER(II) SULFATE PENTAHYDRATE (1:1:5); CP BASIC SULFATE; CSP; CUPRIC SULFATE; CUPRIC SULFATE ANHYDROUS; CUPRIC SULFATE,PENTAHYDRATE; CUPRIC SULPHATE; GRANULAR CRYSTALS COPPER SULFATE; GRIFFIN SUPER CU; INCRACIDE 10A; INCRACIDE E 51; KILCOP 53; KOBASIC; KUPFERSULFAT; KUPFERSULFAT-PENTAHYDRAT; KUPFERVITRIOL; PHELPS TRIANGLE BRAND COPPER SULFATE; PHYTO-BORDEAUX; ROMAN VITRIOL; SA-50 BRAND COPPER SULFATE GRANULAR CRYSTALS; SALZBURG VITRIOL; SNOW CRYSTAL COPPER SULFATE; SULFATE DE CUIVRE; SULFURIC ACID COPPER(2+) SALT (1:1),PENTAHYDRATE; SULFURIC ACID,COPPER(2+) SALT (1:1); SULFURIC ACID,COPPER(2+) SALT,PENTAHYDRATE; TNCS 53; TOBACCO STATES BRAND COPPER SULFATE; TRIANGLE; TRINAGLE

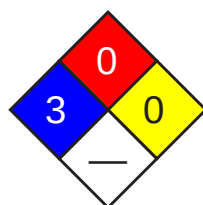
Derivation: Occurs in nature as the mineral hydrocyanite. Produced commercially by reacting dilute sulfuric acid with copper or cupric oxide (often as oxide ores) in large quantities with evaporation and subsequent crystallization.

General Use: The anhydrous salt is used as a dehydrating agent (especially for alcohols) and as a fungicide. The pentahydrate has a wider range of uses, including use as a fungicide, algicide, bactericide, herbicide, food and fertilizer additive, pigment for paints and varnishes, reagent toner in photography, flotation agent, battery electrolyte; in preparation of azo dyes and other copper compounds, preserving hides and tanning leather, in preserving wood, electroplating solutions, petroleum refining, pyrotechnic compositions, water-resistant adhesives for wood, and in anti-rusting compositions for radiator and heating systems.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Copper sulfate		ca 100% wt
OSHA PEL	NIOSH REL	DFG (Germany) MAK
ACGIH TLV		TWA: 1 mg/m ³ ; PEAK: 2 mg/m ³ ; as Cu, measured as inhalable fraction of the aerosol, substances with systemic effects, onset of effect within 2 hours.

Section 3 - Hazards Identification



Fire Diamond

	ChemWatch Hazard Ratings				
Flammability					
Toxicity					
Body Contact					
Reactivity					
Chronic					
	0	1	2	3	4
	Min	Low	Moderate	High	Extreme

HMIS	
2	Health
0	Flammability
0	Reactivity

ANSI Signal Word

Warning!

☆☆☆☆☆ **Emergency Overview** ☆☆☆☆☆

Grayish-white to greenish-white crystals/powder, or blue crystals/powder. Severely irritating to eyes/skin/respiratory tract. Other Acute Effects: metallic taste, nausea, vomiting, damage to blood/kidneys.

Potential Health Effects

Target Organs: Eyes, skin, respiratory tract, gastrointestinal tract, blood, kidneys, liver.

Primary Entry Routes: Inhalation, skin and eye contact, ingestion.

Acute Effects

Inhalation: Irritation of the respiratory tract. Systemic symptoms (as per ingestion) may also occur if sufficient amounts are absorbed through the mucous membranes of the respiratory tract.

Eye: Severe irritation may occur with clouding of the cornea and conjunctivitis.

Skin: Irritation with itching and eczema may occur.

Ingestion: Gastritis, ulceration of the gastrointestinal tract, diarrhea, nausea and vomiting, red blood cell hemolysis (leading to anemia), hypertension leading to shock, kidney tubule damage (suppression of urine followed by jaundice), and possible coma. Ingestion of as little as 5.3 mg has resulted in vomiting. Ingestion of 50 g, produced cyanosis, suppressed urination, anemia, severe intravascular hemolysis, and methemoglobinemia with death resulting in 16 hours. The lethal dose of copper sulfate for adults appears to vary widely from < 1 gram to several ounces.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: Persons with Wilson's disease (inability to metabolize copper) or those with glucose-6-phosphate dehydrogenase deficiency are at increased risk of developing hemolytic anemia from exposure to copper or its salts (including copper sulfate).

Chronic Effects: Liver degeneration will occur in persons with Wilson's disease. Mutation data has been reported.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician or ophthalmologist immediately.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treatment is symptomatic and supportive. Chelation therapy (dimercaprol/penicillamine) can be effective if performed shortly after ingestion.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: Noncombustible

Autoignition Temperature: Noncombustible

LEL: None reported.

UEL: None reported.

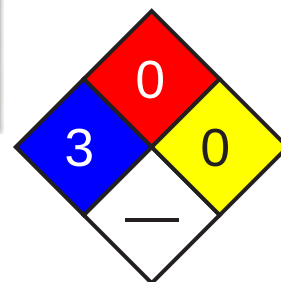
Flammability Classification: Noncombustible solid

Extinguishing Media: Use agents suitable for surrounding area.

General Fire Hazards/Hazardous Combustion Products: Carbon and sulfur oxide(s).

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

See
DOT
ERG



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Cleanup personnel should protect against inhalation and skin/eye contact.

Small Spills: Carefully scoop up or vacuum (with appropriate filter) and place in suitable container.

Large Spills: Flush with water to containment area for later disposal. *Do not* release into sewers or waterways. Damp mop with dilute sodium bicarbonate solution.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: Use only with sufficient ventilation to prevent airborne hazards and wear appropriate PPE. Never eat, drink, or smoke in work areas. Practice good personal hygiene after using copper sulfate, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed containers (hygroscopic) in a cool, dry, well-ventilated area away from incompatibles (Sec. 10). *Do not* store in iron or galvanized iron containers.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where possible, enclose processes to prevent dust dispersion into work area. Provide general or local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on the blood and kidneys.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For $\leq 5 \text{ mg/m}^3$, wear any dust or mist respirator. For $\leq 10 \text{ mg/m}^3$, wear any dust or mist respirator except single-use and quarter-mask respirators or any supplied-air respirator. For $\leq 25 \text{ mg/m}^3$, wear any supplied-air respirator operated in continuous-flow mode or any powered, air-purifying respirator with a dust and mist filter. For $\leq 50 \text{ mg/m}^3$, wear any air-purifying, full facepiece respirator with a high-efficiency particulate filter; any powered, air-purifying respirator with a high-efficiency particulate filter, any SCBA with a full facepiece, or any supplied-air respirator with a full facepiece. For $\leq 100 \text{ mg/m}^3$, wear any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive-pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. **Warning!** *Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove copper sulfate from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Grayish-white to greenish-white crystals or powder (anhydrous), blue crystals or powder (pentahydrate); metallic taste.

Physical State: Solid

Formula Weight: 159.60

Density: 3.6 g/cm^3 (anhydrous), 2.284 g/cm^3 (pentahydrate)

Refractive Index: 1.733, 1.724, 1.739

Boiling Point: $392^\circ\text{F}/200^\circ\text{C}$ (slight decomposition); $> 1202^\circ\text{F}/560^\circ\text{C}$ (decomposition to cupric oxide)

Water Solubility: $14.3 \text{ g}/100 \text{ cc}$ at 32°F (0°C), $75.4 \text{ g}/100 \text{ cc}$ at 212°F (100°C)

Other Solubilities: Slightly soluble in alcohol and glycerol. Soluble ($1.04 \text{ g}/100 \text{ cc}$) in methanol at 64.4°F (18°C).

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Copper sulfate is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization does not occur. Exposure to incompatibles.

Storage Incompatibilities: Hydroxylamine (*ignites*), magnesium (*evolves hydrogen gas*), ammonia (or other caustic) + acetylene (*explodes*), sodium hypobromite, or nitromethane. Strongly corrosive to iron or galvanized iron.

Hazardous Decomposition Products: Thermal oxidative decomposition of copper sulfate can produce carbon and sulfur oxide(s).

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral, LD₅₀: 300 mg/kg.

Human, oral, LD_{Lo}: 50 mg/kg caused somnolence, changes in kidney tubules (acute kidney failure and necrosis), and hemorrhage.

Human, oral, TD_{Lo}: 11 mg/kg caused gastritis, hypermotility, diarrhea, and nausea or vomiting.

Other Effects:

Rat, oral: 915 mg/kg administered intermittently for 1 year caused changes in the coronary artery and serum composition.

Rat, oral: 157 mg/kg administered intermittently for 6 weeks caused changes in adrenal weight, weight loss or decreased weight gain, and affected dehydrogenase levels.

Genetic Effects - Rat, liver cell: 1 mmol/L caused DNA damage.

Mouse, intravenous: 3200 µg/kg administered on the 8th day of pregnancy caused fetotoxicity and specific developmental abnormalities of the central nervous system and cardiovascular system.

See RTECS GL8800000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, copper sulfate may leach to groundwater, be partly oxidized, or bind to humic materials, clay, or hydrous oxides of iron and manganese. In water, it will bind to carbonates as well as humic materials, clay, and hydrous oxides of iron and manganese. Copper is accumulated by plants and animals, but it does not appear to biomagnify from plants to animals. This lack of biomagnification appears common with heavy metals. In air, copper aerosols (in general) have a residence time of 2 to 10 days in an unpolluted atmosphere and 0.1 to > 4 days in polluted, urban areas.

Ecotoxicity: American eel (*Anguilla rostrata*), LC₅₀ = 3.20 mg/L/96 hr; Coho salmon (*Oncorhynchus kistuch*), LC₅₀ = 286 mg/L/96 hr; rainbow trout, TL_m = 3.8 ppm/24 hr

Section 13 - Disposal Considerations

Disposal: Add slowly to an excess of water, stir in soda ash, let stand 24 hr, decant liquid into new container and neutralize with 6 M HCl. Flush to drain with excess water. Landfill sludge. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Copper based pesticides, solid, toxic

ID: UN2775

Hazard Class: 6.1 - Poisonous materials

Packing Group: I - Great Danger

Symbols:

Label Codes: 6.1 - Poison or Poison Inhalation Hazard if inhalation hazard, Zone A or B

Special Provisions: IB7, IP1

Packaging: Exceptions: None **Non-bulk:** 211 **Bulk:** 242

Quantity Limitations: Passenger aircraft/rail: 5 kg **Cargo aircraft only:** 50 kg

Vessel Stowage: Location: A **Other:** 40



Shipping Name and Description: Copper based pesticides, solid, toxic

ID: UN2775

Hazard Class: 6.1 - Poisonous materials

Packing Group: II - Medium Danger

Symbols:

Label Codes: 6.1 - Poison or Poison Inhalation Hazard if inhalation hazard, Zone A or B

Special Provisions: IB8, IP2, IP4

Packaging: Exceptions: None **Non-bulk:** 212 **Bulk:** 242

Quantity Limitations: Passenger aircraft/rail: 25 kg **Cargo aircraft only:** 100 kg

Vessel Stowage: Location: A **Other:**



Shipping Name and Description: Copper based pesticides, solid, toxic**ID:** UN2775**Hazard Class:** 6.1 - Poisonous materials**Packing Group:** III - Minor Danger**Symbols:****Label Codes:** 6.1 - Poison or Poison Inhalation Hazard *if inhalation hazard, Zone A or B***Special Provisions:** IB8, IP3**Packaging:** Exceptions: 153 Non-bulk: 213 Bulk: 240**Quantity Limitations:** Passenger aircraft/rail: 100 kg Cargo aircraft only: 200 kg**Vessel Stowage:** Location: A Other:

Section 15 - Regulatory Information

EPA Regulations:**RCRA 40 CFR:** Not listed**CERCLA 40 CFR 302.4:** Listed per CWA Section 311(b)(4) 10 lb (4.535 kg)**SARA 40 CFR 372.65:** Listed as Compound**SARA EHS 40 CFR 355:** Not listed**TSCA:** Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Dibenz[a,h]anthracene

CAS Number: 53-70-3

Chemical Formula: C₂₂H₁₄

EINECS Number: 200-181-8

ACX Number: X1002922-0

Synonyms: 1,2:5,6-BENZANTHRACENE; DB(A,H)A; 1,2,5,6-DBA; DBA; 1,2,5,6-DIBENZANTHRACEEN; 1,2,5,6-DIBENZANTHRACENE; 1,2:5,6-DIBENZ(A)ANTHRACENE; 1,2:5,6-DIBENZANTHRACENE; DIBENZ[A,H]ANTHRACENE; 1,2:5,6-DIBENZOANTHRACENE; DIBENZO(A,H)ANTHRACENE

General Use: research chemical

Section 2 - Composition / Information on Ingredients

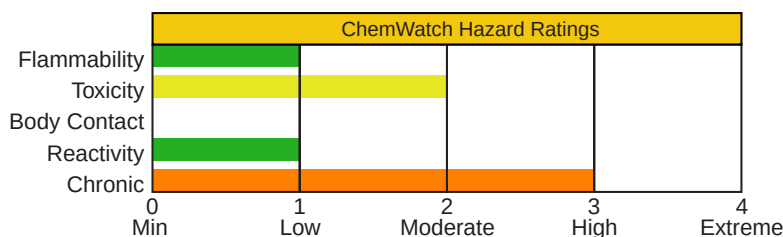
Name	CAS	%
dibenz[a,h]anthracene	53-70-3	>98

OSHA PEL

NIOSH REL

ACGIH TLV

Section 3 - Hazards Identification



ANSI Signal Word

Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless crystals, plates or leaflets. May cause irritation. Toxic. Chronic Effects: may cause heritable genetic damage; mutagen. Carcinogen. Will burn.

Potential Health Effects

Target Organs: respiratory system, liver

Primary Entry Routes: accidental skin and eye contact, inhalation of generated dusts

Acute Effects

Inhalation: The dust is harmful and discomforting to the upper respiratory tract. Persons with impaired respiratory function, airway diseases, or conditions such as emphysema or chronic bronchitis may incur further disability if excessive concentrations of particulate are inhaled.

Eye: The dust may be discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/ or other transient eye damage/ ulceration.

Skin: The material may be mildly discomforting to the skin. Open cuts and abraded or irritated skin should not be exposed to this material. Toxic effects may result from skin absorption.

Ingestion: The solid/dust is discomforting to the gastrointestinal tract and harmful if swallowed. Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Listed; IARC - Group 2A, Probably carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Not listed.

Chronic Effects: The so-called polycyclic aromatic hydrocarbons (PAHs) comprise a large family; some members occur in coal tar, tobacco smoke, petroleum and air pollution. Some substituted derivatives have been identified, in animal studies, as amongst the most highly active carcinogens. Rodent species are sensitive to some PAHs with skin

application producing cancerous growths. Injection produces soft tissue tumors (sarcomas) in rats and mice. Administration of PAHs to Rhesus monkey on the other hand has not yet proved successful in yielding tumors and there is inadequate data to support the proposition that individual PAHs produce cancer in humans. There are however a number of epidemiology and mortality studies that show increased incidence of cancer in humans exposed to mixtures of PAHs. Evidence exists of lung and genito-urinary cancer mortality amongst coke-oven workers and skin tumors in workers exposed to creosote. Exposures to other chemical mixtures containing PAHs such as cigarette smoke, coal tar, coal tar pitch and bitumens, have been associated with increased incidences of lung cancer in humans.

Section 4 - First Aid Measures

Inhalation: • If dust is inhaled, remove to fresh air.

- Encourage patient to blow nose to ensure clear breathing passages.
- Rinse mouth with water. Consider drinking water to remove dust from throat.
- Seek medical attention if irritation or discomfort persist.
- If fumes or combustion products are inhaled, remove to fresh air.
- Lay patient down. Keep warm and rested.
- Other measures are usually unnecessary.

Eye Contact: • Immediately hold the eyes open and flush with fresh running water.

- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Seek medical attention if pain persists or recurs.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: • Immediately remove all contaminated clothing, including footwear (after rinsing with water).

- Wash affected areas thoroughly with water (and soap if available).
- Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center. If more than 15 minutes from a hospital:

- INDUCE vomiting with IPECAC SYRUP, or fingers down the back of the throat, ONLY IF CONSCIOUS. Lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. NOTE: Wear a protective glove when inducing vomiting by mechanical means.
- SEEK MEDICAL ATTENTION WITHOUT DELAY.
- In the meantime, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient's condition.
- If the services of a medical officer or medical doctor are readily available, the patient should be placed in his/her care and a copy of the MSDS should be provided.
- If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of the MSDS.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: Not available; probably combustible

Extinguishing Media: Foam. Dry chemical powder. BCF (where regulations permit). Carbon dioxide. Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: • Solid which exhibits difficult combustion or is difficult to ignite.

- Avoid generating dust, particularly clouds of dust in a confined or unventilated space, as dust may form an explosive mixture with air and any source of ignition, e.g., flame or spark, will cause fire or explosion.
- Dry dust can also be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport.
- Build-up of electrostatic charge may be prevented by bonding and grounding.
- Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e., nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: • Contact fire department and tell them location and nature of hazard.

- Wear breathing apparatus plus protective gloves for fire only.
- Prevent, by any means available, spillage from entering drains or waterways.
- Use fire fighting procedures suitable for surrounding fire.
- Do not approach containers suspected to be hot.
- Cool fire-exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.
- Equipment should be thoroughly decontaminated after use.

See
DOT
ERG

Section 6 - Accidental Release Measures

Small Spills: • Clean up all spills immediately.

- Avoid contact with skin and eyes.
- Wear protective clothing, gloves, safety glasses and dust respirator.
- Use dry clean up procedures and avoid generating dust.
- Vacuum up or sweep up.
- Place in clean drum then flush area with water.

Large Spills: • Clear area of personnel and move upwind.

- Contact fire department and tell them location and nature of hazard.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or waterways.
- No smoking, bare lights or ignition sources.
- Increase ventilation.
- Stop leak if safe to do so.
- Water spray or fog may be used to disperse/absorb vapor.
- Contain or absorb spill with sand, earth or vermiculite.
- Collect recoverable product into labeled containers for recycling.
- Collect solid residues and seal in labeled drums for disposal.
- Wash area and prevent runoff into drains.
- After clean up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.
- If contamination of drains or waterways occurs, advise emergency services.

See
DOT
ERG

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: • Avoid all personal contact, including inhalation.

- Wear protective clothing when risk of overexposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.
- DO NOT enter confined spaces until atmosphere has been checked.
- Do not allow material to contact humans, exposed food or food utensils.
- Avoid smoking, bare lights or ignition sources.
- When handling, DO NOT eat, drink or smoke.
- Avoid contact with incompatible materials.
- Keep containers securely sealed when not in used.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Working clothes should be laundered separately. Launder contaminated clothing before reuse.
- Follow good occupational work practices.
- Observe manufacturer's storage/handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Recommended Storage Methods: Glass container. Plastic container. Metal can. Metal drum. Check that all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Local exhaust ventilation usually required. If risk of overexposure exists, wear NIOSH-approved respirator. Provide adequate ventilation in warehouse or closed storage area.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields or chemical goggles. Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Wear chemical protective gloves, e.g. PVC. Wear safety footwear.

Other: • Overalls.

- PVC Apron.
- PVC protective suit may be required if exposure severe.
- Eyewash unit.
- Ensure there is ready access to a safety shower.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Light-yellow crystalline powder. Soluble in petroleum ether, benzene, toluene, xylene, oils and cyclohexanane.

Physical State: colorless crystals, plates or leaflets

Vapor Pressure (kPa): 1×10^{-10} mm Hg

Formula Weight: 278.33

Specific Gravity (H₂O=1, at 4 °C): 1.282

Boiling Point: 524 °C (975 °F)

Freezing/Melting Point: 266 °C (510.8 °F)

Volatile Component (% Vol): Negligible

Water Solubility: 0.0005 mg/L in Water at 27 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid reaction with oxidizing agents.

Section 11 - Toxicological Information

No significant acute toxicological data identified in literature search.

NOTE: Substance has been shown to be mutagenic in various assays, or belongs to a family of chemicals producing damage or change to cellular DNA.

See RTECS HN2625000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Release to the environment is quite general since it is a ubiquitous product of incomplete combustion. It is largely associated with particulate matter, soils, and sediments. Its presence in places distant from primary sources indicates that it is reasonably stable in the atmosphere and capable of long distance transport. If it is released to soils it will be expected to adsorb very strongly to the soils and will not be expected to leach to the groundwater, hydrolyze or evaporate from soils or surfaces. It will be subject to biodegradation in soils with reported half-lives of 18 and 21 days. If it is released to water it will be expected to adsorb very strongly to sediments and particulate matter and to bioconcentrate in aquatic organisms which lack microsomal oxidase (this enzyme enables the rapid metabolism of certain polycyclic aromatic hydrocarbons). Based on limited data from laboratory screening tests using settled domestic wastewater and activated sludge, it may be subject to biodegradation in natural waters. Since it absorbs solar radiation strongly, it may be subject to direct photolysis in natural waters. However, adsorption may significantly retard photolysis as the photosensitivity of polyaromatic hydrocarbons is strongly dependent upon the nature of the surface upon which the compound is adsorbed. It will not hydrolyze and should not evaporate from water. If released to the atmosphere it will likely be associated with particulate matter and may be subject to moderately long range transport, depending mainly on the particle size distribution and climatic conditions which will determine the rates of wet and dry deposition. Its presence in areas remote from primary sources demonstrates the potential for this long range transport as well as its considerable stability in the air. It may be subject to direct photolysis in the atmosphere; however, adsorption may significantly retard photolysis as the photosensitivity of polyaromatic hydrocarbons is strongly dependent upon the nature of the surface upon which the compound is adsorbed. The estimated vapor phase half-life in the atmosphere is 1.00 day as a result of reaction with photochemically produced hydroxyl radicals.

Ecotoxicity: TL_m Neanthes arenaceodentata > 1 ppm/96 hr at 22 °C in a static bioassay

Henry's Law Constant: calculated at 7×10^{-8}

BCF: daphnia magna 652

Octanol/Water Partition Coefficient: log K_{ow} = 6.50

Soil Sorption Partition Coefficient: K_{oc} = sediments 8.05392×10^5 to 3.059425×10^6

Section 13 - Disposal Considerations

Disposal: • Recycle wherever possible or consult manufacturer for recycling options.

- Follow applicable local, state, and federal regulations.
- Bury residue in an authorized landfill.
- Recycle containers if possible, or dispose of in an authorized landfill.

Section 14 - Transport Information**DOT Hazardous Materials Table Data (49 CFR 172.101):**

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Toxic solids, organic, n.o.s.

ID: UN2811

Hazard Class: 6.1 - Poisonous materials

Packing Group: I - Great Danger

Symbols: G - Technical Name Required

Label Codes: 6.1 - Poison or Poison Inhalation Hazard *if inhalation hazard, Zone A or B*

Special Provisions: IB7

Packaging: Exceptions: None **Non-bulk:** 211 **Bulk:** 242

Quantity Limitations: Passenger aircraft/rail: 5 kg **Cargo aircraft only:** 50 kg

Vessel Stowage: Location: B **Other:**



Shipping Name and Description: Toxic solids, organic, n.o.s.

ID: UN2811

Hazard Class: 6.1 - Poisonous materials

Packing Group: II - Medium Danger

Symbols: G - Technical Name Required

Label Codes: 6.1 - Poison or Poison Inhalation Hazard *if inhalation hazard, Zone A or B*

Special Provisions: IB8, IP2, IP4

Packaging: Exceptions: None **Non-bulk:** 212 **Bulk:** 242

Quantity Limitations: Passenger aircraft/rail: 25 kg **Cargo aircraft only:** 100 kg

Vessel Stowage: Location: B **Other:**



Shipping Name and Description: Toxic solids, organic, n.o.s.

ID: UN2811

Hazard Class: 6.1 - Poisonous materials

Packing Group: III - Minor Danger

Symbols: G - Technical Name Required

Label Codes: 6.1 - Poison or Poison Inhalation Hazard *if inhalation hazard, Zone A or B*

Special Provisions: IB8, IP3

Packaging: Exceptions: 153 **Non-bulk:** 213 **Bulk:** 240

Quantity Limitations: Passenger aircraft/rail: 100 kg **Cargo aircraft only:** 200 kg

Vessel Stowage: Location: A **Other:**

**Section 15 - Regulatory Information****EPA Regulations:**

RCRA 40 CFR: Listed U063 Toxic Waste

CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a) 1 lb (0.454 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Dibenzofuran

CAS Number: 132-64-9

Chemical Formula: C₁₂H₈O

EINECS Number: 205-071-3

ACX Number: X1002923-7

Synonyms: (1,1'-BIPHENYL)-2,2'-DIYL OXIDE; 2,2'-BIPHENYLENE OXIDE; 2,2'-BIPHENYLYLENE OXIDE; DIBENZO(B,D)FURAN; DIBENZOFURAN; DIBENZOL(B,D)FURAN; DIPHENYLENE OXIDE

General Use: Intermediate. Heterocyclic aromatic hydrocarbon.

Section 2 - Composition / Information on Ingredients

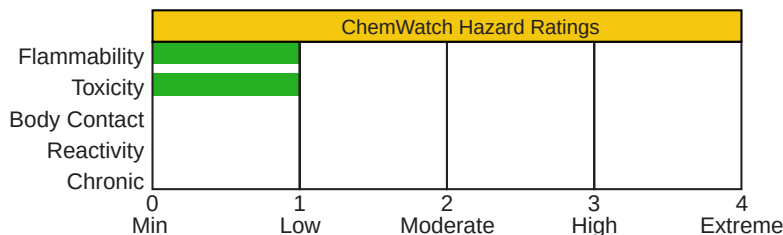
Name	CAS	%
dibenzofuran	132-64-9	>98

OSHA PEL

NIOSH REL

ACGIH TLV

Section 3 - Hazards Identification



☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

White, crystalline solid. May cause irritation. Also causes: may be harmful by inhalation, ingestion, or skin absorption. Will burn.

Potential Health Effects

Target Organs: No data found.

Primary Entry Routes: skin contact/absorption and inhalation of generated dust

Acute Effects

Inhalation: The dust may be discomforting to the upper respiratory tract.

Persons with impaired respiratory function, airway diseases, or conditions such as emphysema or chronic bronchitis may incur further disability if excessive concentrations of particulate are inhaled.

Eye: The material is moderately discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to windburn), temporary impairment of vision and/ or other transient eye damage/ ulceration.

Skin: The material may be mildly discomforting to the skin. Open cuts and abraded or irritated skin should not be exposed to this material. The material may accentuate any pre-existing skin condition.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments. The material is moderately discomforting to the gastrointestinal tract and may be harmful if swallowed in large quantity.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: The so-called polycyclic aromatic hydrocarbons (PAHs) comprise a large family; some members occur in coal tar, tobacco smoke, petroleum and air pollution. Some substituted derivatives have been identified, in animal studies, as amongst the most highly active carcinogens.

Administration of PAHs to Rhesus monkey on the other hand has not yet proved successful in yielding tumors and there is inadequate data to support the proposition that individual PAHs produce cancer in humans. There are however a number of epidemiology and mortality studies that show increased incidence of cancer in humans exposed to mixtures of PAHs. Evidence exists of lung and genito-urinary cancer mortality amongst coke-oven workers and skin tumors in

workers exposed to creosote. Exposures to other chemical mixtures containing PAHs such as cigarette smoke, coal tar, coal tar pitch and bitumens, have been associated with increased incidences of lung cancer in humans.

Section 4 - First Aid Measures

Inhalation: • If dust is inhaled, remove to fresh air.

- Encourage patient to blow nose to ensure clear breathing passages.
- Rinse mouth with water. Consider drinking water to remove dust from throat.
- Seek medical attention if irritation or discomfort persist.

Eye Contact: If this product comes in contact with the eyes:

- Immediately hold the eyes open and flush with fresh running water.
- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Seek medical attention if pain persists or recurs.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: If product comes in contact with the skin:

- Immediately remove all contaminated clothing, including footwear (after rinsing with water).
- Wash affected areas thoroughly with water (and soap if available).
- Seek medical attention in event of irritation.

Ingestion: Rinse mouth out with plenty of water. Seek medical attention if irritation or discomfort persist.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically.

Section 5 - Fire-Fighting Measures

Flash Point: 130 °C

Extinguishing Media: Foam. Dry chemical powder. BCF (where regulations permit). Carbon dioxide. Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: • Solid which exhibits difficult combustion or is difficult to ignite.

- Avoid generating dust, particularly clouds of dust in a confined or unventilated space, as dust may form an explosive mixture with air and any source of ignition, i.e., flame or spark, will cause fire or explosion. Dust clouds generated by the fine grinding of the solid are a particular hazard; accumulations of fine dust may burn rapidly and fiercely if ignited
- Dry dust can also be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport.
- Build-up of electrostatic charge may be prevented by bonding and grounding.
- Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting. Combustion products include carbon monoxide (CO).

Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.

Fire-Fighting Instructions: • Use water delivered as a fine spray to control fire and cool adjacent area.

- Do not approach containers suspected to be hot.
- Cool fire-exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.
- Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: • Clean up all spills immediately.

- Avoid contact with skin and eyes.
- Wear impervious gloves and safety glasses.
- Use dry clean up procedures and avoid generating dust.
- Vacuum up or sweep up.
- Place spilled material in clean, dry, sealable, labeled container.

Large Spills: • Clear area of personnel and move upwind.

- Contact fire department and tell them location and nature of hazard.
- Control personal contact by using protective equipment and dust respirator.
- Prevent spillage from entering drains, sewers or waterways.
- Avoid generating dust.
- Sweep, shovel up. Recover product wherever possible.
- Put residues in labeled plastic bags or other containers for disposal.
- If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: • Limit all unnecessary personal contact.

- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- When handling, do not eat, drink or smoke.
- Always wash hands with soap and water after handling.
- Avoid physical damage to containers.
- Observe manufacturer's storage and handling recommendations.

Recommended Storage Methods: Polyethylene or polypropylene container. Plastic carboy. Plastic drum. Polyliner drum. Packing as recommended by manufacturer. Check that all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: General exhaust is adequate under normal operating conditions. If risk of overexposure exists, wear NIOSH-approved respirator. Provide adequate ventilation in warehouse or closed storage areas.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses; safety glasses with side shields; chemical goggles. Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Wear general protective gloves, e.g. light weight rubber gloves.

Other: Overalls; impervious protective clothing.
Eyewash unit.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Tan powder.

Physical State: white, crystalline solid

Odor Threshold: 0.7752 to 1.6150 mg/m³

Vapor Pressure (kPa): negligible

Vapor Density (Air=1): 5.8

Formula Weight: 168.19

Specific Gravity (H₂O=1, at 4 °C): 1.0886 at 99 °C/4 °C

Evaporation Rate: not applicable

pH: not applicable

pH (1% Solution): not applicable

Boiling Point: 287 °C (549 °F) at 760 mm Hg

Freezing/Melting Point: 86 °C (186.8 °F) to 87 °C (188.6 °F)

Volatile Component (% Vol): negligible

Water Solubility: < 1 mg/mL at 20 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid reaction with oxidizing agents.

Section 11 - Toxicological Information

No significant acute toxicological data identified in literature search.

See RTECS HP4430000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to the atmosphere, it will exist primarily in the gas-phase where it will degrade relatively rapidly by reaction with photochemically produced hydroxyl radicals (estimated half-life of 11.3 hr in average air). A small percentage released to air will exist in the particulate phase which may be relatively persistent to atmospheric degradation. Physical removal from air can occur by both wet and dry deposition. If released to water, it may partition significantly from the water column to sediments and suspended material. Volatilization from the water column may be important; however, sorption to sediment may diminish the potential importance of volatilization. If released to soil, it is not expected to leach significantly in most soil types. Biological screening studies have shown that it is biodegraded readily by adapted microbes in the presence of sufficient oxygen. However, in various groundwaters or aquatic sediments where oxygen is limited or lacking, biodegradation may occur very slowly resulting in long periods of persistence.

Ecotoxicity: No data found.

Henry's Law Constant: estimated at 9.73×10^{-5}

BCF: fish 947

Octanol/Water Partition Coefficient: $\log K_{ow} = 4.12$

Soil Sorption Partition Coefficient: $K_{oc} = 4600$ to 6350

Section 13 - Disposal Considerations

- Disposal:**
- Consult manufacturer for recycling options and recycle where possible.
 - Follow applicable local, state, and federal regulations.
 - Incinerate residue at an approved site.
 - Recycle containers if possible, or dispose of in an authorized landfill.

Section 14 - Transport Information**DOT Hazardous Materials Table Data (49 CFR 172.101):**

Shipping Name and Description: No data found.

Section 15 - Regulatory Information**EPA Regulations:**

RCRA 40 CFR: Not listed

CERCLA 40 CFR 302.4: Listed per CAA Section 112 100 lb (45.35 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Diethyl Phthalate

CAS Number: 84-66-2

Chemical Formula: C₁₂H₁₄O₄

Structural Chemical Formula: C₆H₄(CO₂C₂H₅)₂

EINECS Number: 201-550-6

ACX Number: X1000987-3

Synonyms: ANOZOL; 1,2-BENZENEDICARBOXYLIC ACID DIETHYL ESTER; 1,2-BENZENEDICARBOXYLIC ACID, DIETHYL ESTER; O-BENZENEDICARBOXYLIC ACID DIETHYL ESTER; DEP; DIETHYL 1,2-BENZENEDICARBOXYLATE; DIETHYL ESTER OF PHTHALIC ACID; DIETHYL O-PHTHALATE; DIETHYL PHTHALATE; DIETHYLESTER KYSELINY FTALOVE; DIETHYL-O-PHTHALATE; DPX-F5384; ESTOL 1550; ETHYL PHTHALATE; NEANTINE; PALATINOL A; PHTHALIC ACID, DIETHYL ESTER; PHTHALOL; PHTHALSAEUREDIAETHYLESTER; PLACIDOL E; SOLVANOL; UNIMOLL DA

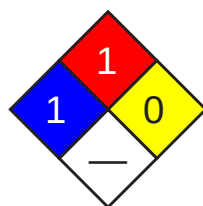
Derivation: By reacting phthalic anhydride with ethanol in the presence of concentrated sulfuric acid catalyst followed by careful purification.

General Use: As a solvent for nitrocellulose and cellulose acetate, a wetting agent, a plasticizer, an alcohol denaturant, a plasticizer in solid rocket propellants, a camphor substitute; in plastics, perfumery as a fixative and solvent, mosquito repellents, the manufacture of varnish, and insecticidal sprays.

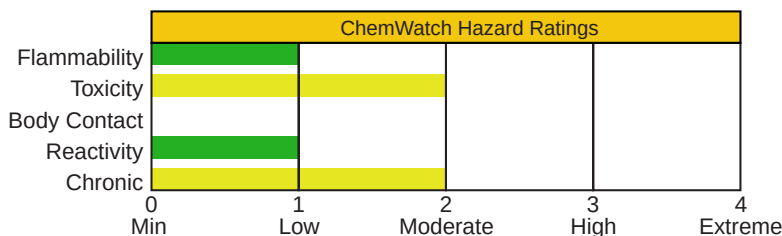
Section 2 - Composition / Information on Ingredients

Name	CAS	%
Diethyl Phthalate	84-66-2	99+% vol (technical grade)
OSHA PEL NIOSH REL TWA: 5 mg/m ³ .		
ACGIH TLV TWA: 5 mg/m ³ .		

Section 3 - Hazards Identification



Fire Diamond



HMIS	
1	Health
1	Flammability
0	Reactivity

ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless, oily liquid; slight aromatic odor. May be irritating to eyes/skin/respiratory tract. Other Acute Effects: high concentrations may be narcotic producing partial or near complete unconsciousness. Combustible.

Potential Health Effects

Target Organs: Eyes, skin, respiratory system, central nervous system, and liver and reproductive system (in animals).

Primary Entry Routes: Inhalation and skin and/or eye contact/absorption.

Acute Effects

Inhalation: Upon heating of diethyl phthalate, exposure may cause irritation of eyes (discharge of tears), nose, and throat, headache, dizziness, and narcosis (partial or near complete unconsciousness) at high concentrations.

Eye: May cause minimal ocular irritation as observed in animals.

Skin: May cause mild irritation as observed in animals. Diethyl phthalate is associated with allergic contact dermatitis in a limited number of polyvinyl chloride workers.

Ingestion: Burning irritation of the mucous membranes. Diethyl phthalate is of low toxicity.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: Mixtures of phthalate plasticizers have caused vestibular dysfunction [relating to the vestibule of the ear, affecting functioning of the semicircular canals (balance) and possibly the cochlea (hearing)] and polyneuritis (simultaneous inflammation of a large number of spinal nerves marked by pain, paralysis, and wasting of muscles), but diethyl phthalate has not been specifically implicated.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult a physician or ophthalmologist if irritation or pain develops and persists.

Skin Contact: Remove contaminated clothing. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water. If large amounts are ingested, consider inducing vomiting with syrup of Ipecac.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically and supportively.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: 322 °F (161 °C), Open Cup

Autoignition Temperature: 855 °F (457 °C)

LEL: 0.7% v/v at 368 °F (186 °C)

UEL: None reported.

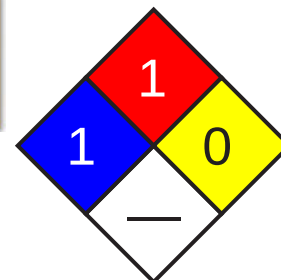
Flammability Classification: OSHA Class IIIB Combustible Liquid

Extinguishing Media: Use dry chemical, foam, or carbon dioxide. Water or foam may cause frothing.

General Fire Hazards/Hazardous Combustion Products: Carbon monoxide, carbon dioxide, and various hydrocarbons.

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

See
DOT
ERG



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, remove heat and ignition sources, and ventilate area. Cleanup personnel should protect against skin or eye contact and fume or mist inhalation.

Small Spills: Take up spilled diethyl phthalate with an inert, noncombustible material such as sand or vermiculite and place in appropriate containers for disposal.

Large Spills: For large spills, dike far ahead of liquid spill for later disposal. Do not release into sewers or waterways.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: Avoid inhalation of mist, vapors, or fume when heated. Avoid prolonged or repeated contact. Practice good personal hygiene procedures. Keep away from heat and ignition sources.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using diethyl phthalate, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in closed containers in a cool, dry, well-ventilated area away from heat and ignition sources and incompatibles (Sec. 10). Protect containers from physical damage.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all containers and equipment. Where feasible, enclose all processes to prevent the release of diethyl phthalate, especially if it is heated, into the workplace. Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Consider preplacement and periodic medical exams.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove diethyl phthalate from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless, oily; slight aromatic odor.

Physical State: Liquid

Vapor Pressure (kPa): 3.45×10^{-4} mm Hg at 68 °F (20 °C); 1.65×10^{-3} mm Hg at 77 °F (25 °C); 14 mm Hg at 325 °F (163 °C); 30 mm Hg at 360 °F (182 °C)

Bulk Density: 9.31 lb/gal at 68 °F (20 °C)

Formula Weight: 222.26

Density: 1.120 g/mL at 77 °F (25 °C)

Refractive Index: 1.5002 at 77 °F (25 °C)

Boiling Point: 568 °F (298 °C)

Freezing/Melting Point: -40.9 °F (-40.5 °C)

Viscosity: 31.3 centistokes at 32 °F (0 °C)

Surface Tension: 37.5 dyne/cm at 68 °F (20 °C)

Water Solubility: Insoluble

Other Solubilities: Completely soluble with alcohols, ketones, esters, aromatic hydrocarbons; partly soluble with aliphatic solvents and vegetable oils.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Diethyl phthalate is stable at room temperature in closed containers under normal storage and handling conditions. Diethyl phthalate is stable to light. Hazardous polymerization cannot occur. Avoid heat and ignition sources and incompatibles.

Storage Incompatibilities: Strong oxidizers, strong acids, nitric acid, permanganates, and water. Diethyl phthalate may attack some forms of plastics.

Hazardous Decomposition Products: Thermal oxidative decomposition of diethyl phthalate can produce carbon monoxide, carbon dioxide, and various hydrocarbons.

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral, LD₅₀: 8600 mg/kg produced toxic effects including general depressed activity, withdrawal, and weight loss or decreased weight gain.

Rabbit, oral, LD₅₀: 1 g/kg.

Acute Inhalation Effects:

Human, inhalation, TC_{Lo}: 1000 mg/m³; toxic effects include lacrimation, cough, and other changes of the lungs, thorax, or respiration.

Other Effects:

Rat, oral: 44240 mg/kg /14 days/continuous produced toxic effects including changes in liver weight, weight loss or decreased weight gain, and changes in testicular weight.

Rat, oral: 25 g/kg administered to females during the 6-15th day of pregnancy caused specific developmental abnormalities of the musculoskeletal system.

Tumorigenicity, mouse, skin: 101 g/kg administered to females during the 1-17th day of pregnancy caused fetotoxicity and specific developmental abnormalities of the musculoskeletal system.

See RTECS T11050000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Diethyl phthalate is expected to undergo aerobic biodegradation if released to soil. It is fairly mobile in soil. Chemical hydrolysis, oxidation, and volatilization from wet soil surfaces are not expected to be significant fate processes. It may volatilize from dry soil surfaces. If released to water, diethyl phthalate is expected to biodegrade (aerobic biodegradation half-life approximately two days to > two weeks). Removal by chemical hydrolysis, oxidation, direct photolysis, indirect photolysis, or bioaccumulation in aquatic organisms should not be significant. Volatilization should not be an important removal process in most bodies of water. If released to the atmosphere, diethyl phthalate is expected to exist in vapor form and as adsorbed matter on airborne particulates. It is expected to react with photochemically generated hydroxyl radicals (estimated half-life = 22.2 hours). Physical removal by particulate settling washout in precipitation will also occur.

Ecotoxicity: *Lepomis macrochirus* (bluegill), LC_{50} : 120 mg/L/24 hr; sheepshead minnows, LC_{50} : 30 ppm/96 hr (95% confidence limits 23-38 ppm); *Selenastrum capricornutum* (alga), EC_{50} : 90,300 µg/L/96 hr, toxic effect: chlorophyll a; 85,600 µg/L/96 hr, toxic effect: cell number.

Henry's Law Constant: 7.8×10^{-7} atm m³/mol

Octanol/Water Partition Coefficient: $\log K_{ow} = 2.47$

Section 13 - Disposal Considerations

Disposal: Consider atomizing into an incinerator. Mix with a more flammable solvent to improve combustion. Diethyl phthalate is a good candidate for liquid injection, rotary kiln, or fluidized bed incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Environmentally hazardous substances, liquid, n.o.s.

ID: UN3082

Hazard Class: 9 - Miscellaneous hazardous material

Packing Group: III - Minor Danger

Symbols: G - Technical Name Required

Label Codes: 9 - Class 9

Special Provisions: 8, 146, IB3, T4, TP1, TP29

Packaging: Exceptions: 155 **Non-bulk:** 203 **Bulk:** 241

Quantity Limitations: Passenger aircraft/rail: No limit **Cargo aircraft only:** No limit

Vessel Stowage: Location: A **Other:**



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U088 Toxic Waste

CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a) 1000 lb (453.5 kg)

SARA 40 CFR 372.65: Not listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Dibutyl Phthalate

CAS Number: 84-74-2

Chemical Formula: C₁₆H₂₂O₄

Structural Chemical Formula: C₆H₄(CO₂C₄H₉)₂

EINECS Number: 201-557-4

ACX Number: X1000920-8

Synonyms: AI-3-00283; 1,2-BENZENEDICARBOXYLIC ACID DIBUTYL ESTER; BENZENE-O-DICARBOXYLIC ACID DI-N-BUTYL ESTER; 1,2-BENZENEDICARBOXYLIC ACID, DIBUTYL ESTER; O-BENZENEDICARBOXYLIC ACID, DIBUTYL ESTER; BUTYL PHTHALATE; N-BUTYL PHTHALATE; N-BUTYL PHTHALATE; CELLUFLEX DPB; DBP; DBP (ESTER); DI BUTYL PHTHALATE; DIBUTYL 1,2-BENZENE-DICARBOXYLATE; DIBUTYL 1,2-BENZENEDICARBOXYLATE; DI-N-BUTYL PHTHALATE; DIBUTYL PHTHALATE; DI-N-BUTYLESTER KYSELINY FTALOVE; DIBUTYL-O-PHTHALATE; ELAOL; EPA PESTICIDE CHEMICAL CODE 028001; ERGOPLAST FDB; ERSOPLAST FDA; GENOPLAST B; HATCOL DBP; HEXAPLAS M/B; KODAFLEX DBP; PALATINOL C; PHTHALIC ACID DIBUTYL ESTER; PHTHALIC ACID, DIBUTYL ESTER; POLYCIZER DBP; PX 104; RC PLASTICIZER DBP; STAFLEX DBP; UNIFLEX DBP; UNIMOLL DB; WITCIZER 300

Derivation: Esterification of phthalic anhydride and butanol in the presence of sulfuric acid.

General Use: Used as an insect repellent for the impregnation of clothing; plasticizer in nitrocellulose lacquers, elastomers, explosives, and nail polish; as a solvent for perfumes, oils, textiles, lubricating agent, safety glass, and other chemicals.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Dibutyl phthalate	84-74-2	ca 100% vol

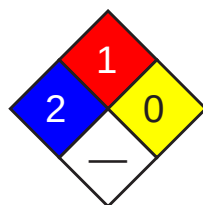
OSHA PEL
TWA: 5 mg/m³.

NIOSH REL
TWA: 5 mg/m³.

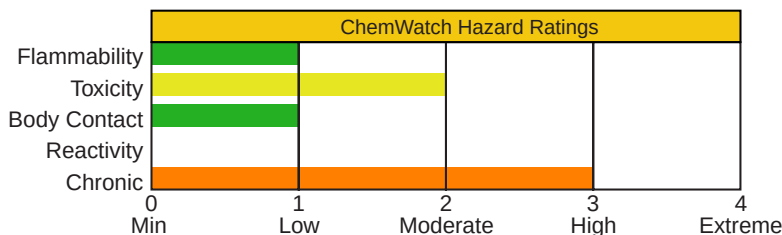
ACGIH TLV
TWA: 5 mg/m³.

IDLH Level
4000 mg/m³.

Section 3 - Hazards Identification



Fire Diamond



HMIS	
①	Health
①	Flammability
①	Reactivity

ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Oily, colorless to faint-yellow liquid; mild, ester odor. Irritating to skin. Other Acute Effects: possible allergic dermatitis, systemic toxicity can lead to conjunctivitis/kidney toxicity. Combustible.

Potential Health Effects

Target Organs: Skin, eyes, respiratory tract, kidneys.

Primary Entry Routes: Skin and eye contact, ingestion, inhalation.

Acute Effects

Inhalation: Because dibutyl phthalate has a low vapor pressure, it does not present a significant inhalation hazard unless heated or misted. Some respiratory tract irritation may occur.

Eye: Direct contact may cause irritation. Systemic toxicity can cause photophobia, lacrimation (watering), conjunctivitis, and swelling of the eyelids.

Skin: Irritation and contact burns are possible, but do not occur frequently. Allergic dermatitis has been reported after using antiperspirants and contact with plastics containing dibutyl phthalate (such as a watchband).

Ingestion: Accidental ingestion of 10 g (~40 mg/kg) in one person produced nausea and vomiting, dizziness, photophobia, swelling of the eyelids, watering of the eyes and conjunctivitis, and kidney toxicity (characterized by the presence of red and white blood cells and oxalate crystals in the urine).

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: Workers in the artificial leather industry were studied and it was found that exposure to 1.7 to 66 mg/m³ over a period of 19 years showed central nervous system toxicity after 6 to 7 years. Symptoms included pain, numbness, weakness, and spasms in the upper and lower extremities. Because there was concurrent exposure to other phthalates and a few adipates and sebacates, dibutyl phthalate cannot be singled out as the direct cause.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult a physician or ophthalmologist if pain or irritation persist.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: If respiratory tract irritation is present, monitor pulmonary function tests and perform a chest x-ray. Support respiratory and cardiovascular function.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: 315 °F (157.22 °C) CC; 354 °F (179 °C) OC

Autoignition Temperature: 757 °F (402 °C)

LEL: 0.5% v/v at 456 °F (235 °C)

UEL: 2.5% v/v

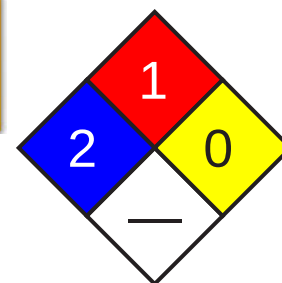
Flammability Classification: Class IIIB Combustible Liquid

Extinguishing Media: Use dry chemical or carbon dioxide. Water spray and foam may cause frothing.

General Fire Hazards/Hazardous Combustion Products: Carbon oxide(s). Container may explode in heat of fire.

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

See
DOT
ERG



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off all ignition sources. Cleanup personnel should protect against inhalation and skin/eye contact.

Small Spills: Take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable containers.

Large Spills: Dike far ahead of spill for later disposal. *Do not* release into sewers or waterways. Damp mop any residue.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: Use only with adequate ventilation and appropriate PPE.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using dibutyl phthalate, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in a cool, dry, well-ventilated area away from heat, ignition sources, and incompatibles (Sec. 10).

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all equipment used with and around dibutyl phthalate. Provide general or local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on the skin and kidneys.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Polyvinyl alcohol, fluorocarbon rubber, butyl rubber, and nitrile rubber are suitable materials for PPE with breakthrough times (BT) of > 8 hr. *Do not* use neoprene (BT = 1 to 4 hr), polyvinyl chloride, or natural rubber (BT < 1 hr). Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For $\leq 50 \text{ mg/m}^3$, use any dust and mist respirator with a full facepiece. For $\leq 125 \text{ mg/m}^3$, use any supplied-air respirator operated in continuous flow mode or any powered, air-purifying respirator with a dust and mist filter. For $\leq 250 \text{ mg/m}^3$, use any air-purifying full facepiece respirator with a high-efficiency particulate filter, any SCBA with a full facepiece, or any supplied-air respirator with a full facepiece. For $\leq 4000 \text{ mg/m}^3$, use any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive-pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove dibutyl phthalate from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Oily, colorless to faint yellow; mild ester odor; strong bitter taste.

Physical State: Liquid

Vapor Pressure (kPa): 1.1 mm Hg at 302 °F (150 °C);
< 0.1 mm Hg at 68 °F (20 °C)

Bulk Density: 8.72 lb/gal at 68 °F (20 °C)

Formula Weight: 278.34

Specific Gravity (H₂O=1, at 4 °C): 1.0459 at 68 °F (20 °C)

Refractive Index: 1.4911 at 68 °F (20 °C)

Boiling Point: 644 °F (340 °C)

Freezing/Melting Point: -31 °F (-35 °C)

Viscosity: 0.203 poise at 68 °F (20 °C)

Surface Tension: 34 dyne/cm at 68 °F (20 °C)

Critical Temperature: 932 °F (500 °C)

Critical Pressure: 17 atm

Water Solubility: 13 mg/L at 77 °F (25 °C)

Other Solubilities: Soluble in alcohol, acetone, ether, and benzene.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Dibutyl phthalate is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization does not occur. Exposure to heat, ignition sources, and incompatibles.

Storage Incompatibilities: Oxidizers, nitrates, acids, alkalis, and liquid chlorine (explosive reaction).

Hazardous Decomposition Products: Thermal oxidative decomposition of dibutyl phthalate can produce carbon oxides.

Section 11 - Toxicological Information

Acute Oral Effects:

Human, oral, TD_{Lo} : 140 mg/kg caused hallucinations, distorted perceptions, nausea and vomiting, and kidney and bladder changes.

Acute Inhalation Effects:

Rat, inhalation, LC_{50} : 4250 mg/m³.

Acute Skin Effects:

Rat, skin, LD_{Lo} : 6 g/kg.

Other Effects:

Rat, oral: 22.75 mg/kg administered continuously for 1 yr. affected food intake and caused death.

Rat, oral: 28 g/kg administered intermittently for 14 days caused changes in testicular weight and death.

Rat, oral: 8400 mg/kg (male, 7 days prior to mating) affected the testes, epididymis, and sperm duct.

S. typhimurium: 100 µg/plate (+ S9) caused mutation.

See RTECS TI0875000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, dibutyl phthalate will adsorb moderately and slowly biodegrade (66 to 98% degradation in 26 weeks). Some leaching to groundwater can occur. In water, it is expected to adsorb to particulates and sediment (especially those high in fulvic acids). Volatilization is not rapid but can occur with a half-life of 47 days from a river 1 m deep, flowing 1 m/sec. with a wind speed of 3 m/sec. Hydrolysis does not normally occur except in oligotrophic, alkaline waters (half-life = 76 days at pH 9). In air, the majority of dibutyl phthalate remains in the particulate phase and is subject to gravitational settling. The small amount that exists in the vapor phase will react with photochemically-produced hydroxyl radicals with an estimated half-life of 18 hr.

Ecotoxicity: Bluegill, TL_m : 1234 ppm/24 hr; *Gymnodinium breve* (algae), LC_{50} = 200 µg/L/96 hr

Henry's Law Constant: 1.09×10^{-6} atm/m³/mole

Octanol/Water Partition Coefficient: $\log K_{ow}$ = 4.9

Section 13 - Disposal Considerations

Disposal: Dibutyl phthalate is a good candidate for liquid injection incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Environmentally hazardous substances, liquid, n.o.s.

ID: UN3082

Hazard Class: 9 - Miscellaneous hazardous material

Packing Group: III - Minor Danger

Symbols: G - Technical Name Required

Label Codes: 9 - Class 9

Special Provisions: 8, 146, IB3, T4, TP1, TP29

Packaging: Exceptions: 155 **Non-bulk:** 203 **Bulk:** 241

Quantity Limitations: **Passenger aircraft/rail:** No limit **Cargo aircraft only:** No limit

Vessel Stowage: **Location:** A **Other:**



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U069 Toxic Waste

CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a) 10 lb (4.535 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: di-n-Octyl Phthalate

CAS Number: 117-84-0

Chemical Formula: C₂₄H₃₈O₄

Structural Chemical Formula: o-C₆H₄[COOCH₂CH(C₂H₅)(CH₂)₃CH₃]₂

EINECS Number: 204-214-7

ACX Number: X1002916-2

Synonyms: 1,2-BENZENEDICARBOXYLIC ACID DIOCTYL ESTER; 1,2-BENZENEDICARBOXYLIC ACID, DIOCTYL ESTER; BENZENEDICARBOXYLIC ACID DI-N-OCTYL ESTER; BENZENEDICARBOXYLIC ACID,DI-N-OCTYL ESTER; O-BENZENEDICARBOXYLIC ACID,DIOCTYL ESTER; CELLUFLEX DOP; DINOPOL NOP; DIOCTYL 1,2-BENZENEDICARBOXYLATE; DIOCTYL O-BENZENEDICARBOXYLATE; DI-N-OCTYL PHTHALATE; DIOCTYL PHTHALATE; N-DIOCTYL PHTHALATE; DIOKTYLESTER KYSELINY FTALOVE; DNOP; N-OCTYL PHTHALATE; OCTYL PHTHALATE; PHTHALIC ACID DIOCTYL ESTER; PHTHALIC ACID,DIOCTYL ESTER; POLYCIZER 162; PX-138; VINICIZER 85

General Use: Used as a plasticizer for resins, elastomers, vinyl products, films for packaging, containers and electrical cables. High purity grades used as electrical insulating (dielectric) fluid.

Section 2 - Composition / Information on Ingredients

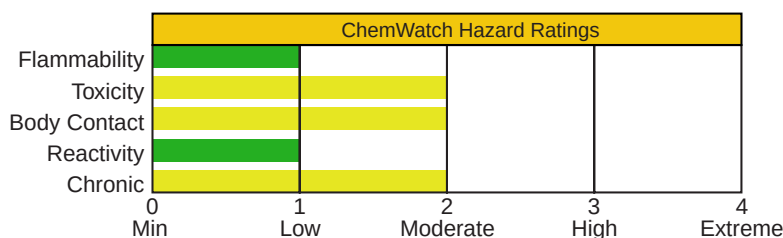
Name	CAS	%
di-n-octyl phthalate	117-84-0	>99

OSHA PEL

NIOSH REL

ACGIH TLV

Section 3 - Hazards Identification



ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Liquid; slight odor. May be irritating. Also causes: coughing, sneezing, dermatitis, dizziness, headache, nausea. Will burn.

Potential Health Effects

Target Organs: Skin, eyes, respiratory tract, central nervous system (CNS)

Primary Entry Routes: accidental skin and eye contact and by inhalation of vapors especially at higher temperatures

Acute Effects

Inhalation: Not normally a hazard due to nonvolatile nature of product. Inhalation hazard is increased at higher temperatures.

The mist is discomforting to the upper respiratory tract.

Inhalation of concentrated mists can cause coughing, sneezing, severe irritation, dizziness, headache and nausea.

Eye: The liquid may produce eye discomfort and is capable of causing temporary impairment of vision and / or transient eye inflammation, ulceration. The mist is moderately discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid is mildly discomforting to the skin if exposure is prolonged and may cause drying of the skin, which may lead to dermatitis.

Irritation and skin reactions are possible with sensitive skin.

The material may accentuate any pre-existing dermatitis condition.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness and swelling, which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer and intracellular edema of the epidermis.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments. The liquid is discomforting and is regarded as harmful if swallowed.

Ingestion may result in nausea, abdominal irritation, pain and vomiting.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: Causes cancer in animals.

Di-sec-octyl phthalate can cause testicular damage in rats (dietary and gavage studies) with a no-effect level of 0.3% to 0.5% in the diet. Inhalation or dermal exposures did not produce testicular effects. When the substance was fed to pregnant rats (5 mL/kg) it produced slight effects on embryonic and fetal development with skeletal abnormalities more common.

A Russian study describes exposure by workers to mixed phthalates (and other plasticizers) - pain, numbness and spasms in the upper and lower extremities were related to duration of exposures. Symptoms usually developed after the sixth or seventh year of work. Neurological studies revealed the development of polyneuritis in about 30% of the workers involved in this study. Because the study described mixed exposures it is difficult to determine what, if any, unique role was played by the phthalates. Increased incidences of anovulatory reproductive cycles and low estrogen concentrations were reported among Russian women working with phthalate plasticizers; the abnormal cycles were associated with spontaneous abortion.

It has been alleged that the phthalates mimic or interfere with sex hormones. Phthalates are added as plasticizers in plastics (including food packaging) and are used as ingredients in paints, inks and adhesives. Their potential for entering the human body is marked. They have been added to a list of chemicals that are implicated in reducing sperm counts and fertility in males.

Although the human fetus is "bathed" in naturally occurring estrogens during pregnancy it is suggested that it has developed a protective mechanism against natural estrogens but is not safe from synthetic variants. These tend to accumulate in body fats which sets them apart from the natural product. During early pregnancy, fats are broken down and may flood the body with concentrated pollutants.

Section 4 - First Aid Measures

Inhalation: • If fumes or combustion products are inhaled, remove to fresh air.

- Lay patient down. Keep warm and rested.
- Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- If breathing is shallow or has stopped, ensure clear airway and apply resuscitation, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital or doctor.

Eye Contact: • Immediately hold eyes open and flush continuously with running water for at least 15 minutes.

- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Seek medical attention without delay.

Skin Contact: If product comes in contact with the skin:

- Immediately remove all contaminated clothing, including footwear (after rinsing with water).
- Wash affected areas thoroughly with water (and soap if available).
- Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center. If swallowed, and if more than 15 minutes from a hospital:

- Induce vomiting with Ipecac syrup, or fingers down the back of the throat, only if conscious. Lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. Note: Wear a protective glove when inducing vomiting by mechanical means.
- Seek medical attention without delay.
- In the meantime, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient's condition.
- If the services of a medical officer or medical doctor are readily available, the patient should be placed in his/her care and a copy of the MSDS should be provided. Further action will be the responsibility of the medical specialist.
- If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of the MSDS.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically.

Section 5 - Fire-Fighting Measures

Flash Point: 218 °C Open Cup

Autoignition Temperature: 385 °C

LEL: 0.3% v/v

UEL: 4.0% v/v

Extinguishing Media: Water spray or fog. Foam. Dry chemical powder. BCF (where regulations permit). Carbon dioxide.

General Fire Hazards/Hazardous Combustion Products: • Combustible.

- Slight fire hazard when exposed to heat or flame.
- Heating may cause expansion or decomposition leading to violent rupture of containers.
- On combustion, may emit toxic fumes of carbon monoxide (CO).
- May emit acrid smoke.
- Mists containing combustible materials may be explosive.
- Hot organic vapors or mist are capable of sudden spontaneous combustion when mixed with air even at temperatures below their published autoignition temperatures.
- The temperature of ignition decreases with increasing vapor volume and vapor/air contact times and is influenced by pressure change.
- Ignition may occur under elevated-temperature process conditions especially in processes performed under vacuum subjected to sudden ingress of air or in processes performed at elevated pressure, where sudden escape of vapors or mists to the atmosphere occurs.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e., nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: • Contact fire department and tell them location and nature of hazard.

- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or waterways.
- If safe, switch off electrical equipment until vapor fire hazard removed.
- Use water delivered as a fine spray to control fire and cool adjacent area.
- Avoid spraying water onto liquid pools.
- Do not approach containers suspected to be hot.
- Cool fire-exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: • Remove all ignition sources.

- Clean up all spills immediately.
- Avoid breathing vapors and contact with skin and eyes.
- Control personal contact by using protective equipment.
- Contain and absorb spill with sand, earth, inert material or vermiculite.
- Wipe up.
- Place in a suitable labeled container for waste disposal.

Large Spills: Contact fire department and tell them location and nature of hazard. Clear area of personnel and move upwind. Shut off all possible sources of ignition and increase ventilation. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Stop leak if safe to do so. Absorb or cover spill with sand, earth, inert material or vermiculite. Recover liquid and place in labeled, sealable container for recycling. Collect residues and seal in labeled drums for disposal. Wash spill area with detergent and water. If contamination of drains or waterways occurs, advise emergency services. After clean up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained. Use in a well-ventilated area. Avoid generating and breathing mist, and vapor. Avoid contact with incompatible materials. Avoid prolonged and repeated skin contact. Avoid smoking, bare lights or ignition sources. Avoid physical damage to containers. Keep containers securely sealed when not in use. Wear personal protective equipment when handling. When handling, do not eat, drink or smoke. Always wash hands with soap and water after handling. Work clothes should be laundered separately.

Recommended Storage Methods: Metal can. Metal drum. Packing as recommended by manufacturer. Check that all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: None under normal operating conditions. Otherwise: general exhaust is adequate under normal operating conditions. If inhalation risk of overexposure exists, wear NIOSH-approved organic-vapor respirator. If mist is present, use air supplied breathing apparatus.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields or, as required, chemical goggles. Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Barrier cream and nitrile rubber gloves or neoprene rubber gloves. Safety footwear.

Other: Overalls.

Eyewash unit.

Glove Selection Index:

NATURAL RUBBER..... Best selection

NATURAL+NEOPRENE..... Best selection

NEOPRENE/NATURAL..... Best selection

NITRILE Best selection

NEOPRENE..... Best selection

PVA Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Light-colored, almost odorless, oily liquid.

Physical State: liquid

pH: not applicable

Vapor Pressure (kPa): < 0.2 mm Hg at 150 °C

pH (1% Solution): not applicable

Vapor Density (Air=1): 13.48

Boiling Point: 220 °C (428 °F) at 4 torr

Formula Weight: 390.56

Freezing/Melting Point: -25 °C (-13 °F)

Specific Gravity (H₂O=1, at 4 °C): 0.978 at 25 °C

Volatile Component (% Vol): none at 38 °C

Evaporation Rate: very slow

Water Solubility: 3 mg/L in water at 25 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Hazardous polymerization will not occur. Stable under normal storage conditions.

Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Toxicity

Oral (rat) LD₅₀: 47000 mg/kg

Intraperitoneal (rat) LD₅₀: >50ml/kg

Oral (mouse) LD₅₀: 6513 mg/kg

Intraperitoneal (mouse) LD₅₀: 65000 mg/kg

Dermal (guinea pig) LD₅₀: >5000 mg/kg

Irritation

Skin (rabbit): 500 mg/24 hr - mild

Eye (rabbit): 20 mg - SEVERE

Eye (rabbit): 500 mg/24 hr - mild

See RTECS T11925000, for additional data.

Section 12 - Ecological Information

Environmental Fate: It will adsorb strongly to sediment and particulate matter and slowly biodegrade with acclimation. The half-life for removal from the aqueous phase was reported to be 5 days in an ecosystem study. It bioconcentrates in algae and other aquatic organisms. The data for fish are contradictory but bioconcentration is probably important in species where little or no metabolism occurs. If emitted into the atmosphere as an aerosol it will be subject to gravitational settling and photodegradation by hydroxy radicals (estimated half-life 14 hr.).

Ecotoxicity: LC₅₀Lepomis microlopus (Redear sunfish) 6.180 ug/l/7-8 days. /Conditions of bioassay not specified; LC₅₀Ictalurus punctatus (Channel catfish) 690 ug/l/7 days. /Conditions of bioassay not specified

Henry's Law Constant: 2.2 x10⁻⁴

BCF: non accumulative in carp

Octanol/Water Partition Coefficient: log K_{ow} = 5.22

Soil Sorption Partition Coefficient: K_{oc} = estimated at 1.9 x10⁴

Section 13 - Disposal Considerations

- Disposal:** • Consult manufacturer for recycling options and recycle where possible.
- Follow applicable local, state, and federal regulations.
 - Incinerate residue at an approved site.
 - Recycle containers if possible, or dispose of in an authorized landfill.

Section 14 - Transport Information**DOT Hazardous Materials Table Data (49 CFR 172.101):**

Shipping Name and Description: No data found.

Section 15 - Regulatory Information**EPA Regulations:**

RCRA 40 CFR: Listed U107 Toxic Waste

CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a) 5000 lb (2268 kg)

SARA 40 CFR 372.65: Not listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: di-sec-Octyl Phthalate

CAS Number: 117-81-7

Chemical Formula: $C_{24}H_{38}O_4$

Structural Chemical Formula: $C_6H_4[COOCH_2CH(C_2H_5)(CH_2)_3]_2$

EINECS Number: 204-211-0

ACX Number: X1003752-2

Synonyms: BEHP; 1,2-BENZENEDICARBOXYLIC ACID,BIS(2-ETHYLHEXYL) ESTER; 1,2-BENZENEDICARBOXYLIC ACID,BIS(ETHYLHEXYL) ESTER; BIS(2-ETHYLHEXYL) 1,2-BENZENEDICARBOXYLATE; BIS(2-ETHYLHEXYL)-1,2-BENZENEDICARBOXYLATE; BIS-(2-ETHYLHEXYL)-1,2-BENZENEDICARBOXYLATE; BIS-(2-ETHYLHEXYL)ESTER KYSELINY FTALOVE; BIS(2-ETHYLHEXYL)ESTER PHTHALIC ACID; BIS(2-ETHYLHEXYL)PHTHALATE; BIS-(2-ETHYLHEXYL)PHTHALATE; BISOFLEX 81; BISOFLEX DOP; COMPOUND 889; DAF 68; DEHP; DI(2-ETHYLHEXYL) PHTHALATE; DI(ETHYLHEXYL) PHTHALATE; DIETHYLHEXYL PHTHALATE; DI(2-ETHYLHEXYL)ORTHOPHTHALATE; DI(2-ETHYLHEXYL)PHTHALATE; DI-2-ETHYLHEXYLPHTHALATE; DI-SEC-OCTYL PHTHALATE; DIOCTYL PHTHALATE; DOF; DOP; ERGOPLAST FDO; ERGOPLAST FDO-S; 2-ETHYLHEXYL PHTHALATE; ETHYLHEXYL PHTHALATE; EVIPLAST 80; EVIPLAST 81; FLEXIMEL; FLEXOL DOP; FLEXOL PLASTICIZER DOP; GOOD-RITE GP 264; HATCOL DOP; HERCOFLEX 260; JAYFLEX DOP; KODAFLEX DOP; MOLLAN O; NUOPLAZ DOP; OCTOIL; OCTYL PHTHALATE; PALATINOL AH; PHTHALIC ACID DIOCTYL ESTER; PHTHALIC ACID,BIS(2-ETHYLHEXYL) ESTER; PITTSBURGH PX-138; PLATINOL AH; PLATINOL DOP; RC PLASTICIZER DOP; REOMOL D 79P; REOMOL DOP; SICOL 150; STAFLEX DOP; TRUFLEX DOP; VESTINOL AH; VINICIZER 80; WITCIZER 312

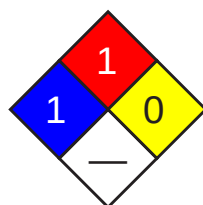
General Use: Used as a plasticizer for resins, elastomers, vinyl products, films for packaging, containers and electrical cables.

High purity grades used as electrical insulating (dielectric) fluid.

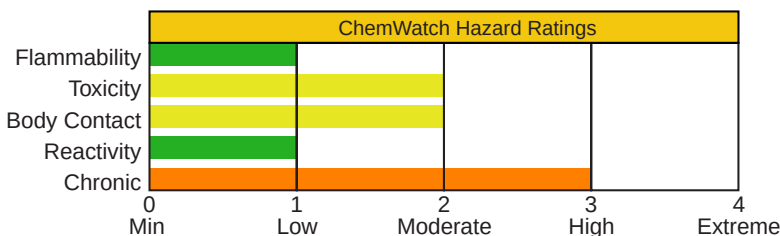
Section 2 - Composition / Information on Ingredients

Name	CAS	%
di-sec-octyl phthalate	117-81-7	>99
OSHA PEL TWA: 5 mg/m ³ .	NIOSH REL TWA: 5 mg/m ³ ; STEL: 10 mg/m ³ .	DFG (Germany) MAK TWA: 10 mg/m ³ ; PEAK: 80 mg/m ³ .
ACGIH TLV TWA: 5 mg/m ³ .	IDLH Level 5000 mg/m ³ .	

Section 3 - Hazards Identification



Fire Diamond



HMIS	
0	Health
1	Flammability
0	Reactivity

ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Light colored liquid; slight odor. Mildly irritating to eyes/skin/respiratory tract. Also causes: conjunctivitis, keratitis, bronchial irritation, eczema, staggering, abdominal cramps, nausea, diarrhea, CNS depression. Possible cancer hazard.

Potential Health Effects

Target Organs: eyes, upper respiratory system, skin, central nervous system (CNS)

Primary Entry Routes: inhalation, ingestion

Acute Effects

Inhalation: Not normally a hazard due to nonvolatile nature of product. Inhalation hazard is increased at higher temperatures.

The mist is discomforting to the upper respiratory tract.

Inhalation of concentrated mists can cause coughing, sneezing, severe irritation, dizziness, headache and nausea.

Eye: The liquid may produce eye discomfort and is capable of causing temporary impairment of vision and/or transient eye inflammation, ulceration. The mist is moderately discomforting to the eyes.

The material may be irritating to the eye, with prolonged contact causing inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid is mildly discomforting to the skin if exposure is prolonged and may cause drying of the skin, which may lead to dermatitis.

Irritation and skin reactions are possible with sensitive skin.

The material may accentuate any pre-existing dermatitis condition.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid is discomforting and is regarded as harmful if swallowed.

Ingestion may result in nausea, abdominal irritation, pain and vomiting.

Phthalates (aromatic dicarboxylic acid esters), in general, exhibit low toxicity, partly because of poor absorption but mainly as a result of rapid metabolism in which the esters are saponified to phthalic acid (which is rapidly excreted) and the parent alcohol (which is subsequently metabolized). The pathology of these compounds seems to be related to the released alcohol and its biological effects. Testicular atrophy produced in rats during feeding studies depends on the length and structure of the alcohol; in general the lower molecular weight esters produce the more severe effects. The toxicity of phthalic acid isomers decreases in the order o-phthalic acid, isophthalic acid and terephthalic acid.

Phthalic acid is not metabolized but is excreted, unchanged, in the urine and feces.

Terephthalic acid appears to potentiate the biological effects of substances such as antibiotics, thiamine and sulfonamides.

Carcinogenicity: NTP - Class 2B, Reasonably anticipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A3, Animal carcinogen; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Not listed.

Chronic Effects: Oral studies of 90-days to 2-years in rat, 1-year in guinea pig and up to 1-year in dog have shown a no-effect level of about 60 mg/kg/day. Higher doses produced growth retardation and increased weights of livers and kidneys.

Rats and mice fed on diets containing 6000-12000 (rats) and 3000-6000 (mice) mg/kg body weight for 103 weeks showed an increased incidence of hepatocellular carcinomas in female rats and male and female mice, and an increased incidence of either hepatocellular carcinomas or neoplastic nodules in male rats. About 35% of the hepatocellular carcinomas in mice had metastasised to the lungs.

The substance can cause testicular damage in rats (dietary and gavage studies) with a no-effect level in 0.3% to 0.5% in the diet. Inhalation or dermal exposures did not produce testicular effects. When the substance was fed to pregnant rats (5 mL/kg) it produced slight effects on embryonic and fetal development with skeletal abnormalities more common.

A Russian study describes exposure by workers to mixed phthalates (and other plasticizers) - pain, numbness and spasms in the upper and lower extremities were related to duration of exposures. Symptoms usually developed after the sixth or seventh year of work. Neurological studies revealed the development of polyneuritis in about 30% of the workers involved in this study. About 30% of the workforce showed depression of the vestibular receptors. Because the study described mixed exposures it is difficult to determine what, if any, unique role was played by the phthalates. Increased incidences of anovulatory reproductive cycles and low estrogen concentrations were reported among Russian women working with phthalate plasticizers; the abnormal cycles were associated with spontaneous abortion. The specific phthalates implicated, dose levels and other data were not reported.

It has been alleged that the phthalates mimic or interfere with sex hormones. Phthalates are added as plasticizers in plastics (including food packaging) and are used as ingredients in paints, inks and adhesives. Their potential for entering the human body is marked. They have been added to a list of chemicals (including alkyl phenolics, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and dioxins) which are implicated in reducing sperm counts and fertility in males a phenomenon which has apparently arisen since the mid 1960s.

Although the human fetus is "bathed" in naturally occurring estrogens during pregnancy it is suggested that it has developed a protective mechanism against natural estrogens but is not safe from synthetic variants. These tend to

accumulate in body fats which sets them apart from the natural product. During early pregnancy, fats are broken down and may flood the body with concentrated pollutants.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold eyes open and flush continuously with running water for at least 15 minutes. Ensure irrigation under eyelids.

Seek medical attention without delay.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

If more than 15 minutes from a hospital, induce vomiting, preferably using Ipecac Syrup APF.

Note: DO NOT INDUCE VOMITING in an unconscious person.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically.

Section 5 - Fire-Fighting Measures

Flash Point: 215 °C Open Cup

Autoignition Temperature: 391 °C

LEL: 0.3% v/v

Extinguishing Media: Water spray or fog; foam, dry chemical powder, or BCF (where regulations permit).

Carbon dioxide.

General Fire Hazards/Hazardous Combustion Products: Combustible. Slight fire hazard when exposed to heat or flame.

Heating may cause expansion or decomposition leading to violent rupture of containers.

On combustion, may emit toxic fumes of carbon monoxide (CO).

May emit acrid smoke.

Mists containing combustible materials may be explosive.

Hot organic vapors or mist are capable of sudden spontaneous combustion when mixed with air even at temperatures below their published autoignition temperatures. The temperature of ignition decreases with increasing vapor volume and vapor/air contact times and is influenced by pressure change.

Ignition may occur under elevated-temperature process conditions especially in processes performed under vacuum subjected to sudden ingress of air or in processes performed at elevated pressure, where sudden escape of vapors or mists to the atmosphere occurs.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

If safe, switch off electrical equipment until vapor fire hazard removed.

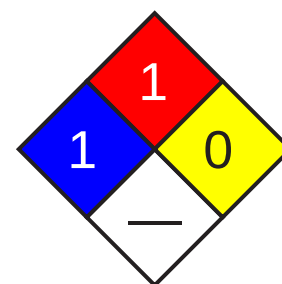
Use water delivered as a fine spray to control fire and cool adjacent area.

Avoid spraying water onto liquid pools.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protected location.

If safe to do so, remove containers from path of fire.



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.

Avoid breathing vapors and contact with skin and eyes.

Control personal contact by using protective equipment.

Contain and absorb spill with sand, earth, inert material or vermiculite.

Wipe up. Place in a suitable labeled container for waste disposal.

Large Spills: Contact fire department and tell them location and nature of hazard.

Clear area of personnel and move upwind.

Shut off all possible sources of ignition and increase ventilation.

Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

Stop leak if safe to do so.

Absorb or cover spill with sand, earth, inert material or vermiculite.
 Recover liquid and place in labeled, sealable container for recycling.
 Collect residues and seal in labeled drums for disposal.
 Wash spill area with detergent and water.
 If contamination of drains or waterways occurs, advise emergency services.
 After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Use good occupational work practices.

Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Use in a well-ventilated area.

Avoid generating and breathing mist and vapor.

Avoid contact with incompatible materials.

Avoid prolonged and repeated skin contact.

Avoid smoking, bare lights or ignition sources.

Avoid physical damage to containers.

Keep containers securely sealed when not in use.

Wear personal protective equipment when handling.

When handling, DO NOT eat, drink or smoke.

Always wash hands with soap and water after handling. Work clothes should be laundered separately.

Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.

Check all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: None under normal operating conditions. OTHERWISE: General exhaust is adequate under normal operating conditions.

If inhalation risk of overexposure exists, wear NIOSH-approved organic-vapor respirator.

If mist is present, use air supplied breathing apparatus.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; or as required, chemical goggles.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Barrier cream and Nitrile rubber gloves or Neoprene rubber gloves.

Safety footwear.

Respiratory Protection:

Exposure Range >5 to 50 mg/m³: Air Purifying, Negative Pressure, Half Mask

Exposure Range >50 to 500 mg/m³: Air Purifying, Negative Pressure, Full Face

Exposure Range >500 to <5000 mg/m³: Supplied Air, Constant Flow/Pressure Demand, Half Mask

Exposure Range 5000 to unlimited mg/m³: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Cartridge Color: dust/mist filter (use P100 or consult supervisor for appropriate dust/mist filter)

Other: Overalls. Eyewash unit.

Glove Selection Index:

BUTYL Best selection

VITON Best selection

NITRILE Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Light-colored, odorless and oily liquid. Mixes with mineral oil and most organic solvents.

Physical State: Liquid

pH: Not applicable

Vapor Pressure (kPa): 0.17 at 200 °C

pH (1% Solution): Not applicable.

Vapor Density (Air=1): 13.45

Boiling Point: 230 °C (446 °F) at 5 mm Hg

Formula Weight: 390.54

Freezing/Melting Point: -50 °C (-58 °F)

Specific Gravity (H₂O=1, at 4 °C): 0.99 at 20 °C

Water Solubility: < 0.01% at 25 °C

Evaporation Rate: Very Slow

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Hazardous polymerization will not occur. Stable under normal storage conditions.

Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Toxicity

Oral (rat) LD₅₀: 30000 mg/kg

Oral (human) TD_{Lo}: 143 mg/kg

Oral (mouse) LD₅₀: 1500 mg/kg

Oral (rabbit) LD₅₀: 34000 mg/kg

Dermal (rabbit) LD₅₀: 25000 mg/kg

Intraperitoneal (rabbit) LD₅₀: >31 mL/kg

Oral (guinea pig) LD₅₀: 26000 mg/kg

Dermal (g.pig) LD₅₀: 10000 mg/kg

Gastrointestinal changes, respiratory system changes, somnolence, hemorrhage, necrotic changes in GI tract, lowered blood pressure, liver, endocrine tumors, feto toxicity, paternal effects, maternal effects, specific developmental abnormalities (hepatobiliary system, musculoskeletal system, cardiovascular system, urogenital system, central nervous system, eye/ear), fetolethality recorded.

NOTE: Substance has been shown to be mutagenic in various assays, or belongs to a family of chemicals producing damage or change to cellular DNA.

Irritation

Skin (rabbit): 500 mg/24 hr mild

Eye (rabbit): 500 mg/24 hr mild

See RTECS TI 0350000, for additional data.

Section 12 - Ecological Information

Environmental Fate: In water it will biodegrade (half-life 2-3 wk), adsorb to sediments and bioconcentrate in aquatic organisms. Atmospheric material will be carried long distances and be removed by rain.

Ecotoxicity: LC₅₀ Gammarus pseudolimnaeus more than 32 mg/l/96 hr at 21 °C; juvenile /static bioassay; LC₅₀ Ictalurus punctatus (channel catfish) more than 100 mg/l/96 hr at 20 °C; wt 1.5 g /static bioassay; EC₅₀ Gymnodinium breve growth rate 3.1% vol/vol/96 hr /Conditions of bioassay not specified; LC₅₀ Oncorhynchus kisutch (coho salmon) more than 100 mg/l/96 hr at 16 °C; wt 1.5 g /static bioassay; LC₅₀ Daphnia magna: 1,000-5,000 ug/l/48 hr /Conditions of bioassay not specified; LC₅₀ Chironomus plumosus (Midge): > 18,000 ug/l/48 hr /Conditions of bioassay not specified

Henry's Law Constant: 1 x10⁻⁴

BCF: fish 2

Biochemical Oxygen Demand (BOD): acclimated < 1 lb/lb, 5 days

Octanol/Water Partition Coefficient: log K_{ow} = 4.89

Soil Sorption Partition Coefficient: K_{oc} = 4 to 5

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.

Follow applicable federal, state, and local regulations.

Incinerate residue at an approved site.

Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: None

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U028 Toxic Waste

CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Ethylbenzene

CAS Number: 100-41-4

Chemical Formula: C₈H₁₀

Structural Chemical Formula: C₆H₅•C₂H₅

EINECS Number: 202-849-4

ACX Number: X1003016-1

Synonyms: AETHYLBENZOL; BENZENE,ETHYL-; EB; ETHYL BENZENE; ETHYLBENZEEN;
 ETHYLBENZENE; ETHYLBENZOL; ETILBENZENE; ETYLOBENZEN; PHENYLETHANE

General Use: Used in the manufacture of cellulose acetate, styrene and synthetic rubber; solvent or diluent; component of automotive and aviation gasoline.

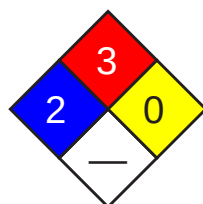
Component of many petroleum hydrocarbon solvents, thinners.

The use of a quantity of material in an unventilated or confined space may result in increased exposure and an irritating atmosphere developing. Before starting consider control of exposure by mechanical ventilation.

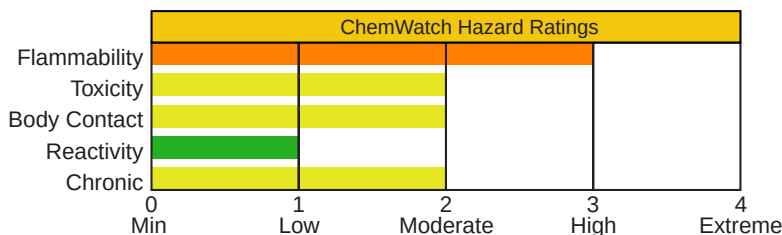
Section 2 - Composition / Information on Ingredients

Name	CAS	%
ethylbenzene	100-41-4	>95
OSHA PEL TWA: 100 ppm; 435 mg/m ³ .	NIOSH REL TWA: 100 ppm (435 mg/m ³); STEL: 125 ppm (545 mg/m ³).	DFG (Germany) MAK Skin.
ACGIH TLV TWA: 100 ppm; STEL: 125 ppm.	IDLH Level 800 ppm (10% LEL).	
EU OEL TWA: 100 ppm; STEL: 200 ppm.		

Section 3 - Hazards Identification



Fire Diamond



ANSI Signal Word

Warning!

HMIS	
2	Health
3	Flammability
0	Reactivity



Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; pungent odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: chest constriction, vertigo, narcosis, cramps, respiratory paralysis. Chronic Effects: fatigue, sleepiness, headache, blood disorders, lymphocytosis. Flammable.

Potential Health Effects

Target Organs: eyes, respiratory system, skin, central nervous system (CNS), blood

Primary Entry Routes: inhalation, skin contact, eye contact

Acute Effects

Inhalation: The vapor is discomforting to the upper respiratory tract.

Inhalation hazard is increased at higher temperatures.

Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Inhalation of vapor may aggravate a pre-existing respiratory condition such as asthma, bronchitis, emphysema.

When humans were exposed to the 100 and 200 ppm for 8 hours about 45-65% is retained in the body. Only traces of unchanged ethyl benzene are excreted in expired air following termination of inhalation exposure.

Humans exposed to concentrations of 23-85 ppm excreted most of the retained dose in the urine (mainly as metabolites).

Guinea pigs that died from exposure had intense congestion of the lungs and generalized visceral hyperemia. Rats exposed for three days at 8700 mg/m³ (2000 ppm) showed changes in the levels of dopamine and noradrenaline in various parts of the brain.

Eye: The liquid is highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Two drops of the material in to the conjunctival sac produced only slight irritation of the conjunctival membrane but no corneal injury.

Skin: The liquid is discomforting to the skin if exposure is prolonged and is capable of causing skin reactions which may lead to dermatitis.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

The mean rate of absorption of liquid ethyl benzene applied to 17.3 cm² area of the forearm of seven volunteers for 10-15 minutes was determined to be 38 mg/cm²/hr. Immersion of the whole hand in aqueous solutions of ethyl benzene (112-156 mg/l) for 1 hour yielded mean absorption rates of 118 and 215.7 ug/cm²/hr. The rate of absorption is thus greater than that of aniline, benzene, nitrobenzene, carbon disulfide and styrene.

Repeated application of the undiluted product to the abdominal area of rabbits (10-20 applications over 2-4 weeks) resulted in erythema, edema and superficial necrosis. The material did not appear to be absorbed through the skin in sufficient quantity to produce outward signs of toxicity.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid may produce considerable gastrointestinal discomfort and may be harmful or toxic if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.

Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.

Industrial workers exposed to a maximum level of ethyl benzene of 0.06 mg/l (14 ppm) reported headaches and irritability and tired quickly. Functional nervous system disturbances were found in some workers employed for over 7 years whilst other workers had enlarged livers.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Rinse mouth out with plenty of water. DO NOT induce vomiting.

Observe the patient carefully. Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.

Give water (or milk) to rinse out mouth. Then provide liquid slowly and as much as casualty can comfortably drink.

Transport to hospital or doctor without delay.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:

See
DOT
ERG

1. Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.
2. Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases ($pO_2 < 50$ mm Hg or $pCO_2 > 50$ mm Hg) should be intubated.
3. Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance
4. A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
5. Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
6. Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

Section 5 - Fire-Fighting Measures

Flash Point: 12.8 °C Closed Cup

Autoignition Temperature: 432 °C

LEL: 1.6% v/v

UEL: 7% v/v

Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.

Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.

Moderate fire hazard when exposed to heat or flame.

Vapor forms an explosive mixture with air.

Moderate explosion hazard when exposed to heat or flame.

Vapor may travel a considerable distance to source of ignition.

Heating may cause expansion or decomposition leading to violent rupture of containers.

On combustion, may emit toxic fumes of carbon monoxide (CO).

May emit clouds of acrid smoke.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

If safe, switch off electrical equipment until vapor fire hazard removed.

Use water delivered as a fine spray to control fire and cool adjacent area.

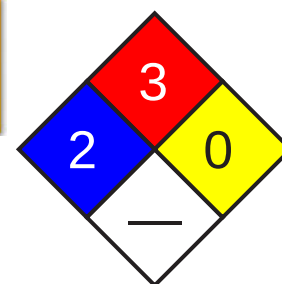
Avoid spraying water onto liquid pools.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protected location.

If safe to do so, remove containers from path of fire.

See
DOT
ERG



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.

Avoid breathing vapors and contact with skin and eyes.

Control personal contact by using protective equipment.

Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: Clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

No smoking, bare lights or ignition sources. Increase ventilation.

Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.

Use only spark-free shovels and explosion proof equipment.

Collect recoverable product into labeled containers for recycling.

Absorb remaining product with sand, earth or vermiculite.

Collect solid residues and seal in labeled drums for disposal.

Wash area and prevent runoff into drains.

If contamination of drains or waterways occurs, advise emergency services.

See
DOT
ERG

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Avoid all personal contact, including inhalation.

Wear protective clothing when risk of exposure occurs.

Use in a well-ventilated area. Prevent concentration in hollows and sumps.

DO NOT enter confined spaces until atmosphere has been checked.

Avoid smoking, bare lights, heat or ignition sources.

When handling, DO NOT eat, drink or smoke.

Vapor may ignite on pumping or pouring due to static electricity.

DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.

Avoid contact with incompatible materials.

Keep containers securely sealed. Avoid physical damage to containers.

Always wash hands with soap and water after handling.

Work clothes should be laundered separately.

Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.

Check all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear. Use in a well-ventilated area.

General exhaust is adequate under normal operating conditions.

If risk of overexposure exists, wear NIOSH-approved respirator.

Correct fit is essential to obtain adequate protection.

Provide adequate ventilation in warehouse or closed storage areas.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; or as required, chemical goggles.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Barrier cream with polyethylene gloves or Nitrile gloves.

Protective footwear.

Respiratory Protection:

Exposure Range >100 to <800 ppm: Air Purifying, Negative Pressure, Half Mask

Exposure Range 800 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Cartridge Color: black

Other: Overalls. Eyewash unit.

Glove Selection Index:

VITON Best selection

TEFLON Best selection

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear highly flammable liquid; floats on water. Aromatic solvent odor. Soluble in alcohol, benzene, carbon tetrachloride and ether.

Physical State: Liquid

Odor Threshold: 8.7 to 870.0 mg/m³

Vapor Pressure (kPa): 1.333 at 25.9 °C

Vapor Density (Air=1): 3.66

Formula Weight: 106.17

Specific Gravity (H₂O=1, at 4 °C): 0.8670 at 20 °C

Evaporation Rate: Fast

pH: Not applicable

pH (1% Solution): Not applicable.

Boiling Point: 136.2 °C (277 °F) at 760 mm Hg

Freezing/Melting Point: -95 °C (-139 °F)

Volatile Component (% Vol): 100

Water Solubility: 0.01% by weight

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Toxicity

Oral (rat) LD₅₀: 3500 mg/kg

Inhalation (human) TC_{Lo}: 100 ppm/8h

Inhalation (rat) LC_{Lo}: 4000 ppm/4h

Intraperitoneal (mouse) LD₅₀: 2642 mg/kg~

Dermal (rabbit) LD₅₀: 17800 mg/kg~

Liver changes, uterine tract, effects on fertility, specific developmental abnormalities (musculoskeletal system) recorded.

NOTE: Substance has been shown to be mutagenic in various assays, or belongs to a family of chemicals producing damage or change to cellular DNA.

Irritation

Skin (rabbit): 15 mg/24h mild

Eye (rabbit): 500 mg - SEVERE

See RTECS DA 0700000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to the atmosphere, it exists predominantly in the vapor phase based on its vapor pressure where it will photochemically degrade by reaction with hydroxyl radicals (half-life 0.5 to 2 days) and partially return to earth in rain. It will not be subject to direct photolysis. Releases into water will decrease in concentration by evaporation and biodegradation. The time for this decrease and the primary loss processes will depend on the season, and the turbulence and microbial populations in the particular body of water. Representative half-lives are several days to 2 weeks. Some may be adsorbed by sediment but significant bioconcentration in fish is not expected to occur based upon its octanol/water partition coefficient. It is only adsorbed moderately by soil. It will not significantly hydrolyze in water or soil.

Ecotoxicity: LC₅₀ Cyprinodon variegatus (sheepshead minnow) 275 mg/l 96 hr in a static unmeasured bioassay; LC₅₀ Pimephales promelas (fathead minnow) 12.1 mg/l/96 hr (confidence limit 11.5 - 12.7 mg/l), flow-through bioassay with measured concentrations, 26.1 °C, dissolved oxygen 7.0 mg/l, hardness 45.6 mg/l calcium carbonate, alkalinity 43.0 mg/l; Toxicity threshold (cell multiplication inhibition test): Pseudomonas putida (bacteria) 12 mg/l ; LC₅₀ Palaemonetes pugio (grass shrimp, adult) 14,400 ug/l/24 hr in a static unmeasured bioassay; LC₅₀ Palaemonetes pugio (grass shrimp, larva) 10,200 ug/l/24 hr in a static unmeasured bioassay; Toxicity threshold (cell multiplication inhibition test): Microcystis aeruginosa (algae) 33 mg/l; Scenedesmus quadricauda (green algae) > 160 mg/l

Henry's Law Constant: 8.44 x10⁻³

BCF: goldfish 1.9

Biochemical Oxygen Demand (BOD): theoretical 2.8%, 5 days

Octanol/Water Partition Coefficient: log K_{ow} = 3.15

Soil Sorption Partition Coefficient: K_{oc} = 164

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.

Follow applicable federal, state, and local regulations.

Incinerate residue at an approved site.

Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Ethylbenzene

ID: UN1175

Hazard Class: 3 - Flammable and combustible liquid

Packing Group: II - Medium Danger

Symbols:

Label Codes: 3 - Flammable Liquid

Special Provisions: IB2, T4, TP1

Packaging: Exceptions: 150 **Non-bulk:** 202 **Bulk:** 242

Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L

Vessel Stowage: **Location:** B **Other:**



Section 15 - Regulatory Information**EPA Regulations:****RCRA 40 CFR:** Not listed**CERCLA 40 CFR 302.4:** Listed per CWA Section 311(b)(4), per CWA Section 307(a) 1000 lb (453.5 kg)**SARA 40 CFR 372.65:** Listed**SARA EHS 40 CFR 355:** Not listed**TSCA:** Listed**Section 16 - Other Information**

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Fluoranthene

CAS Number: 206-44-0

Chemical Formula: C₁₆H₁₀

EINECS Number: 205-912-4

ACX Number: X1001738-4

Synonyms: 1,2-BENZACENAPHTHENE; BENZENE,1,2-(1,8-NAPHTHALENEDIYL)-; BENZENE,1,2-(1,8-NAPHTHYLENE)-; BENZO (J,K) FLUORENE; BENZO(J,K)FLUORENE; BENZO(JK)FLUORENE; FLUORANTHENE; IDRYL; 1,2-(1,8-NAPHTHALENE)BENZENE; 1,2-(1,8-NAPHTHALENEDIYL)BENZENE; 1,2-(1,8-NAPHTHYLENE)BENZENE

Derivation: Fluoranthene is derived from coal tar and from the pyrolytic processing of organic raw materials such as coal or petroleum at high temperatures.

General Use: Fluoranthene is a constituent of coal tar and petroleum derived asphalt used as a lining material to protect the interior of steel and ductile-iron potable water pipes and storage tanks; used as a research chemical and medication.

Section 2 - Composition / Information on Ingredients

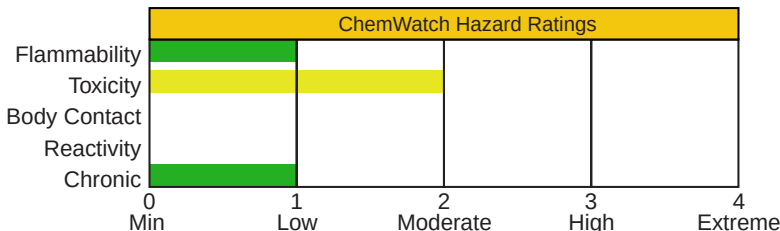
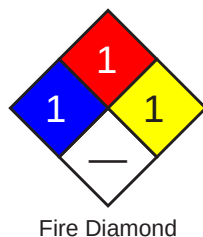
Name	CAS	%
Fluoranthene	206-44-0	ca 98% wt

OSHA PEL

NIOSH REL

ACGIH TLV

Section 3 - Hazards Identification



HMIS	
①	Health
①	Flammability
①	Reactivity

ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless to pale yellow solid. Irritating to eyes/skin/respiratory tract. Chronic: mutagenic and tumorigenic effects, possible kidney/bladder cancer. Combustible.

Potential Health Effects

Target Organs: Eyes, skin, and respiratory system

Primary Entry Routes: Inhalation, skin/eye contact, ingestion

Acute Effects Note: In general, polynuclear aromatic hydrocarbons (PAH's) have a low order of acute toxicity in humans. The following effects from exposure are based on analogy to phenol and coal tar.

Inhalation: Causes irritation of the mucous membranes and upper respiratory tract.

Eye: Contact causes eye irritation and burning.

Skin: Contact causes skin irritation and burning.

Ingestion: Causes nausea, tachycardia, cardiac arrhythmias, pulmonary edema, and respiratory arrest.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: Persons with existing skin disorders may be more susceptible to the effects of coal tar pitches.

Chronic Effects: Cough and bronchitis, photosensitivity of the eyes and skin, coal tar warts, erythema, and acneiform lesions, leukoplakia, mild hepatotoxicity, and hematuria. Laboratory experiments have shown mutagenic and tumorigenic effects. Some PAH's have been associated with kidney, skin, bladder, lung, and gastrointestinal cancers. PAH's may cross the placenta and are excreted in breast milk in animals.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult a physician or ophthalmologist if pain, irritation, swelling, lacrimation, or photophobia persist.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water. *Do not* induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Monitor arterial blood gases, pulmonary function, and chest x-ray for patients with significant exposure. If cough or difficulty breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. If bronchospasm and wheezing occur, consider treatment with inhaled sympathomimetic agents. Inhalation exposure to PAH's may be complicated by exposure to other substances which produce acute respiratory and systemic effects. Treat according to clinical presentation and exposure history. Treat dermal irritation or burns with standard topical therapy. Patients developing dermal hypersensitivity may require treatment with systemic or topical corticosteroids or antihistamines.

Section 5 - Fire-Fighting Measures

Flash Point: Data not found.

Autoignition Temperature: Data not found.

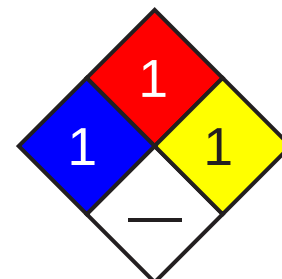
LEL: Data not found.

UEL: Data not found.

Extinguishing Media: Extinguish with water spray, carbon dioxide, dry chemical powder or appropriate foam.

General Fire Hazards/Hazardous Combustion Products: Emits toxic fumes of carbon monoxide and carbon dioxide.

Fire-Fighting Instructions: *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources. Isolate and ventilate area, deny entry, stay upwind. Cleanup personnel should protect against exposure (Sec. 8).

Small Spills: If in solid form, *do not* sweep! Spills of hot coal tar may be covered with sand. Carefully scoop up or vacuum (with a HEPA filter).

Large Spills: For large spills, dike far ahead of spill for later disposal. *Do not* release into sewers or waterways.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Wear personal protective clothing and equipment to prevent vapor inhalation and contact with skin or eyes (Sec. 8). To prevent skin absorption of coal tar products, *do not* use solvents to clean hands. Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed containers in a cool, well-ventilated area away from heat, light, ignition sources, and incompatibles. Control storage conditions to prevent overheating and pressure buildup in containers of coal tar products. Design and operate transfer and storage systems to prevent blockage by condensed coal tar products.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose operations to avoid vapor dispersion into the work area. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Educate workers about the health and safety hazards associated with this material. Train in work practices which minimize exposure. Institute a complete respiratory protection program which includes regular training, maintenance, inspection, cleaning, and evaluation. Make available to employees exposed to coal tar pitch volatiles a complete history and physical examination with emphasis on the oral cavity, respiratory tract, bladder, and kidneys. Examine the skin for evidence of chronic disorders, for premalignant and malignant lesions, and evidence of hyperpigmentation or photosensitivity. Obtain a urinalysis including specific gravity, albumin, glucose, and a microscopic examination of centrifuged sediment, as well as a test for red blood cells. Also perform a complete blood count to search for leukemia and aplastic anemia. Employees having 5 or more years of exposure or who are 45 years of age or older should have a urinary cytology exam. Employees having 10 or more years of exposure or who are 45 year of age or older should have a sputum cytology examination, a 14" x 17" chest roentgenogram, and periodic measure of FVC and FEV (1 sec).

Personal Protective Clothing/Equipment: Wear chemically protective gloves, aprons, and gauntlets to prevent any skin contact. Employees handling drums, cans, or other large containers of coal tar products shall wear impervious shoes or boots with safety toe caps. Protect leather safety shoes with impervious coverings such as rubbers. Wear cup type or rubber-framed chemical safety goggles with a full length, plastic face shield (20 cm min.), per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not protective eye devices. Appropriate eye protection must be worn instead of contact lenses. *Do not* wear contacts while working with fluoranthene.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For exposure to concentrations $\leq 2 \text{ mg/m}^3$, wear a chemical cartridge respirator with an organic vapor cartridge(s) and with a fume or high efficiency filter or any supplied-air respirator or any SCBA; for exposure to concentrations $\leq 10 \text{ mg/m}^3$, wear a chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s) and with a fume or high efficiency filter, or a gas mask with a chin style or a front- or back- mounted organic vapor canister and with a full facepiece and a fume or high efficiency filter, or any supplied-air respirator with a full facepiece, helmet, or hood or any SCBA with a full facepiece; for exposure to concentrations $\leq 200 \text{ mg/m}^3$, wear a type C supplied-air respirator operated in pressure-demand or other positive-pressure or continuous flow mode, or a powered air- purifying respirator with an organic vapor cartridge and a high efficiency particulate filter; for exposure to concentrations $\leq 400 \text{ mg/m}^3$, wear a type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive-pressure mode, or with a full facepiece, helmet, or hood operated in continuous flow mode. For exposure to concentrations $\geq 400 \text{ mg/m}^3$ or for emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes and place in a closed container in the change room. Launder daily before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless to pale yellow

Physical State: Solid; needles or plates from alcohol

Vapor Pressure (kPa): 0.01 mm Hg at 68 °F (20 °C)

Formula Weight: 202.2

Density: 1.252 g/mL at 0°C/4°C

Specific Gravity (H₂O=1, at 4 °C): 1.252

Boiling Point: 707 °F (375 °C)

Freezing/Melting Point: 230 °F (110 °C)

Ionization Potential (eV): 7.95 +/- 0.3 eV

Water Solubility: Insoluble; 0.20 to 0.26 mg/L

Other Solubilities: Soluble in acetic acid, benzene, carbon disulfide, chloroform, and ether; at 72 °F (22 °C): 5-10 mg/mL 95% ethanol, $\geq 100 \text{ mg/mL}$ acetone, and $\geq 100 \text{ mg/mL}$ DMSO

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Fluoranthene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Avoid contact with chemical incompatibles, heat, and sources of ignition.

Storage Incompatibilities: Include strong oxidizing agents.

Hazardous Decomposition Products: Thermal oxidative decomposition of fluoranthene can produce toxic fumes of carbon monoxide and carbon dioxide.

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral, LD₅₀: 2 g/kg.

Acute Skin Effects:

Rabbit, skin, LD₅₀: 3180 mg/kg.

Other Effects:

Multiple Dose Toxicity Effects: Rat, oral, 67500 mg/kg administered for 90 days intermittently produced toxic effects: kidney, ureter, and bladder - changes in tubules (including acute renal failure, acute tubular necrosis); blood - normocytic anemia, changes in leukocyte (WBC) count.

Genetic Effects: Bacteria, *S Typhimurium*, 5 µg/plate (-S9) induced mutations in microorganisms.

Human, lymphocyte, 2 µmol/L induced mutations in mammalian somatic cells.

Hamster, ovary, 9 mg/L induced sister chromatid exchange.

Rat, embryo, 50 mg/L induced morphological transformation.

Mouse, skin, 280 mg/kg administered for 58 weeks intermittently produced toxic effects: tumorigenic - equivocal tumorigenic agent by RTECS criteria; skin and appendages - tumors; tumorigenic - tumors at site of application.

See RTECS LL4025000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Fluoranthene degrades slowly in soil. When released to water, fluoranthene is expected to bioconcentrate into aquatic organisms. In the unadsorbed state it will degrade by photolysis. It appears to be stable in sediment for decades or more. Biodegradation in a few years in the presence of acclimated organisms is expected to occur. Fluoranthene released in the atmosphere will photodegrade in the free state. Fluoranthene will rapidly become adsorbed to sediment and particulate matter in the water column. Fluoranthene adsorbs strongly to soil. It is expected to remain in the upper layers of soil. However, it has been detected in groundwater samples, which demonstrates that it can be transported there by some other process. log K_{ow}: 4.90

Ecotoxicity: *Lepomis macrochirus*/ LC₅₀: 4.0 mg/L/96 hr

BCF: 2.58 (rainbow trout)

Soil Sorption Partition Coefficient: K_{oc} = 6.6x10⁴

Section 13 - Disposal Considerations

Disposal: Fluoranthene is a good candidate for disposal by rotary kiln or fluidized bed forms of incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable federal, state, and local regulations. Handle empty containers carefully as hazardous residues may still remain. Triple rinse containers and dispose of wash wastewater appropriately.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Not specifically listed.

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U120 Toxic Waste

CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Fluorene

CAS Number: 86-73-7

Chemical Formula: C₁₃H₁₀

EINECS Number: 201-695-5

ACX Number: X1003048-3

Synonyms: 2,3-BENZINDENE; O-BIPHENYLENEMETHANE; O-BIPHENYLMETHANE; ALPHA-DIPHENYLENEMETHANE; DIPHENYLENEMETHANE; ALPHA-DIPHENYLENEMETHANE-9H-FLUORENE; 9H-FLUORENE; FLUORENE; METHANE,DIPHENYLENE-; 2,2'-METHYLENEBIPHENYL

Derivation: Fluorene is derived from coal tar; from acetylene and hydrogen in a red-hot tube; from charcoal by boiling and fuming with HNO₃; from 2,2'-dibromodiphenylmethane on boiling with hydrazine hydrate in the presence of palladium; or by reduction of diphenylene ketone with zinc.

General Use: Fluorene is used in the formation of polyradicals for resins, and in resinous products and dyestuffs. Derivatives of fluorene show activity as herbicides and growth regulators.

Section 2 - Composition / Information on Ingredients

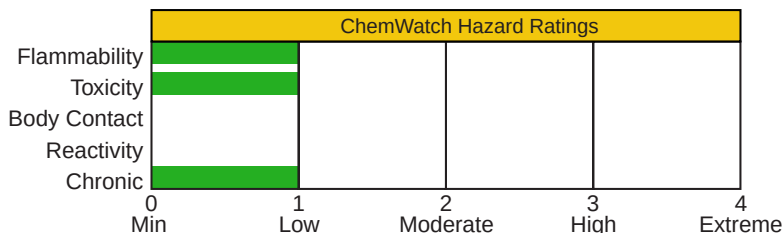
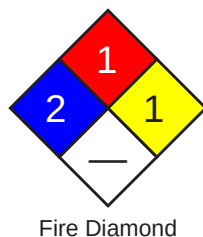
Name	CAS	%
Fluorene	86-73-7	ca 98% wt

OSHA PEL

NIOSH REL

ACGIH TLV

Section 3 - Hazards Identification



HMIS	
2	Health
1	Flammability
1	Reactivity

ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Dazzling white leaflets or flakes, fluorescent when impure. Irritating to eyes/skin/respiratory tract. Chronic effects: mutation effects. Combustible.

Potential Health Effects

Target Organs: Skin, eyes, respiratory system

Primary Entry Routes: Inhalation and skin/eye contact

Acute Effects The toxicological properties of fluorene have not been thoroughly investigated. The following effects are for those of polycyclic aromatic hydrocarbons (PAHs) in general.

Inhalation: Causes irritation to the respiratory system.

Eye: Contact causes irritation.

Skin: Contact causes irritation.

Ingestion: Causes irritation.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: Include photosensitivity and irritation of the eyes; irritation of the respiratory system with cough, bronchitis, and chance of bronchogenic cancer; leukoplakia and cancers of the lip and oral cavity; dermal burns, "coal tar warts" (precancerous lesions enhanced by UV light exposure), erythema, acneiform lesions, and irritation; mild hepatotoxicity; hematuria; and an increased chance of cancer of the skin, kidney, bladder, lung and gastrointestinal tract. Fluorinated PAHs may cross the placenta.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed. Monitor for respiratory distress. If cough or difficulty in breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis.

Administer 100% humidified supplemental oxygen with assisted ventilation as required. If bronchospasm and wheezing occur, consider treatment with inhaled sympathomimetic agents.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult a physician or ophthalmologist if pain, irritation, swelling, lacrimation or photophobia persist.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician. Treat dermal irritation or burns with a standard topical therapy. Patients developing dermal hypersensitivity reactions may require treatment with systemic or topical corticosteroids or antihistamines. Avoid direct exposure of affected skin to sunlight and UV sources.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water. *Do not* induce vomiting. Gastric lavage and routine use of cathartics are not recommended.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Chronic effects, particularly cancer, are more common than acute toxicity. Acute respiratory effects in persons are typically due to other toxic agents at the worksite. Carefully observe patients with inhalation exposure for the development of any systemic signs or symptoms and administer symptomatic treatment as necessary. Monitor arterial blood gases, pulmonary function, and chest x-ray for patients with significant exposure.

Section 5 - Fire-Fighting Measures

Flash Point: Data not found; combustible

Autoignition Temperature: Data not found.

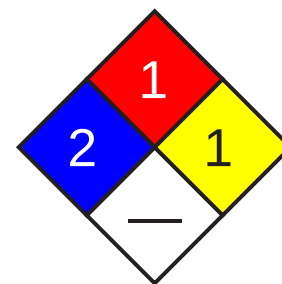
LEL: Data not found.

UEL: Data not found.

Extinguishing Media: Extinguish with water spray, carbon dioxide, dry chemical or appropriate foam.

General Fire Hazards/Hazardous Combustion Products: When heated to decomposition it emits acrid smoke and toxic fumes of carbon monoxide and carbon dioxide.

Fire-Fighting Instructions: *Do not* breathe the dust. *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Wear protective clothing including rubber boots and heavy rubber gloves to prevent contact with skin and eyes.



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources. Isolate and ventilate area, deny entry, stay upwind. Cleanup personnel should protect against exposure (Sec. 8).

Small Spills: If in solid form, *do not* sweep! Avoid raising dust. Carefully scoop up or vacuum (with a HEPA filter). Absorb liquid spill with an inert, noncombustible absorbent such as sand or vermiculite. Wash spill site after material pickup is complete.

Large Spills: For large spills, dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Wear personal protective clothing and equipment to prevent dust inhalation and contact of solid or liquid with skin or eyes (Sec. 8).

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed containers in a cool, well-ventilated area away from heat, light, ignition sources, and incompatibles.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose operations to avoid dust dispersion into the work area. Provide local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Educate workers about the health and safety hazards associated with this material. Train in work practices which minimize exposure. Consider preplacement and periodic medical exams including a complete blood count, hepatic and renal function test, dermal assessments, chest x-ray and pulmonary function tests.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not protective eye devices. Appropriate eye protection must be worn instead of, or in conjunction with, contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For 'normal' uses an air-purifying toxic dust* mask for particulates, and an organic vapor with toxic dust* pre-filters for vapors, dusts, and mists (* = purple or magenta color cartridge). Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: White. Fluorescent when impure.

Physical State: Solid; crystalline powder or small crystalline plates; leaflets or flakes from alcohol. Sublimes easily in high vacuum.

Vapor Pressure (kPa): 0.013 mm Hg at 68 °F (20 °C)

Formula Weight: 166.21

Density: 1.202 g/mL

Specific Gravity (H₂O=1, at 4 °C): 1.203 at 0 °C/4 °C

Boiling Point: 563 °F (295 °C) (decomposes)

Freezing/Melting Point: 237 to 241 °F (114 to 116 °C)

Ionization Potential (eV): 7.89 +/-0.2 eV

Water Solubility: Insoluble; 1.98 mg/kg

Other Solubilities: Freely soluble in glacial acetic acid; soluble in hot 95% ethanol, acetone, benzene, carbon disulfide, carbon tetrachloride, ether, pyridine, and toluene.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Fluorene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Avoid contact with chemical incompatibles, heat, and sources of ignition. Avoid heating to decomposition.

Storage Incompatibilities: Include strong oxidizing agents.

Hazardous Decomposition Products: Thermal oxidative decomposition of fluorene can produce acrid smoke and toxic fumes of carbon monoxide and carbon dioxide.

Section 11 - Toxicological Information

Other Effects:

- Genetic Effects: Mouse, lymphocyte, 150 µmol/L induced DNA damage.
- Mouse, lymphocyte, 19500 nmol/L (+S9) induced mutations in microorganisms.
- Mouse, lymphocyte, 584 µmol/L induced mutations in mammalian somatic cells.
- Hamster, lung, 25 mg/L induced cytogenetic analysis.
- Mouse, mammary gland, 1 µg/L induced morphological transformation.
- Mouse, intraperitoneal, LD₅₀: >2 g/kg.

See RTECS LL5670000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to the atmosphere, fluorene will exist primarily in the vapor phase where it will degrade readily by photochemically produced hydroxyl radicals (estimated half-life of 29 hr). If released to soil or water, fluorene will biodegrade readily (aerobically) in the presence of acclimated microbes; microbial adaptation is an important fate process. Biodegradation can be slow in pristine soils or waters (or under conditions of limited oxygen). Strong adsorption to soil and water sediment is an important transport process. Log K_{ow}: 4.18 to 4.38

Ecotoxicity: TL_m *Neanthes arenaceodentata* LC₅₀/1.0 ppm/96 hr at 72 °F (22 °C) in a static bioassay, seawater

Henry's Law Constant: 0.0001

BCF: 1288 (fathead minnow)

Soil Sorption Partition Coefficient: K_{oc} = log 3.70 to 4.21

Section 13 - Disposal Considerations

Disposal: Dissolve or mix fluorene with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. The particle-bound portion of polycyclic aromatic hydrocarbons (PAH) can be removed by sedimentation, flocculation, and filtration processes. The remaining dissolved polynuclear aromatic hydrocarbons usually require oxidation for partial removal/transformation. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable federal, state, and local regulations. Handle empty containers carefully as hazardous residues may still remain. Triple rinse containers and dispose of wash wastewater appropriately.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Not specifically listed.

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Not listed

CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 5000 lb (2268 kg)

SARA 40 CFR 372.65: Not listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Section 1 - Chemical Product and Company Identification

61

Material Name: Indeno[1,2,3-cd]pyrene

CAS Number: 193-39-5

Chemical Formula: C₂₂H₁₂

EINECS Number: 205-893-2

ACX Number: X1004975-9

Synonyms: IDENO(1,2,3-CD)PYRENE; INDENO(1,2,3-C,D) PYRENE; INDENO(1,2,3-CD)PYRENE; INDENO[1,2,3-CD]PYRENE; INDENO(1,2,3-C,D)PYRENE; INDENOPYRENE; IP; 1,10-(1,2-PHENYLENE)PYRENE; 1,10-(O-PHENYLENE)PYRENE; 1,10-(ORTHO-PHENYLENE)PYRENE; 2,3-O-PHENYLENEPYRENE; 2,3-ORTHO-PHENYLENEPYRENE; 2,3-PHENYLENEPYRENE; O-PHENYLENEPYRENE; ORTHO-PHENYLENEPYRENE

General Use: Laboratory standard used in cancer research. Found in automotive and diesel exhaust, cigarette smoke condensate, benzene and pyrene pyrolysis products, soot, coal tar and coal tar pitch and petroleum asphalt.

Section 2 - Composition / Information on Ingredients

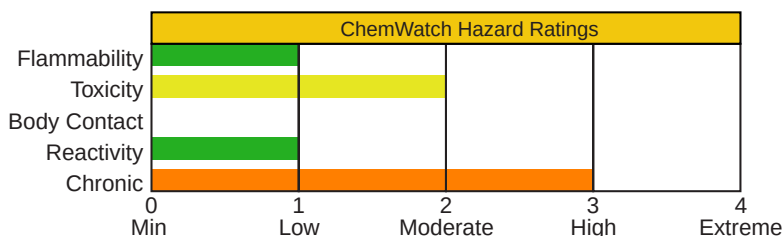
Name	CAS	%
indeno[1,2,3-cd]pyrene	193-39-5	>98

OSHA PEL

NIOSH REL

ACGIH TLV

Section 3 - Hazards Identification



☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Yellow plates or needles. May cause irritation to eyes/skin. Also causes: may be harmful by inhalation, ingestion, or skin absorption.

Potential Health Effects

Target Organs: No data found.

Primary Entry Routes: accidental skin and eye contact and inhalation of generated dusts

Acute Effects

Inhalation: The dust is harmful and discomforting to the upper respiratory tract.

Persons with impaired respiratory function, airway diseases, or conditions such as emphysema or chronic bronchitis may incur further disability if excessive concentrations of particulate are inhaled.

Eye: The dust may be discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to windburn), temporary impairment of vision and/ or other transient eye damage/ ulceration.

Skin: The material may be mildly discomforting to the skin. Open cuts and abraded or irritated skin should not be exposed to this material.

Toxic effects may result from skin absorption.

Ingestion: The solid/dust is discomforting to the gastrointestinal tract and harmful if swallowed.

Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Listed; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Not listed.

Chronic Effects: The so-called polycyclic aromatic hydrocarbons (PAHs) comprise a large family; some members occur in coal tar, tobacco smoke, petroleum and air pollution. Some substituted derivatives have been identified, in animal studies, as amongst the most highly active carcinogens.

Section 4 - First Aid Measures

Inhalation: • If dust is inhaled, remove to fresh air.

- Encourage patient to blow nose to ensure clear breathing passages.
- Rinse mouth with water. Consider drinking water to remove dust from throat.
- Seek medical attention if irritation or discomfort persist.
- If fumes or combustion products are inhaled, remove to fresh air.
- Lay patient down. Keep warm and rested.
- Other measures are usually unnecessary.

Eye Contact: If this product comes in contact with the eyes:

- Immediately hold the eyes open and flush with fresh running water.
- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Seek medical attention if pain persists or recurs.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: If product comes in contact with the skin:

- Immediately remove all contaminated clothing, including footwear (after rinsing with water).
- Wash affected areas thoroughly with water (and soap if available).
- Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center. If swallowed, and if more than 15 minutes from a hospital:

- Induce vomiting with Ipecac syrup, or fingers down the back of the throat, only if conscious. Lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. Note: Wear a protective glove when inducing vomiting by mechanical means.
- Seek medical attention without delay.
- In the meantime, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient's condition.
- If the services of a medical officer or medical doctor are readily available, the patient should be placed in his/her care and a copy of the MSDS should be provided. Further action will be the responsibility of the medical specialist.
- If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of the MSDS.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Extinguishing Media: Foam. Dry chemical powder. BCF (where regulations permit). Carbon dioxide. Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: • Solid which exhibits difficult combustion or is difficult to ignite.

- Avoid generating dust, particularly clouds of dust in a confined or unventilated space, as dust may form an explosive mixture with air and any source of ignition, i.e., flame or spark, will cause fire or explosion. Dust clouds generated by the fine grinding of the solid are a particular hazard; accumulations of fine dust may burn rapidly and fiercely if ignited
- Dry dust can also be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport.
- Build-up of electrostatic charge may be prevented by bonding and grounding.
- Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e., nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: • Contact fire department and tell them location and nature of hazard.

- Wear breathing apparatus plus protective gloves for fire only.
- Prevent, by any means available, spillage from entering drains or waterways.
- Use fire fighting procedures suitable for surrounding fire.
- Do not approach containers suspected to be hot.
- Cool fire-exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.
- Equipment should be thoroughly decontaminated after use.

See
DOT
ERG

Section 6 - Accidental Release Measures

Small Spills: • Clean up all spills immediately.

- Avoid contact with skin and eyes.
- Wear protective clothing, gloves, safety glasses and dust respirator.
- Use dry clean up procedures and avoid generating dust.
- Vacuum up or sweep up.
- Place in clean drum then flush area with water.

Large Spills: • Clear area of personnel and move upwind.

- Contact fire department and tell them location and nature of hazard.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or waterways.
- No smoking, bare lights or ignition sources.
- Increase ventilation.
- Stop leak if safe to do so.
- Water spray or fog may be used to disperse/absorb vapor.
- Contain or absorb spill with sand, earth or vermiculite.
- Collect recoverable product into labeled containers for recycling.
- Collect solid residues and seal in labeled drums for disposal.
- Wash area and prevent runoff into drains.
- After clean up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.
- If contamination of drains or waterways occurs, advise emergency services.

See
DOT
ERG

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: • Avoid all personal contact, including inhalation.

- Wear protective clothing when risk of overexposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.
- Do not enter confined spaces until atmosphere has been checked.
- Do not allow material to contact humans, exposed food or food utensils.
- Avoid smoking, bare lights or ignition sources.
- When handling, do not eat, drink or smoke.
- Avoid contact with incompatible materials.
- Keep containers securely sealed when not in used.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately. Launder contaminated clothing before reuse.
- Observe manufacturer's storage/handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Recommended Storage Methods: Glass container. Plastic container. Metal can. Metal drum. Packing as recommended by manufacturer. Check that all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Local exhaust ventilation usually required. If risk of overexposure exists, wear approved respirator. Supplied-air type respirator may be required in special circumstances. An approved self contained breathing apparatus (SCBA) may be required in some situations. Provide adequate ventilation in warehouse or closed storage area.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields. Chemical goggles. Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Wear chemical protective gloves, e.g. PVC. Wear safety footwear.

Other: • Overalls.

- PVC Apron.
- PVC protective suit may be required if exposure severe.
- Eyewash unit.
- Ensure there is ready access to a safety shower.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Off-white powder.

Physical State: yellow plates or needles

Vapor Pressure (kPa): 1.0×10^{-1} mm Hg

Vapor Density (Air=1): not applicable

Formula Weight: 276.34

Evaporation Rate: not applicable

pH: not applicable

pH (1% Solution): not applicable

Boiling Point: 530 °C (986 °F)

Freezing/Melting Point: 162.5 °C (324.5 °F) to 164 °C (327.2 °F)

Volatile Component (% Vol): negligible

Water Solubility: 0.062 mg/L water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid reaction with oxidizing agents.

Section 11 - Toxicological Information

Substance has been shown to be mutagenic in at least one assay, or belongs to a family of chemicals producing damage or change to cellular DNA.

See RTECS NK9300000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil it will sorb strongly (estimated $K_{oc} = 20,146$) and hence is not expected to leach. No information was found about volatilization from, hydrolysis in, or biodegradation in soil. Released to water it will sorb strongly to suspended particulate matter, biota and sediments. Although there is a high potential to bioconcentrate in most aquatic organisms, it may not in fish since fish contain microsomal oxidase, which allows polycyclic aromatic hydrocarbons to be metabolized. No information was found about volatilization, photolysis, hydrolysis, or biodegradation in water. It will probably be persistent in the aquatic environment and concentrate in sediments. Almost all released to the atmosphere will be sorbed to particulate matter; thus its atmospheric fate will primarily depend on physical processes such as dry and wet deposition. However, a computer-estimated half-life in the vapor phase is about 20 hours due to reaction with photochemically produced hydroxyl radicals.

Ecotoxicity: No data found.

Henry's Law Constant: 5.89×10^{-10}

BCF: estimated at 5.9407×10^4

Octanol/Water Partition Coefficient: $\log K_{ow} = 6.584$

Soil Sorption Partition Coefficient: $K_{oc} = 2.0146 \times 10^4$

Section 13 - Disposal Considerations

Disposal: • Recycle wherever possible or consult manufacturer for recycling options.

• Follow applicable local, state, and federal regulations.

• Bury residue in an authorized landfill.

• Recycle containers if possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Toxic solids, organic, n.o.s.

ID: UN2811

Hazard Class: 6.1 - Poisonous materials

Packing Group: I - Great Danger

Symbols: G - Technical Name Required

Label Codes: 6.1 - Poison or Poison Inhalation Hazard if inhalation hazard, Zone A or B

Special Provisions: IB7

Packaging: Exceptions: None

Non-bulk: 211

Bulk: 242

Quantity Limitations: Passenger aircraft/rail: 5 kg

Cargo aircraft only: 50 kg

Vessel Stowage:

Location: B

Other:



Shipping Name and Description: Toxic solids, organic, n.o.s.**ID:** UN2811**Hazard Class:** 6.1 - Poisonous materials**Packing Group:** II - Medium Danger**Symbols:** G - Technical Name Required**Label Codes:** 6.1 - Poison or Poison Inhalation Hazard *if inhalation hazard, Zone A or B***Special Provisions:** IB8, IP2, IP4**Packaging:** **Exceptions:** None **Non-bulk:** 212 **Bulk:** 242**Quantity Limitations:** **Passenger aircraft/rail:** 25 kg **Cargo aircraft only:** 100 kg**Vessel Stowage:** **Location:** B **Other:****Shipping Name and Description:** Toxic solids, organic, n.o.s.**ID:** UN2811**Hazard Class:** 6.1 - Poisonous materials**Packing Group:** III - Minor Danger**Symbols:** G - Technical Name Required**Label Codes:** 6.1 - Poison or Poison Inhalation Hazard *if inhalation hazard, Zone A or B***Special Provisions:** IB8, IP3**Packaging:** **Exceptions:** 153 **Non-bulk:** 213 **Bulk:** 240**Quantity Limitations:** **Passenger aircraft/rail:** 100 kg **Cargo aircraft only:** 200 kg**Vessel Stowage:** **Location:** A **Other:**

Section 15 - Regulatory Information

EPA Regulations:**RCRA 40 CFR:** Listed U137 Toxic Waste**CERCLA 40 CFR 302.4:** Listed per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)**SARA 40 CFR 372.65:** Listed**SARA EHS 40 CFR 355:** Not listed**TSCA:** Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

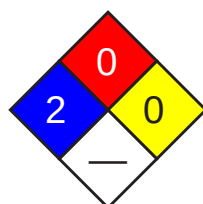
61

Material Name: Lead **CAS Number:** 7439-92-1
Chemical Formula: Pb
Structural Chemical Formula: Pb
EINECS Number: 231-100-4
ACX Number: X1000227-2
Synonyms: C.I. 77575; C.I. PIGMENT METAL 4; GLOVER; KS-4; LEAD; LEAD FLAKE; LEAD INORGANIC; LEAD METAL; LEAD S2; LEAD SZ; OLOW; OMAHA & GRANT; PB-S 100; PLUMBUM
General Use: Used as a construction material in chemical reaction equipment (tank piping, etc.); manufacture of tetraethyl lead; pigments for paints.
 Used in pottery glazes, glass, ceramics, bearing metal and alloys, solder and other lead alloys.
 Also used in metallurgy of steel and other metals, cable sheathing, storage batteries, radiation shielding and ammunition.

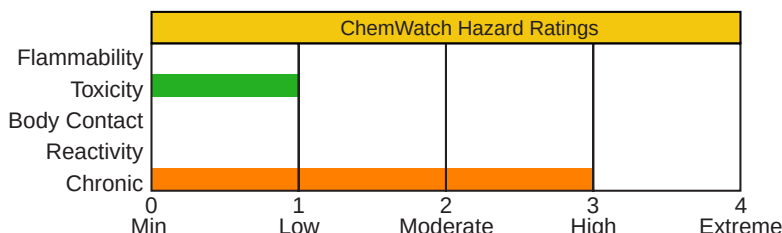
Section 2 - Composition / Information on Ingredients

Name	CAS	%
lead	7439-92-1	>99
OSHA PEL TWA: 0.05 mg/m ³ ; as Pb inorganic.	NIOSH REL TWA: 0.050 mg/m ³ . IDLH Level 100 mg/m ³ (as Pb).	DFG (Germany) MAK TWA: 0.1 mg/m ³ ; PEAK: 8 mg/m ³ ; measured as inhalable fraction of the aerosol; Excluding lead arsenate and lead chromate.
ACGIH TLV TWA: 0.05 mg/m ³ .		
EU OEL TWA: 0.1 mg/m ³ .		

Section 3 - Hazards Identification



Fire Diamond



HMIS	
3	Health
1	Flammability
0	Reactivity

ANSI Signal Word

Danger!



Poison

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Bluish-white, silvery, or gray metal. Cumulative poison. Chronic Effects: severe neurological effects, blood/kidney damage, sterility, decreased fertility, developmental damage to fetus. Possible cancer hazard.

Potential Health Effects

Target Organs: blood, central nervous system (CNS), peripheral nervous system, kidneys, gastrointestinal (GI) tract

Primary Entry Routes: inhalation, ingestion

Acute Effects

Inhalation: The dust may be discomfoting to the upper respiratory tract and may be harmful if inhaled.

Eye: The dust may be discomfoting to the eyes.

Skin: The material may be mildly discomfoting to the skin.

Prolonged exposure may cause skin reactions.

Skin absorption is not considered a significant route of exposure.

Ingestion: The material is moderately discomfoting to the gastrointestinal tract and may be harmful if swallowed.

In rats intestinal lead absorption is bidirectional and does not follow a linear relationship with oral dose.

Acute effects of exposure are generally minor because of its relative insolubility and physical form. Unusual instances of exposure have been reported in inadequately ventilated indoor firing ranges (as fume), in the application of surma, a mascara-like cosmetic agent, to the conjunctival surfaces in Asian countries and in lead-smelting and associated occupations.

In humans lead metabolism fits into a three compartment model. The first compartment in which lead has a half-life of about 35 days includes the blood; it receives blood from the gut and delivers some of it to the urine and communicates with the other two pools. The second compartment in which lead has a similar half-life includes the soft tissues which contain about half the blood level; they share lead with hair, nails, sweat, saliva, bile and other digestive secretions. The skeleton is the third compartment and contains the vast bulk of the total body burden, possesses a very long half-life and demonstrates a difference between the dense and less dense components to bind lead.

Carcinogenicity: NTP - Not listed; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Not listed.

Chronic Effects: Symptoms of exposure include headache, fatigue, sleep disturbances, abdominal pains and decreased appetite. Overexposure to lead in the form of dust has toxic effects on the lungs and kidneys and on the nervous system resulting in mental disturbances and anemia.

Skin absorption is not considered to be a significant route of exposure.

Worker exposure to lead must be kept to a minimum, especially in cases where lead is worked at temperatures whereby lead vapors are evolved e.g. metal refining.

Lead is an accumulative poison and exposure even to small amounts can raise the body's content to toxic levels. Potential adverse effects on the offspring of pregnant workers have been cited in the literature.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Rinse mouth out with plenty of water.

Seek medical attention if irritation or discomfort persist.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: 1. Gastric acids solubilize lead and its salts and lead absorption occurs in the small bowel.

2. Particles of less than 1µm diameter are substantially absorbed by the alveoli following inhalation.

3. Lead is distributed to the red blood cells and has a half-life of 35 days.

It is subsequently redistributed to soft tissue & bone-stores or eliminated. The kidney accounts for 75% of daily lead loss; integumentary and alimentary losses account for the remainder.

4. Neurasthenic symptoms are the most common symptoms of intoxication.

Lead toxicity produces a classic motor neuropathy.

Acute encephalopathy appears infrequently in adults.

Diazepam is the best drug for seizures.

5. Whole-blood lead is the best measure of recent exposure; free erythrocyte protoporphyrin (FEP) provides the best screening for chronic exposure. Obvious clinical symptoms occur in adults when whole-blood lead exceeds 80 µg/dL.

6. British Anti-Lewisite is an effective antidote and enhances fecal and urinary excretion of lead. The onset of action of BAL is about 30 minutes and most of the chelated metal complex is excreted in 4-6 hours, primarily in the bile.

Adverse reaction appears in up to 50% of patients given BAL in doses exceeding 5 mg/kg. CaNa₂EDTA has also been used alone or in concert with BAL as an antidote.

D-penicillamine is the usual oral agent for mobilization of bone lead; its use in the treatment of lead poisoning remains investigational.

2-3-dimercapto-1-propanesulfonic acid (DMPS) and dimercaptosuccinic acid (DMSA) are water soluble analogues of BAL and their effectiveness is undergoing review.

As a rule, stop BAL if lead decreases below 50 µg/dL; stop CaNa₂EDTA if blood lead decreases below 40 µg/dL or urinary lead drops below 2 mg/24 hrs.

BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

<u>Determinant</u>	<u>Index</u>	<u>Sampling Time</u>	<u>Comments</u>
Lead in blood	50 ug/100 mL	Not Critical	B
Lead in urine	150 ug/gm creatinine	Not critical	B
Zinc Protoporphyrin in blood	250 ug/100 mL erythrocytes OR 100 ug/100 mL blood	After 1 month exposure	B

B: Background levels occur in specimens collected from subjects NOT exposed.

Section 5 - Fire-Fighting Measures

Flash Point: Not available; probably noncombustible

Autoignition Temperature: Not applicable

LEL: Not applicable

UEL: Not applicable

Extinguishing Media: There is no restriction on the type of extinguisher which may be used.

General Fire Hazards/Hazardous Combustion Products: Noncombustible.

Not considered to be a significant fire risk; however, containers may burn.

Moderate fire hazard, in the form of dust, when exposed to heat or flames.

Decomposition products may include toxic lead dust and lead oxide fumes.

Fire Incompatibility: Incompatible with strong acids, oxidants, ammonium nitrate, chlorine trifluoride and sodium azide.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

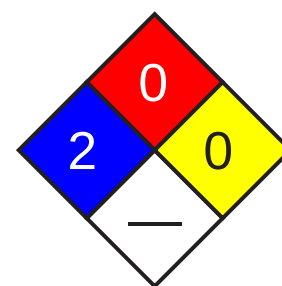
Use fire fighting procedures suitable for surrounding area.

Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways.

If safe to do so, remove containers from path of fire.

Cool fire-exposed containers with water spray from a protected location.

Equipment should be thoroughly decontaminated after use.



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Clean up all spills immediately. Avoid contact with skin and eyes.

Wear protective clothing, gloves, safety glasses and dust respirator.

Use dry clean-up procedures and avoid generating dust.

Vacuum up.

Place spilled material in clean, dry, sealable, labeled container.

Large Spills: Clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

Control personal contact by using protective equipment and dust respirator.

Prevent spillage from entering drains, sewers or waterways.

Recover product wherever possible. Avoid generating dust. Sweep / shovel up.

If required, wet with water to prevent dusting.

Put residues in labeled plastic bags or other containers for disposal.

Wash area down with large quantity of water and prevent runoff into drains.

If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Limit all unnecessary personal contact.

Wear protective clothing when risk of exposure occurs.

Use in a well-ventilated area.

Avoid contact with incompatible materials.

When handling, DO NOT eat, drink or smoke.

Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling.

Work clothes should be laundered separately.

Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Recommended Storage Methods: Check that containers are clearly labeled.

Packaging as recommended by manufacturer.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: General exhaust is adequate under normal operating conditions.

If risk of overexposure exists, wear NIOSH-approved dust respirator.

Correct fit is essential to obtain adequate protection.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; or as required, chemical goggles.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Impervious gloves; rubber gloves.

Rubber boots.

Protective footwear.

Respiratory Protection:

Exposure Range >0.05 to 0.5 mg/m³: Air Purifying, Negative Pressure, Half Mask

Exposure Range >0.5 to 2.5 mg/m³: Air Purifying, Negative Pressure, Full Face

Exposure Range >2.5 to 50 mg/m³: Powered Air Purifying Respirator, Half or Full Facepiece or Hood

Exposure Range >50 to 100 mg/m³: Supplied Air Respirator with Full Facepiece, Hood, Helmet, or Suit, operated in a Positive Pressure Mode

Exposure Range >100 to unlimited mg/m³: Self-contained Breathing Apparatus, Pressure Demand, Full Face Cartridge Color: magenta (P100)

Note: (29CFR 1910.1025) for general industry

Other: Overalls. Eyewash unit. Skin cleansing cream.

Provide adequate ventilation in warehouse or closed storage areas.

General and local exhaust ventilation usually required to maintain airborne dust levels to safety levels.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Bluish-white, silvery-gray metal. Malleable, lustrous when freshly cut and tarnishes when exposed to air. Reacts with strong acids like nitric acid, sulphuric or hydrochloric acid. Attacked by water in presence of oxygen. Poor electrical conductor. Lead fumes are formed at temperatures above 500-700 °C.

Physical State: Divided solid

pH: Not applicable

Vapor Pressure (kPa): 0.24 at 1000 °C

pH (1% Solution): Not applicable.

Vapor Density (Air=1): Not applicable

Boiling Point: 1740 °C (3164 °F)

Formula Weight: 207.19

Freezing/Melting Point: 327.4 °C (621.32 °F)

Specific Gravity (H₂O=1, at 4 °C): 11.34

Volatile Component (% Vol): Not applicable

Evaporation Rate: Not applicable

Water Solubility: Insoluble in water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Hazardous polymerization will not occur. Stable under normal storage conditions.

Storage Incompatibilities: Avoid storage with strong acids, oxidants, ammonium nitrate, chlorine trifluoride and sodium azide.

Section 11 - Toxicological Information

Toxicity

Oral (woman) TD_{Lo}: 450 mg/kg/6 years

Inhalation (human) TC_{Lo}: 0.01 mg/m³

WARNING: Lead is a cumulative poison and has the potential to cause abortion and intellectual impairment to unborn children of pregnant workers.

Irritation

Nil Reported

See RTECS OF 7525000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released or deposited on soil, it will be retained in the upper 2-5 cm of soil, especially soils with at least 5% organic matter or a pH 5 or above. Leaching is not important under normal conditions although there is some evidence to suggest that it is taken up by some plants. Generally, the uptake from soil into plants is not significant. It is expected to slowly undergo speciation to the more insoluble sulfate, sulfide, oxide, and phosphate salts. It enters water from atmospheric fallout, runoff or wastewater; little is transferred from natural ores. It is a stable metal and adherent films of protective insoluble salts form that protect the metal from further corrosion. That which dissolves tends to form ligands. It is effectively removed from the water column to the sediment by adsorption to organic matter and clay minerals, precipitation as insoluble salt (the carbonate or sulfate, sulfide), and reaction with hydrous iron and manganese oxide. Under most circumstances, adsorption predominates. It does not appear to bioconcentrate significantly in fish but does in some shellfish such as mussels. When released to the atmosphere, it will generally be in dust or adsorbed to particulate matter and subject to gravitational settling and be transformed to the oxide and carbonate.

Ecotoxicity: LC₅₀ Japanese quail (*Coturnix japonica*), males or females, 14 days old, oral (5-day ad libitum in diet) >5,000 ppm; at 1000, 2236 & 5000 onset of toxic signs began at 7, 7 & 7 days and remitted at 11, 11 & 12 days, respectively, no mortality was observed; control references were dieldrin & dicrotophos; corn oil diluent was added to diet at ratio of 2:98 by wt; (extreme concentrations: 1,000-5,000 ppm)

BCF: freshwater fish 1.38 to 1.65

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options.
Follow applicable federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: None

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed

CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 10 lb (4.535 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

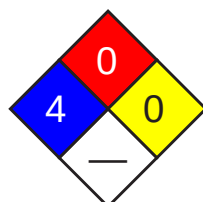
61

Material Name: Mercury **CAS Number:** 7439-97-6
Chemical Formula: Hg
EINECS Number: 231-106-7
ACX Number: X1002555-9
Synonyms: COLLOIDAL MERCURY; HYDRARGYRUM; KWIK; LIQUID SILVER; MERCURE; MERCURIO; MERCURY; MERCURY (ELEMENTAL); MERCURY METAL; COLLOIDAL MERCURY; MERCURY, METALLIC; METALLIC MERCURY; QUECKSILBER; QUICK SILVER; QUICKSILVER; QUICKSILVER SYNONYMS OF; RTEC
Derivation: Obtained by roasting cinnabar (mercury sulfide) and purified by distillation, or as a by-product of gold mining.
General Use: Used in agricultural poisons, anti-fouling paint, dental amalgams, mining amalgamation (to remove gold and other metals from ore), thermometers, barometers, dry cell batteries, chlorine and caustic soda production, electrical apparatus, and as a neutron absorber in nuclear power plants.

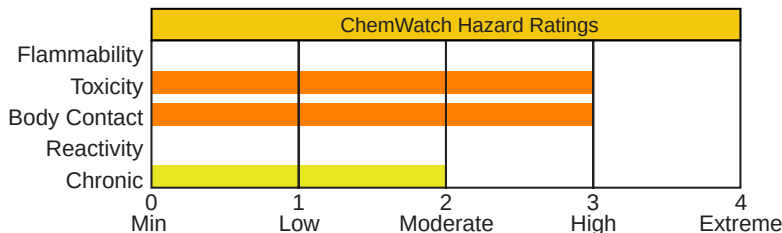
Section 2 - Composition / Information on Ingredients

Name	CAS	%
Mercury		ca 100% wt
OSHA PEL Ceiling: 0.1 mg/m ³ .	NIOSH REL Hg Vapor: TWA: 0.05 mg/m ³ ; skin; Ceiling: 0.1 mg/m ³ ; skin.	DFG (Germany) MAK TWA: 0.1 mg/m ³ ; PEAK: 0.8 mg/m ³ ; danger of sensitization of the skin.
ACGIH TLV TWA: 0.025 mg/m ³ ; skin.	IDLH Level 10 mg/m ³ (as Hg).	

Section 3 - Hazards Identification



Fire Diamond



ANSI Signal Word

Danger!

HMIS	
4	Health
0	Flammability
0	Reactivity



Poison



Corrosive

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Heavy silver-white liquid metal; odorless. Corrosive. Poison. Other Acute Effects: irreversible nervous system damage.

Potential Health Effects

Target Organs: Central nervous system, eyes, skin, respiratory system, liver, kidneys.

Primary Entry Routes: Inhalation, eye and skin contact/absorption.

Acute Effects The onset of signs and symptoms usually is prompt, but may be delayed up to 12 hr.

Systemic Effects by all routes: Nausea, vomiting, abdominal pain, diarrhea, excessive salivation, sweating, headache, giddiness, vertigo (dizziness), weakness, blurring or dimness of vision, miosis or mydriasis (dilatation of the pupils), tearing, bradycardia (slow heart beat), tachycardia (fast heart beat), cardiac irregularities (arrhythmias, complete heart block), loss of muscle coordination, slurred speech, muscle twitching (particularly tongue and eyelids), generalized profound weakness, confusion, disorientation, drowsiness, difficulty in breathing, excessive secretion of saliva and mucus, cyanosis, rales, high blood pressure, random jerky movements, incontinence, convulsions, coma, and death due to respiratory paralysis.

Inhalation: Exposure to high vapor concentrations can cause severe respiratory damage. Other symptoms include wakefulness, muscle weakness, anorexia, headache, ringing in the ear, headache, diarrhea, liver changes, fever, gingivitis, chest pain, difficulty breathing, cough, inflammation of the mouth (stomatitis), salivation, bronchitis, and pneumonitis. Acrodynia (pink or Swifts disease), characterized by redness and peeling of the skin on the toes and fingers, was commonly seen in children in the 1950s and is still *infrequently* seen in workers.

Eye: Irritation and corrosion.

Skin: Skin can become severely irritated if allowed to remain in contact with mercury. Skin absorption will occur at 2.2% of the rate of absorption through the lungs.

Ingestion: Mercury generally passes through the digestive tract uneventfully. However, large amounts may get caught up in the intestine and require surgical removal. If an abscess or other perforation is present along the digestive tract, absorption into the blood stream with subsequent mercury poisoning is possible.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: Central nervous system disorders.

Chronic Effects: Chronic exposure appears more common than acute and is primarily associated with central nervous system damage which can be permanent (ex. paresthesia of the hands, lips, feet). Early signs of toxicity include weakness, fatigue, anorexia, weight loss, and gastrointestinal disturbances. If exposure levels are high, characteristic tremors of the fingers, eyelids, and lips occur with progression to generalized tremors of the entire body. Psychic disorders are noticeable and characterized by behavior and personality changes, increased excitability, memory loss, insomnia, and depression. In severe cases, delirium and hallucinations may occur. Kidney damage is observed with oliguria (decreased urine output) progressing to anuria (urine cessation) and may require dialysis. The cornea and lens of the eyes may take on a brownish discoloration and the extraocular muscles may be damaged. This syndrome has been termed *Asthenic-Vegetative Syndrome* or *Micromercurialism*. Chronic symptoms occur increasingly with exposures to 0.1 mg/m³ or higher. **Mutation:** Aneuploidy and other chromosomal aberrations have been observed in the lymphocytes from whole blood cultures in workers exposed to mercury. **Reproductive:** Mercury has been detected in stillborn babies of women treated with mercury for syphilis. In a study of six men acutely exposed (occupationally) to mercury levels as high as 44 mg/m³, all suffered impaired sexual function. Repeated skin contact may cause allergic dermatitis in some individuals.

Note: Spilled mercury will release sufficient vapor over time to produce chronic poisoning.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water and then wash exposed area with soap. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. In general, mercury will pass through the digestive tract uneventfully.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: BEI: blood (15 µg/L), urine: (35 µg/g creatinine). Extremely high urine levels of 0.5 to 0.85 mg Hg/L are indicative of polyneuropathy. 0.4 to 22 µg/L is reported to be the human lethal blood level. Obtain urinalysis including at a minimum: albumin, glucose, and a microscopic examination of centrifuged sediment. Use BAL or 2, 3-dimercaptosuccinic acid as chelators. Do not use calcium sodium EDTA because of nephrotoxicity. An electromyograph may determine extent of nerve dysfunction. It has been noted that exposure to mercury may predispose persons to development of carpal tunnel syndrome.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: Nonflammable

Autoignition Temperature: Nonflammable

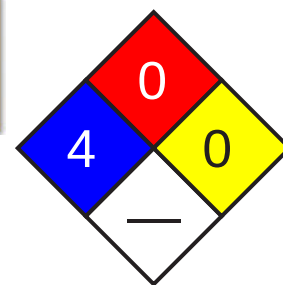
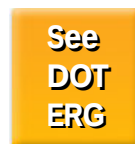
LEL: None reported.

UEL: None reported.

Extinguishing Media: Use agents suitable for surrounding fire.

General Fire Hazards/Hazardous Combustion Products: Toxic mercury vapor and mercuric oxide.

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.



Fire Diamond

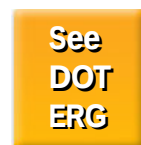
Section 6 - Accidental Release Measures

Spill/Leak Procedures: Keep a mercury spill kit readily available in areas where mercury is used. Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind.

Small Spills: Small and Large Spills: Follow instructions on mercury spill kit. Most kits come with an aspiration-driven vacuum trap with a mercury "sweeper" (copper or copper-plated brush). Wash spill area with a dilute calcium sulfide or nitric acid solution. If spill cannot be taken up readily, dust the top of the spill with flowers of sulfur or preferably, calcium polysulfide. This will produce a surface coating of mercury sulfide which will reduce mercury vapor dispersion into the air.

Large Spills: No data found.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).



Section 7 - Handling and Storage

Handling Precautions: Use appropriate PPE when working with mercury. *Do not* use on porous work surfaces (wood, unsealed concrete, etc.) to prevent spills from lodging in cracks.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in a cool, dry, well-ventilated area away from heat and incompatibles (Sec. 10). Store on non-porous floors and wash them regularly with a dilute calcium sulfide solution. Because mercury will form amalgamations with most metals except iron, metal shelves should be painted with a sufficiently thick coating to prevent this from happening.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Wherever possible, enclose processes to prevent mercury vapor dispersion into work area.

Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2).

Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Consider pre-placement and periodic medical exams of exposed workers with emphasis on the skin, eyes, central nervous system, liver, and kidneys.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets made of butyl rubber, nitrile rubber, fluorocarbon rubber, neoprene rubber, polyvinyl chloride, chlorinated polyethylene, or polycarbonate to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For $\leq 0.5 \text{ mg/m}^3$, use any chemical cartridge respirator with cartridges providing protection against mercury and equipped with an ESLI (end of service life indicator), any SCBA, or any SAR (supplied-air respirator). For $\leq 1.25 \text{ mg/m}^3$, use any SAR operated in continuous-flow mode, any PAPR (powered, air-purifying respirator) with an ESLI. For $\leq 2.5 \text{ mg/m}^3$, use any SCBA or SAR with a full facepiece, any SAR with a tight-fitting facepiece and operated in continuous-flow mode, or any chemical cartridge respirator with a full facepiece, chemical cartridges providing protection against mercury, and equipped with an ESLI. For $\leq 28 \text{ mg/m}^3$, use any SAR operated in pressure-demand or other positive-pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA with full facepiece and operated in pressure-demand or other positive pressure mode. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Silvery-white, odorless.

Physical State: Liquid metal

Vapor Pressure (kPa): 0.0018 mm Hg at 77 °F (25 °C)

Formula Weight: 200.59

Density: 13.534 g/cm³ at 77 °F (25 °C)

Boiling Point: 674.09 °F (356.72 °C)

Freezing/Melting Point: -37.97 °F (-38.87 °C)

Viscosity: 15.5 mP at 77 °F (25 °C)

Surface Tension: 484 dyne/cm at 77 °F (25 °C)

Critical Temperature: 2664 °F (1462 °C)

Critical Pressure: 1587 atm

Water Solubility: 0.28 µmol/L at 77 °F (25 °C)

Other Solubilities: Soluble in boiling sulfuric acid, nitric acid (reacts); slightly in lipids, and 2.7 mg/L in pentane. Insoluble in alcohol, ether, cold sulfuric acid, hydrogen bromide, and hydrogen iodide.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Mercury does not tarnish at ordinary temperatures but when heated to near its boiling point, it slowly oxidizes to mercuric oxide. Hazardous polymerization does not occur. Exposure to high temperatures, metal surfaces or incompatibles.

Storage Incompatibilities: Mercury forms alloys (amalgamates) with most metals except iron. It is incompatible with oxidizers such as bromine, 3-bromopropyne, methylsilane + oxygen, chlorine, chlorine dioxide, nitric acid, or peroxyformic acid; tetracarbonyl nickel + oxygen, alkynes + silver perchlorate, ethylene oxide, acetylenic compounds (explosive), ammonia (explosive), boron phosphodiiodide, methyl azide, nitromethane, and ground sodium carbide.

Hazardous Decomposition Products: Thermal oxidative decomposition of mercury can produce mercuric oxide.

Section 11 - Toxicological Information

Acute Oral Effects:

Man, oral, TD_{Lo}: 43 mg/kg caused tremor and jaundice or other liver changes.

Acute Inhalation Effects:

Woman, inhalation, TC_{Lo}: 150 µg/m³/46 days caused anorexia, diarrhea, and wakefulness.

Man, inhalation, TC_{Lo}: 44300 µg/m³/8 hr caused muscle weakness, liver changes, and increased body temperature.

Acute Skin Effects:

Man, skin, TD_{Lo}: 129 mg/kg for 5 continuous hours caused ringing in the ears, headache, and allergic dermatitis.

Other Effects:

Rat, inhalation: 1 mg/m³/24 hr for 5 continuous weeks caused proteinuria.

Rat, inhalation: 890 ng/m³/24 hr for 16 weeks prior to mating had an effect on spermatogenesis.

See RTECS OV4550000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Mercury is expected to volatilize rapidly when deposited on soil surfaces. Once in the air, it can be transported long distances before being redeposited on soil or in water. In water, mercury appears to bind to particulates where it eventually becomes deposited on the bed sediment. In general, mercury entering the environment can be deposited and revolatilized several times.

Ecotoxicity: Catfish, LC₅₀ = 0.35 mg/L/96 hr; mollusk (*Modiolus carvalhoi*), LC₅₀ = 0.19 ppm/96 hr; tadpole (*Rana hexadactyla*), LC₅₀ = 0.051 ppm/96 hr. Mercury is transformed to methyl mercury by bacteria in the environment and undergoes bioaccumulation readily. BCF for freshwater fish = 63,000; for saltwater fish = 10,000; and for marine and freshwater invertebrates = 100,000.

Section 13 - Disposal Considerations

Disposal: Incineration is *not* an appropriate disposal method. Wastewater may be treated by addition of chlorine to oxidize the mercury to its ionic state. The water can then be passed through an absorbent (an activated charcoal concentrate with a sulfur coating or peanut shell charcoal) to collect the ionic mercury, followed by distillation to recover the mercury. Sodium borohydride, a reducing agent, can be used to precipitate mercury from waste solutions. Bioremediation, using *Pseudomonas putida*, has also been suggested. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information**DOT Hazardous Materials Table Data (49 CFR 172.101):****Shipping Name and Description:** Mercury**ID:** UN2809**Hazard Class:** 8 - Corrosive material**Packing Group:** III - Minor Danger**Symbols:** A W**Label Codes:** 8 - Corrosive**Special Provisions:****Packaging:** **Exceptions:** 164 **Non-bulk:** 164 **Bulk:** 240**Quantity Limitations:** **Passenger aircraft/rail:** 35 kg **Cargo aircraft only:** 35 kg**Vessel Stowage:** **Location:** B **Other:** 40, 97**Section 15 - Regulatory Information****EPA Regulations:****RCRA 40 CFR:** Listed U151 Toxic Waste**CERCLA 40 CFR 302.4:** Listed per RCRA Section 3001, per CWA Section 307(a), per CAA Section 112 1 lb (0.454 kg)**SARA 40 CFR 372.65:** Listed**SARA EHS 40 CFR 355:** Not listed**TSCA:** Listed**Section 16 - Other Information**

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Methylene Chloride

CAS Number: 75-09-2

Chemical Formula: CH₂Cl₂

EINECS Number: 200-838-9

ACX Number: X1000032-3

Synonyms: AEROTHENE MM; CHLORURE DE METHYLENE; DCM; DICHLOROMETHANE; METHANE DICHLORIDE; METHANE,DICHLORO-; METHYLENE BICHLORIDE; METHYLENE CHLORIDE; METHYLENE DICHLORIDE; METHYLENUM CHLORATUM; METYLENU CHLOREK; NARKOTIL; R 30; R30 (REFRIGERANT); SOLAESTHIN; SOLMETHINE

Derivation: Produced by chlorination of methane.

General Use: Used as a solvent for cellulose acetate, adhesives, food processing, and pharmaceuticals; in degreasing and cleaning fluids, paint and varnish removers, decaffeination of coffee, in propellant mixtures for aerosols; as a blowing agent in foams, dewaxing agent, component of fire extinguishing compound, chemical intermediate, low temperature heat-transfer medium, and as a fumigant. Formerly used as an anesthetic.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Methylene chloride	75-09-2	ca < 100% vol

Trace Impurities: Stabilizers may be added such as: amines, 4-cresol, hydroquinone, methanol, 2-methyl-2-ene, 1-naphthol, nitromethane + 1,4-dioxane, phenol, resorcinol, and thymol.

OSHA PEL

TWA: 25 ppm; STEL: 125 ppm.

NIOSH REL

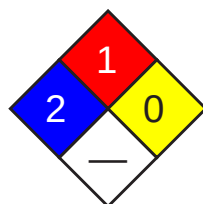
ACGIH TLV

TWA: 50 ppm.

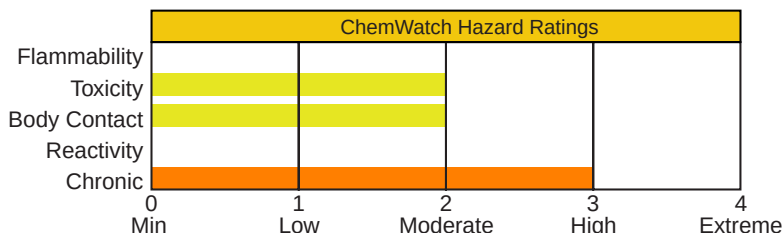
IDLH Level

2300 ppm.

Section 3 - Hazards Identification



Fire Diamond



HMIS	
2	Health
1	Flammability
0	Reactivity

ANSI Signal Word

Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless, volatile liquid; sweet odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: narcosis at high concentrations. Can form flammable mixtures with air, explosive when mixed with oxygen.

Potential Health Effects

Target Organs: Eyes, skin, central nervous system (CNS), cardiovascular system (CVS), blood.

Primary Entry Routes: Inhalation, skin and eye contact.

Acute Effects Methylene chloride will cross the placenta. The estimated lethal dose is 0.5 to 5 mL/kg. Although methylene chloride has a distinct sweetish odor, it is not recognized at levels low enough to protect from overexposure.

Inhalation: Symptoms include headache, giddiness, irritability, nausea, stupor, numbness and tingling of limbs, fatigue, anemia and polymorphonuclear leukocytosis, digestive disturbances, and neurasthenic disorders (emotional and psychic disorders characterized by easy fatigue, lack of motivation, feelings of inadequacy, and psychosomatic symptoms). Many symptoms are attributed to the metabolism of methylene chloride to carbon monoxide in the body. The carbon monoxide forms carboxyhemoglobin in the blood, which unlike hemoglobin, does not have the ability to carry oxygen. This lack of oxygen leads to CNS and CVS problems. However, CNS effects have been seen in persons without a significantly elevated blood carbon monoxide level.

Eye: Exposure to vapors produces irritation, tearing, and conjunctivitis. Direct contact with the liquid causes severe pain, but permanent damage does not occur.

Skin: Contact is irritating and can be painful (burns) if confined to skin (i.e. trapped under gloves or clothing). Methylene chloride can be absorbed through the skin to cause systemic effects.

Ingestion: Expected to cause gastrointestinal irritation, nausea, vomiting, and systemic effects.

Carcinogenicity: NTP - Class 2B, Reasonably anticipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A3, Animal carcinogen; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Class B, Justifiably suspected of having carcinogenic potential.

Medical Conditions Aggravated by Long-Term Exposure: Skin and cardiovascular disorders.

Chronic Effects: Repeated skin contact can cause dermatitis. Liver disease has been reported. *Case Reports:* 1 yr exposure caused toxic encephalopathy (toxicity of the brain) with audio and visual delusions and hallucinations; 3 yr exposure to 300 to 1000 ppm caused memory loss, intellectual impairment, and balance disturbances.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air, administer 100% humidified, supplemental oxygen and support breathing.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult an ophthalmologist if pain or irritation persist.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting with Ipecac syrup. If vomiting does not occur, the decision to perform gastric lavage should be made.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Lethal blood level = 280 mg/L. Biological monitoring: carbon monoxide in expired air (nonsmokers only). Recently, methylene chloride concentrations in urine have been found to correlate well to concentrations in air.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: Methylene chloride does not have a flash point by standard tests. However, it does form flammable mixtures with air.

Autoignition Temperature: 1033 °F (556 °C)

LEL: 15.5% (in oxygen); **LFL:** 12% v/v

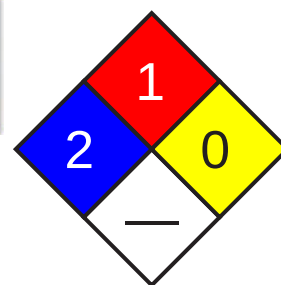
UEL: 66.4% (in oxygen); **UFL:** 19% v/v

Extinguishing Media: For small fires, use dry chemical or carbon dioxide. For large fires, use water spray, fog, or regular foam.

General Fire Hazards/Hazardous Combustion Products: Hydrogen chloride, carbon monoxide and phosgene. Creates an explosion hazard if allowed to enter a confined space. Container may explode in heat of fire.

Fire-Fighting Instructions: Apply cooling water to sides of tanks until well after fire is out. Stay away from ends of tanks. Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighters' protective clothing provides only limited protection.

See
DOT
ERG



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off ignition sources. Cleanup personnel need to protect against inhalation and skin/eye contact.

Small Spills: Take up with earth, sand, vermiculite, or other absorbent, noncombustible material.

Large Spills: Dike far ahead of spill for later reclamation or disposal. Do not release into sewers or waterways. Damp mop any residue.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).



See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: Do not use near ignition sources. Wear appropriate PPE. Do not use plastic or rubber hose for unloading trucks or tank cars unless the materials have been tested and approved for methylene chloride service. Never eat, drink, or smoke in work areas. Practice good personal hygiene after using methylene chloride, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in a cool, dry, well-ventilated area away from heat, ignition sources, and incompatibles (Sec. 10). To minimize decomposition, all storage containers should be galvanized or lined with a phenolic coating. Indoor storage tanks should have vents piped outdoors to prevent vapors from escaping into work areas. Prevent moisture from entering tanks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Do not use closed circuit rebreathing systems employing soda lime or other carbon dioxide absorber because of formation of toxic compounds capable of producing cranial nerve paralysis. To prevent static sparks, electrically ground and bond all equipment used with and around methylene chloride. Provide general or local exhaust ventilation systems to maintain airborne levels below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on skin, liver, CNS, CVS, and blood. A complete blood count should be performed and carboxyhemoglobin levels should be determined periodically. Any level above 5% should prompt investigation of employee and workplace to determine the cause (smokers will already have an increased level of carboxyhemoglobin and are at increased risk). Use less hazardous solvents where possible.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Polyvinyl alcohol and Viton laminated with Neoprene are suitable materials for PPE. Natural rubber, synthetic rubbers, and polyvinyl chloride *do not* provide protection against methylene chloride. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For any detectable concentration, use any SCBA or supplied-air respirator (with auxiliary SCBA) with a full facepiece and operated in pressure demand or other positive-pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove methylene chloride from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless; volatile with a sweet odor.

Physical State: Liquid

Odor Threshold: 540 to 2160 mg/m³

Vapor Pressure (kPa): 350 mm Hg at 68 °F (20 °C);
440 mm Hg at 77 °F (25 °C)

Bulk Density: 11.07 lb/gal at 68 °F (20 °C)

Formula Weight: 84.9

Specific Gravity (H₂O=1, at 4 °C): 1.33 at 15 °C

Refractive Index: 1.4244 at 68 °F (20 °C)

Boiling Point: 104 °F (40 °C)

Freezing/Melting Point: -142 °F (-97 °C)

Viscosity: 0.430 cP at 68 °F (20 °C)

Surface Tension: 0.5 to 2.3 g/L (in oxygen)

Ionization Potential (eV): 11.32 eV

Critical Temperature: 473 °F (245 °C)

Critical Pressure: 60.9 atm

Water Solubility: 2%

Other Solubilities: Soluble in alcohol, acetone, chloroform, carbon tetrachloride, ether, and dimethylformamide.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Methylene chloride is stable at room temperature in closed containers under normal storage and handling conditions. Tends to carbonize when vapor contacts steel or metal chlorides at high temperatures 572 to 842 °F (300 to 450 °C). Hazardous polymerization does not occur. Exposure to heat, ignition sources, and incompatibles.

Storage Incompatibilities: Include aluminum, lithium, sodium, aluminum bromide, azides, dimethyl sulfoxide + perchloric acid, N-methyl-N-nitrosourea + potassium hydroxide, sodium-potassium alloy, potassium *t*-butoxide, dinitrogen pentoxide, dinitrogen tetroxide, nitric acid, and oxidizers. Methylene chloride will attack some forms of plastic, rubber, and coatings. Corrodes iron, some stainless steel, copper, and nickel.

Hazardous Decomposition Products: Hydrogen chloride, carbon monoxide and phosgene.

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral, LD₅₀: 1600 mg/kg.

Human, oral, LD₅₀: 357 mg/kg caused somnolence, paresthesia, and convulsions or effect on seizure threshold.

Acute Inhalation Effects:

Human, inhalation, TC_{Lo}: 500 ppm/8 hr caused euphoria.

Irritation Effects:

Rabbit, eye: 162 mg caused moderate irritation.

Rabbit, skin: 810 mg/24 hr caused severe irritation.

Other Effects:

Rat, oral: 1275 mg/kg caused DNA damage.

Rat, inhalation: 8400 ppm/6 hr/13 weeks (intermittently) caused changes in liver weight.

Rat, inhalation: 3500 ppm/2 yr (intermittently) caused endocrine tumors.

Mutagenicity - Human, fibroblast: 5000 ppm/1 hr (continuously) caused DNA inhibition.

Human, inhalation, TC_{Lo}: 500 ppm/1 yr (intermittently) caused altered sleep time, somnolence, and change in heart rate.

See RTECS PA8050000, for additional data.

Section 12 - Ecological Information

Environmental Fate: In air, methylene chloride degrades by reaction with photochemically-produced hydroxyl radicals (half-life = a few months) but does not undergo *direct* photolysis. Degradation products include carbon monoxide, carbon dioxide, and phosgene. In water, it is removed primarily by evaporation (est. half-life = 3 to 5.6 hr under moderate mixing conditions). Some may biodegrade but it is not expected to adsorb to sediment or bioconcentrate. If released to soil most methylene chloride will rapidly evaporate. Some may leach through soil. Methylene chloride will adsorb to peat moss but not to sand.

Ecotoxicity: *Pimephales promelas* (fathead minnow), LC₅₀ = 193 mg/L/96 hr; *Lepomis macrochirus* (bluegill), LC₅₀ = 230 mg/L/24 hr; *Poecilia reticulata* (guppies), LC₅₀ = 294 ppm/14 days. Cytotoxic to plants.

Octanol/Water Partition Coefficient: log K_{ow} = 1.25

Section 13 - Disposal Considerations

Disposal: Pour on sand or earth at a safe distance/location from occupied areas and allow to evaporate (most is transformed to carbon monoxide). A good candidate for liquid injection, rotary kiln, or fluidized bed incineration. Investigate biodegradation: methylene chloride is reported to completely biodegrade under aerobic conditions with sewage seed or activated sludge between 6 hrs. and 7 days. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Dichloromethane

ID: UN1593

Hazard Class: 6.1 - Poisonous materials

Packing Group: III - Minor Danger

Symbols:

Label Codes: 6.1 - Poison or Poison Inhalation Hazard if inhalation hazard, Zone A or B

Special Provisions: IB3, N36, T7, TP2

Packaging: Exceptions: 153 **Non-bulk:** 203 **Bulk:** 241

Quantity Limitations: **Passenger aircraft/rail:** 60 L **Cargo aircraft only:** 220 L

Vessel Stowage: **Location:** A **Other:**



Section 15 - Regulatory Information**EPA Regulations:****RCRA 40 CFR:** Listed U080 Toxic Waste**CERCLA 40 CFR 302.4:** Listed per RCRA Section 3001, per CWA Section 307(a) 1000 lb (453.5 kg)**SARA 40 CFR 372.65:** Listed**SARA EHS 40 CFR 355:** Not listed**TSCA:** Listed**Section 16 - Other Information**

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Naphthalene

CAS Number: 91-20-3

Chemical Formula: C₁₀H₈

EINECS Number: 202-049-5

ACX Number: X1001294-7

Synonyms: ALBOCARBON; CAMPHOR TAR; DEZODORATOR; FAULDING NAPHTHALENE FLAKES; MIGHTY 150; MIGHTY RD1; MOTH BALLS; MOTH FLAKES; MOTHBALLS; NAFTALEN; NAPHTHALENE; NAPHTHALIN; NAPHTHALINE; NAPHTHENE; TAR CAMPHOR; WHITE TAR

Derivation: From coal tar; from petroleum fractions after various catalytic processing operations.

General Use: Used as a moth repellent, an antiseptic, toilet bowl deodorant, heat transfer agent, fungicide, smokeless powder, cutting fluid, lubricant, wood preservative; an intermediate for naphthol, phthalic anhydride, chlorinated naphthalenes, Tertralin, Decalin, naphthyl and naphthol derivatives, and dyes; in synthetic resins, synthetic tanning, textile chemicals, scintillation counters, and emulsion breakers.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Naphthalene	91-20-3	ca 100% wt.
Grade - By melting point, 165 °F (74 °C) min (crude) to greater than 174 °F (79 °C) (refined); scintillation 176-177 °F (80-81 °C)		

OSHA PEL

TWA: 10 ppm; 50 mg/m³.

NIOSH REL

TWA: 10 ppm (50 mg/m³); STEL: 15 ppm (75 mg/m³).

DFG (Germany) MAK

Skin.

ACGIH TLV

TWA: 10 ppm; STEL: 15 ppm; skin.

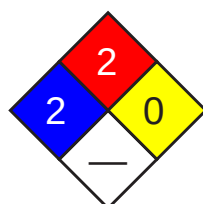
IDLH Level

250 ppm.

EU OEL

TWA: 10 ppm.

Section 3 - Hazards Identification



Fire Diamond

	ChemWatch Hazard Ratings				
Flammability	2	1	0	0	0
Toxicity	2	1	0	0	0
Body Contact	2	1	0	0	0
Reactivity	0	0	0	0	0
Chronic	0	0	0	0	0
	0 Min	1 Low	2 Moderate	3 High	4 Extreme

HMIS	
2	Health
2	Flammability
0	Reactivity

ANSI Signal Word

Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

White crystalline solid; "moth ball" or coal-tar odor. Irritating to eyes/skin/respiratory tract. Toxic by ingestion. Combustible solid. Dust may form explosive mixtures in air.

Potential Health Effects

Target Organs: Blood (red blood cell effects), eyes, skin, central nervous system (CNS), liver and kidneys

Primary Entry Routes: Inhalation, skin absorption, skin and/or eye contact

Acute Effects

Inhalation: Vapor inhalation causes headache, confusion, nausea, sometimes vomiting, loss of appetite, extensive sweating, dysuria (painful urination), hematuria (blood in the urine), and hemolysis (destruction of red blood cells).

Eye: Irritation, conjunctivitis, and corneal injury upon prolonged contact.

Skin: Irritation and hypersensitivity dermatitis.

Ingestion: Unlikely. However, ingestion causes irritation of the mouth and stomach, hemolytic anemia with hepatic and renal lesions and vesical congestion, kidney failure, hematuria, jaundice, depression of CNS, nausea, vomiting, abdominal pain, blue face, lips, or hands, rapid and difficult breathing, headache, confusion, excitement, malaise, fever, perspiration, urinary tract pain, dizziness, convulsions, coma, and death. Symptoms may appear 2 to 4 hours after exposure.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: Diseases of the blood, liver and kidneys; individuals with a hereditary deficiency of the enzyme glucose-6-phosphate dehydrogenase in red blood cells are particularly susceptible to the hemolytic properties of naphthalene metabolites.

Chronic Effects: May cause optical neuritis, corneal injuries, cataracts, kidney damage. There are two reports of naphthalene crossing the placenta in humans.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed. Contact a physician immediately if symptoms of systemic poisoning are present.

Eye Contact: Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult a physician or ophthalmologist if pain, irritation, swelling, or photophobia persist.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area thoroughly with soap and water. For reddened or blistered skin, consult a physician. Contact a physician immediately if symptoms of systemic poisoning are present.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the conscious and alert person drink 1 to 2 glasses of water, then induce vomiting. Contact a physician immediately.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Obtain baseline CBC, electrolytes, liver and renal function tests, glucose-6-phosphatase dehydrogenase level, urinalysis, and benzidine dipstick to check for hemoglobinuria. Urinary metabolite, 1-naphthol or mercapturic acid, may help confirm the diagnosis.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: 174 °F (79 °C) OC; 190 °F (88 °C) CC

Autoignition Temperature: 979 °F (526 °C)

LEL: 0.9% v/v

UEL: 5.9% v/v

Flammability Classification: Combustible solid

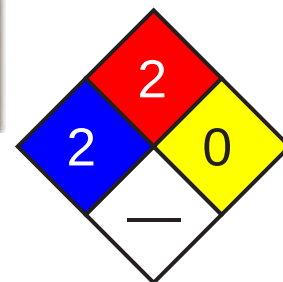
Extinguishing Media: Use dry chemical, foam, carbon dioxide (CO₂), or water spray.

Water or foam may cause frothing. Use water spray to keep fire-exposed containers cool.

General Fire Hazards/Hazardous Combustion Products: Toxic vapors including carbon monoxide. Volatile solid that gives off flammable vapors when heated. Dust may explode in air if an ignition source is provided.

Fire-Fighting Instructions: Move containers from the fire area if it can be done without risk. Otherwise cool fire-exposed containers until well after the fire is extinguished. Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Wear full protective clothing. Structural clothing is permeable, remain clear of smoke, water fall out, and water run off.

See
DOT
ERG



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources. Isolate and ventilate area, deny entry, stay upwind. Stop leak if you can do it without risk. Use spark-proof tools and explosion proof equipment. Cleanup personnel should wear personal protective equipment to protect against exposure.

Small Spills: Do not sweep! Carefully scoop up or vacuum (with a HEPA filter). Absorb liquid spill with an inert, noncombustible absorbent such as sand or vermiculite.

Large Spills: For large spills, dike far ahead of liquid spill for later disposal. Do not release into sewers or waterways.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: To avoid vapor inhalation use only with ventilation sufficient to reduce airborne concentrations to nonhazardous levels. Avoid skin and eye contact. Wear personal protective clothing and equipment to prevent any contact with skin and eyes (see Sec. 8). Practice good personal hygiene procedures to prevent inadvertently ingesting this material.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed, explosion-proof containers in a cool, well-ventilated area away from heat, ignition sources, and incompatibles (see Sec. 10). May be stored under nitrogen gas. Protect containers against physical damage. Use monitoring equipment to measure the extent of vapor present in any storage facility containing naphthalene because of potential fire and explosion hazards.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose operations to avoid vapor and dust dispersion into the work area. Ventilate at the site of chemical release. During the fractional distillation of naphthalene and in any operation entailing the heating or volatilization of naphthalene, enclosed apparatus should be employed. Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Educate workers about the health and safety hazards associated with naphthalene. Train in work practices which minimize exposure. Consider preplacement and periodic medical exams with emphasis on the eyes, skin, liver, kidneys, CBC (RBC count, WBC count, differential count of a stained smear, hemoglobin, and hematocrit), and urinalysis including at a minimum specific gravity, albumin, glucose, and a microscopic examination on centrifuged sediment.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Teflon is recommended. *Do not* use butyl rubber, natural rubber, neoprene or polyvinyl chloride. Wear chemical dust-proof safety goggles and face shield, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove naphthalene from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: White volatile flakes, cakes, cubes, spheres, or powder; strong coal-tar or moth ball odor.

Physical State: Crystalline solid

Odor Threshold: < 0.3 ppm

Vapor Pressure (kPa): 0.05 mm Hg at 68 °F (20 °C);

1.0 mm Hg at 127 °F (53 °C)

Formula Weight: 128.2

Density: 1.145 g/cm³ at 68 °F (20 °C)

Boiling Point: 424 °F (218 °C)

Freezing/Melting Point: 176 °F (80.2 °C)

Water Solubility: Insoluble [31.7 mg/L at 68 °F (20 °C)]

Other Solubilities: Benzene, absolute alcohol; very soluble in ether, chloroform, carbon disulfide, hydronaphthalenes, fixed and volatile oils

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Naphthalene is stable at room temperature in closed containers under normal storage and handling conditions. It volatilizes at room temperature. Hazardous polymerization cannot occur. Exposure to heat and ignition sources, incompatibles.

Storage Incompatibilities: Include aluminum chloride, benzoyl chloride, chromic acid, chromium trioxide, oxidizers. Explosive reaction with dinitrogen pentaoxide. Melted naphthalene will attack some forms of plastics.

Hazardous Decomposition Products: Thermal oxidative decomposition of naphthalene can produce toxic fumes including carbon monoxide.

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral, LD₅₀: 490 mg/kg.
 Mouse, oral, LD₅₀: 533 mg/kg.
 Human (child), oral, LD_{Lo}: 100 mg/kg.

Acute Inhalation Effects:

Rat, inhalation, LC₅₀: >340 mg/m³ produced lacrimation and somnolence.

Irritation Effects:

Rabbit, eye, standard Draize test: 100 mg produced mild irritation.
 Rabbit, skin, open Draize test: 495 mg produced mild irritation.

Other Effects:

Rat, oral: 4500 mg/kg administered on gestational days 6-15 produced fetotoxicity and other developmental abnormalities.

Man, unreported, LD_{Lo}: 74 mg/kg.

Mouse, inhalation: 30 ppm/6 hr/2 yr administered intermittently produced toxic effects: tumorigenic - neoplastic by RTECS criteria; lungs, thorax, or respiration - tumors.

Hamster, ovary: 15 mg/L induced sister chromatid exchange.

See RTECS QJ0525000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to the atmosphere, naphthalene rapidly photodegrades with a half-life of 3-8 hr. Volatilization, photolysis, adsorption, and biodegradation are important loss mechanisms for naphthalene discharged into water. Depending on local conditions, the half-lives range from a couple of days to a few months. If released on land, it is adsorbed moderately to soil, undergoes biodegradation; but in some cases biodegradation may still occur if conditions are aerobic. Bioconcentration occurs to a moderate extent, but is a temporary problem since depuration and metabolism readily proceed in aquatic organisms.

Ecotoxicity: *Oncorhynchus gorbuscha* (pink salmon): 1.37 ppm/96 hr at 39 °F (4 °C). *Pimephales promelas* (fathead minnow): 7.76 mg/L/24 hr.

Octanol/Water Partition Coefficient: log K_{ow} = 3.30

Section 13 - Disposal Considerations

Disposal: Consider rotary kiln or fluidized bed incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations. Handle empty containers carefully as hazardous residues may still remain.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Naphthalene, crude or Naphthalene, refined

ID: UN1334

Hazard Class: 4.1 - Flammable solid

Packing Group: III - Minor Danger

Symbols:

Label Codes: 4.1 - Flammable Solid

Special Provisions: A1, IB8, IP3

Packaging: Exceptions: 151 **Non-bulk:** 213 **Bulk:** 240

Quantity Limitations: **Passenger aircraft/rail:** 25 kg **Cargo aircraft only:** 100 kg

Vessel Stowage: **Location:** A **Other:**



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U165 Toxic Waste

CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

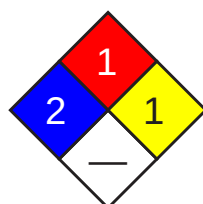
61

Material Name: Nickel **CAS Number:** 7440-02-0
Chemical Formula: Ni
Structural Chemical Formula: Ni
EINECS Number: 231-111-4
ACX Number: X1002560-0
Synonyms: ALCAN 756; C.I. 77775; CARBONYL NICKEL POWDER; EL12; FIBREX; FIBREX P; NI 0901-S; NI 4303-S; NI 4303T; NI-4303T; NI 270; NI 0901-S (HARSHAW); NICHEL; NICKEL; NICKEL 200; NICKEL 201; NICKEL 205; NICKEL 207; NICKEL 270; NICKEL CATALYST SYNONYMS OF OTHER NICKEL COMPOUNDS VARY DEPENDING UPON THE SPECIFIC COMPOUND; NICKEL (DUST); NICKEL METAL; ELEMENTAL NICKEL; NICKEL PARTICLES; NICKEL SPONGE; NICKEL,METAL; NICKLE CATALYST,WET; NP-2; NP 2; PULVERIZED NICKEL; RANEY ALLOY; RANEY NICKEL; RCH 55/5
General Use: Used in the manufacture of Monel metal, stainless steels, and nickel -chrome resistance wire; nickel-plating; various alloys such as new silver, Chinese silver, German silver; for coins, electrotypes, storage batteries. Used for magnets, lightning-rod tips, electrical contacts and electrodes, spark plugs, machinery parts; catalyst for hydrogenation of oils and other organic substances; in alloys for electronic and space applications.

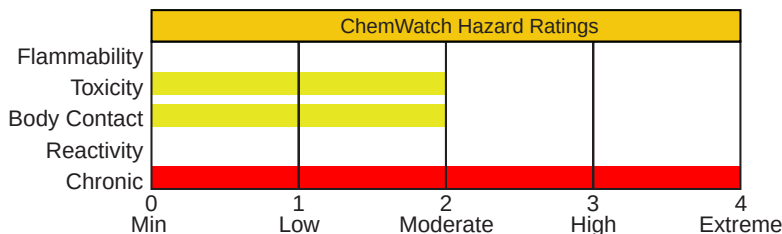
Section 2 - Composition / Information on Ingredients

Name	CAS	%
nickel	7440-02-0	> 99
OSHA PEL TWA: 1 mg/m ³ .	NIOSH REL TWA: 0.015 mg/m ³ .	DFG (Germany) MAK Danger of sensitization of the airways and the skin.
ACGIH TLV TWA: 1.5 mg/m ³ ; measured as inhalable fraction of the aerosol.	IDLH Level 10 mg/m ³ (as Ni).	

Section 3 - Hazards Identification



Fire Diamond



HMIS	
②	Health
①	Flammability
①	Reactivity

ANSI Signal Word

Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Silvery-white metal powder. Irritating. Other Acute Effects: metal fume fever, asthma, noninfectious pneumonia, vomiting, abdominal pain, nickel itch. Possible cancer hazard. Chronic Effects: sensitization, perforation of nasal septum.

Potential Health Effects

Target Organs: nasal cavities, lungs, skin

Primary Entry Routes: inhalation, skin contact, ingestion

Acute Effects

Inhalation: The dust may be discomforting to the upper respiratory tract and may be harmful if inhaled.

Persons with impaired respiratory function, airway diseases, and conditions such as emphysema or chronic bronchitis may incur further disability if excessive concentrations of particulate are inhaled.

Regular exposure to nickel fume, as the oxide, may result in "metal fume fever" a sometimes debilitating upper respiratory tract condition resembling influenza.

Symptoms include malaise, fever, weakness, nausea and may appear quickly if operations occur in closed or poorly ventilated areas.

Pulmonary edema, pulmonary fibrosis and asthma has been reported in welders using nickel alloys; levels of exposure are generally not available and case reports are often confounded by mixed exposures to other agents. Inhalation of freshly formed metal oxide particles sized below 1.5 microns and generally between 0.02 to 0.05 microns may result in "metal fume fever". Symptoms may be delayed for up to 12 hours and begin with the sudden onset of thirst, and a sweet, metallic or foul taste in the mouth.

Other symptoms include upper respiratory tract irritation accompanied by coughing and a dryness of the mucous membranes, lassitude and a generalized feeling of malaise. Mild to severe headache, nausea, occasional vomiting, fever or chills, exaggerated mental activity, profuse sweating, diarrhea, excessive urination and prostration may also occur. Tolerance to the fumes develops rapidly, but is quickly lost. All symptoms usually subside within 24-36 hours following removal from exposure.

Eye: The dust may produce eye discomfort and abrasive eye inflammation.

Skin: The material may be mildly discomforting to the skin.

Nickel dusts, fumes and salts are potent contact allergens and sensitizers producing a dermatitis known as "nickel" rash.

In the absence of properly designed ventilation systems or where respiratory protective devices are inadequate, up to 10% of exposed workers are expected to be symptomatic.

Ingestion: The material may be mildly discomforting to the gastrointestinal tract if swallowed in large quantity.

The potential to generate small quantities of nickel chloride in the stomach may produce a low order toxic effect.

Nickel salts cause vomiting, following ingestion, as a result of astringent and irritant effects. In common with other irritant-emetics the lethal dose varies widely. Absorption is generally poor and systemic poisoning is rare.

Systemic effects include increased blood sugar levels (hyperglycemia), capillary damage (especially in the brain and adrenals), kidney damage, heart damage (myocardial weakness) and central nervous system depression.

Carcinogenicity: NTP - Class 2A, Reasonably anticipated to be a carcinogen, limited evidence of carcinogenicity from studies in humans; IARC - Group 1, Carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Not listed; EPA - Class A, Human carcinogen; MAK - Class A1, Capable of inducing malignant tumors as shown by experience with humans.

Chronic Effects: Metallic dusts generated by the industrial process give rise to a number of potential health problems. The larger particles, above 5 micron, are nose and throat irritants. Smaller particles however, may cause lung deterioration. Particles of less than 1.5 micron can be trapped in the lungs and, dependent on the nature of the particle, may give rise to further serious health consequences.

The most common toxic reaction to nickel is skin sensitization which may produce a chronic eczema called "nickel itch". The first symptom is itching which occurs up to 7 days prior to the appearance of skin eruption.

The primary skin eruption is erythematous or follicular and may be followed by superficial discrete ulcers (which discharge and become crusted), or eczema. In the chronic stages, pigmented or depigmented plaques may be formed. Recovery from the dermatitis usually occurs within 7 days but may take several weeks.

Nickel dusts and several specific compounds are carcinogenic in animals following inhalation or parenteral administration (but not by ingestion or skin contact). Increases in lung and nasal cavity cancers have been observed amongst nickel workers in smelters and refineries.

Respiratory cancer risks primarily relate to chronic exposure to soluble nickels at concentrations in excess of 1 mg Ni/m³ and exposure to the less soluble forms at concentrations greater than 10 mg Ni/m³. Metallic nickel does not appear to pose such a threat.

When injected intramuscularly, nickel induced incidences of fibrosarcomas in rats and hamsters of both sexes, local sarcomas in rats of both sexes and local tumors with some metastases to pre-vertebral lymph nodes in female rats. When injected intrapleurally, nickel powder induced round cell and spindle cell tumors at the site of injection in female rats.

Inhalation of nickel dusts induced lymphosarcomas in female mice and anaplastic intraalveolar carcinomas in male and female guinea pigs.

Subdermal implantation of nickel pellets induced sarcomas surrounding the pellet in rats of both sexes whilst intramedullary injection into the femur of rats produced neoplasms at or near the site of injection, including fibrosarcomas (neurogenic in origin).

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Encourage patient to blow nose to ensure clear breathing passages. Rinse mouth with water. Consider drinking water to remove dust from throat.

Seek medical attention if irritation or discomfort persist.

Eye Contact: Immediately hold the eyes open and flush with fresh running water.

Ensure irrigation under the eyelids by occasionally lifting upper and lower lids. If pain persists or recurs seek medical attention.

Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Rinse mouth out with plenty of water. Seek medical attention if irritation or discomfort persist.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Long term exposure to high dust concentrations may cause changes in lung function i.e. pneumoconiosis; caused by particles less than 0.5 micron penetrating and remaining in the lung. Prime symptom is breathlessness; lung shadows show on X-ray.

* Preplacement and periodic medical examinations of workers exposed to nickel are recommended. Preplacement examination should evaluate any history of skin allergies or asthma, other exposures to nickel, smoking history, condition of nasal cavity and lungs. Periodic examinations should include chest X-rays.

Section 5 - Fire-Fighting Measures

Flash Point: Not available; probably combustible

LEL: Not applicable

UEL: Not applicable

Extinguishing Media: Sand, dry powder extinguishers or other inerts should be used to smother dust fires.

These are the only suitable means for extinguishing metal dust fires.

Do NOT use water.

General Fire Hazards/Hazardous Combustion Products: Metal powders, while generally regarded as noncombustible, may burn when metal is finely divided and energy input is high. Metal dust fires are slow moving but intense and difficult to extinguish. DO NOT disturb burning dust. Explosion may result if dust is stirred into a cloud, by providing oxygen to a large surface of hot metal. DO NOT use water or foam as generation of explosive hydrogen may result.

When heated with sulfur reacts with incandescence.

If involved in fire, may produce toxic fumes of nickel carbonyl and nickel.

Fire Incompatibility: Avoid reaction with nitric acid and other strong acids, oxidizing agents and sulfur compounds. Nickel dust reacts violently with titanium, ammonium nitrate, potassium perchlorate and hydrazoic acid.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

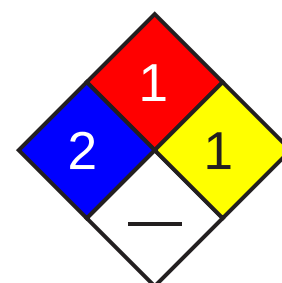
Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

Use fire fighting procedures suitable for surrounding area.

Do not approach containers suspected to be hot.

If safe to do so, remove containers from path of fire.

Equipment should be thoroughly decontaminated after use.



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Clean up all spills immediately. Avoid contact with skin and eyes.

Wear protective clothing, impervious gloves and safety glasses.

Use dry clean-up procedures and avoid generating dust.

Vacuum up or sweep up.

Place in suitable containers for disposal.

Large Spills: Clear area of personnel and move upwind.

Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

Stop leak if safe to do so.

Use dry clean-up procedures and avoid generating dust.

Collect recoverable product into labeled containers for recycling.

Collect residues and seal in labeled drums for disposal.

Wash spill area with large quantities of water.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Limit all unnecessary personal contact.

Wear protective clothing when risk of exposure occurs.

Use in a well-ventilated area. When handling DO NOT eat, drink or smoke.

Always wash hands with soap and water after handling.

Avoid physical damage to containers. Use good occupational work practices.

Observe manufacturer's storing and handling recommendations.

Recommended Storage Methods: Packaging as recommended by manufacturer.

Check that containers are clearly labeled.

Glass container.
 Plastic drum.
 Plastic bag.
 Polyethylene or polypropylene container.
 Metal drum.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Metal dusts must be collected at the source of generation as they are potentially explosive.

1. Vacuum cleaners, of flame-proof design, should be used to minimize dust accumulation.
2. Metal spraying and blasting should, where possible, be conducted in separate rooms. This minimizes the risk of supplying oxygen, in the form of metal oxides, to potentially reactive finely divided metals such as aluminum, zinc, magnesium or titanium.
3. Work-shops designed for metal spraying should possess smooth walls and a minimum of obstructions, such as ledges, on which dust accumulation is possible.
4. Wet scrubbers are preferable to dry dust collectors.
5. Bag or filter-type collectors should be sited outside the workrooms and be fitted with explosion relief doors.
6. Cyclones should be protected against entry of moisture as reactive metal dusts are capable of spontaneous combustion in humid or partially wetted state.
7. Local exhaust systems must be designed to provide a minimum capture velocity at the fume source, away from the worker, of 0.5 meter/sec.

Special ventilation requirements apply for processes which result in the generation of barium, chromium, lead, or nickel fume and in those processes which generate ozone.

The use of mechanical ventilation by local exhaust systems is required as a minimum in all circumstances (including outdoor work).

In confined spaces always check that oxygen has not been depleted by excessive rusting of steel or snowflake corrosion of aluminum. Local exhaust systems must be designed to provide a minimum capture velocity at the fume source, away from the worker, of 0.5 meter/sec.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses. Chemical goggles.

Full face shield.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Impervious gloves; rubber gloves.

Neoprene gloves.

Safety footwear.

Rubber boots.

Respiratory Protection:

Exposure Range >1 to <10 mg/m³: Supplied Air, Constant Flow/Pressure Demand, Half Mask

Exposure Range 10 to unlimited mg/m³: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Note: odor threshold unknown

Other: Overalls. Barrier cream. Eyewash unit.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Lustrous silver-white, hard, ferromagnetic metal. Soluble in dilute nitric acid; slightly soluble in hydrochloric acid and sulfuric acid. Insoluble in ammonia. Mohs' hardness:3.8

Welding flux grades typical sieve analysis (cumulative retention %):- 200 um 0, 150 um 2, 100 um 12, 75 um 60, 63 um 80, 43 um 98.

Physical State: Solid

Vapor Pressure (kPa): 0.13 at 1810 °C

Formula Weight: 58.71

Specific Gravity (H₂O=1, at 4 °C): 8.9

Evaporation Rate: Non-volatile

pH: Not applicable

pH (1% Solution): Not applicable

Boiling Point: 2730 °C (4946 °F)

Freezing/Melting Point: 1455 °C (2651 °F)

Volatile Component (% Vol): Nil at 38 °C

Water Solubility: Insoluble in water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid reaction with oxidizing agents. Reacts with acids producing flammable/explosive hydrogen (H₂) gas.

Section 11 - Toxicological Information**Toxicity**

Oral (rat) LD₅₀: 5000 mg/kg

See RTECS QR 5950000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.

Ecotoxicity: No data found.

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options.

Follow applicable federal, state, and local regulations.

Bury residue in an authorized landfill.

Recycle containers if possible, or dispose of in an authorized landfill.

Section 14 - Transport Information**DOT Hazardous Materials Table Data (49 CFR 172.101):**

Shipping Name and Description: None

Section 15 - Regulatory Information**EPA Regulations:**

RCRA 40 CFR: Listed

CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 100 lb (45.35 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Phenanthrene **CAS Number:** 85-01-8
Chemical Formula: C₁₄H₁₀
Structural Chemical Formula: (C₆H₄CH)₂
EINECS Number: 201-581-5
ACX Number: X1001897-8
Synonyms: COAL TAR PITCH VOLATILES; PHENANTHRENE; PHENANTHREN; PHENANTHRENE;
 PHENANTRIN
Derivation: A polynuclear aromatic hydrocarbon found as a component of coal tar pitch volatiles (products of bituminous coal distillation). Produced from toluene, bibenzil, 9-methyl fluorene or stilbene by passage through red hot tubes or by diene synthesis of 1-vinyl naphthalene and maleic anhydride.
General Use: Used in the manufacture of dyestuffs and explosives; in biological research or drug synthesis.

Section 2 - Composition / Information on Ingredients

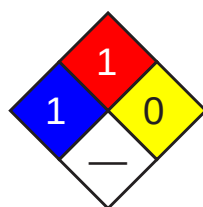
Name	CAS	%
Phenanthrene	85-01-8	ca 100 % wt

OSHA PEL

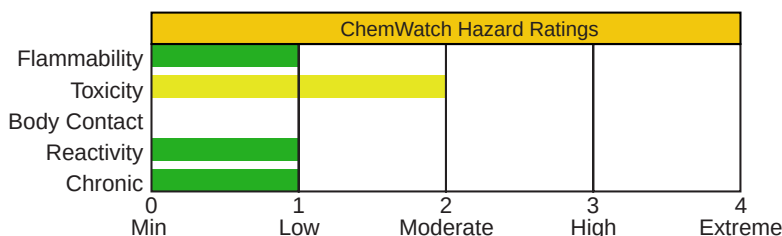
NIOSH REL

ACGIH TLV

Section 3 - Hazards Identification



Fire Diamond



HMIS	
1	Health
1	Flammability
0	Reactivity

ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Shiny crystals; faint, aromatic odor. Acute Effects: skin photosensitization. Combustible. Reacts dangerously with oxidizers.

Potential Health Effects

Target Organs: Skin.

Primary Entry Routes: Skin contact.

Acute Effects

Inhalation: Effects not reported.

Eye: Effects not reported.

Skin: Can cause photosensitization of the skin.

Ingestion: Effects not reported.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: Skin disorders.

Chronic Effects: None reported.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: Do not allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin Contact: Quickly remove contaminated clothing. Rinse exposed area with flooding amounts of water to remove loose material and then move quickly to a soap and water wash. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treatment is symptomatic and supportive.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: 340 °F (171 °C), Open Cup

LEL: Not reported.

UEL: Not reported.

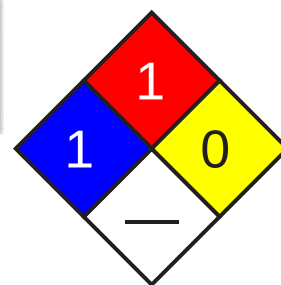
Flammability Classification: Class IIIB Combustible liquid

Extinguishing Media: Use dry chemical or carbon dioxide; water spray or foam may cause frothing.

General Fire Hazards/Hazardous Combustion Products: Carbon oxides (CO_x) and acrid smoke

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

See
DOT
ERG



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off ignition sources. Cleanup personnel should protect against skin contact.

Small Spills: To avoid dust generation, *do not sweep!* Carefully scoop up or vacuum (with appropriate filter). Damp mop residue.

Large Spills: Flush large spill to containment area for later disposal. Do not release into sewers or waterways. Mop up any residue.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: Use nonsparking tools to open containers.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from heat, ignition sources, and strong oxidizers.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all equipment used with and around phenanthrene. Provide general or local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on the skin.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. The following respirator recommendation is for *coal-tar pitch volatiles*: For any detectable concentration, use a SCBA or supplied-air respirator (with auxiliary SCBA) with a full facepiece and operated in pressure-demand or other positive pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless, shiny crystals with a faint, aromatic odor.

Physical State: Solid

Odor Threshold: 0.055 to 0.06 mg/m³

Vapor Pressure (kPa): 1 mm Hg at 244.76 °F (118.2 °C); 400 mm Hg at 586.4 (308 °C)

Formula Weight: 178.22

Density: 1.179 g/L at 77 °F (25 °C)

Refractive Index: 1.59427

Boiling Point: 644 °F (340 °C)

Freezing/Melting Point: 213 °F (101 °C)

Water Solubility: 1.6 mg/L at 59 °F (15 °C)

Other Solubilities: 1 g in: 2.4 mL toluene, 2.4 mL carbon tetrachloride, 2 mL benzene, 1 mL carbon disulfide, 25 mL absolute alcohol, 60 mL cold 95% alcohol, 10 mL boiling 95% alcohol and 3.3 mL anhydrous ether. Also soluble in glacial acetic acid, chloroform, and hot pyridine.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Phenanthrene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization does not occur. Phenanthrene dust generation and exposure to heat ignition sources, or oxidizers.

Storage Incompatibilities: Strong oxidizers.

Hazardous Decomposition Products: Thermal oxidative decomposition of phenanthrene can produce carbon oxide(s).

Section 11 - Toxicological Information

Acute Oral Effects:

Mouse, oral, LD₅₀: 700 mg/kg.

Other Effects:

Tumorigenicity, mouse, skin: 71 mg/kg produced tumors at site of application.

Genetic Effects - Rat, liver cell: 3 mmol/L caused DNA damage.

Human, lymphocyte: 100 µmol/L caused mutation.

See RTECS SF7175000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, some phenanthrene may biodegrade but the majority will bind to the soil without much leaching to groundwater. Volatilization is not expected to be significant. In water, it will adhere to particulates and sediment. Photolysis may occur near the surface producing toxic substances.

Photolysis/photooxidation half-life = 8.4 hr. In the air, it will react with photochemically generated hydroxyl radicals (half-life = 1.67 days). Phenanthrene absorbs strongly to soil and sediment in water.

Ecotoxicity: *Neanthes arenaceodentata*, TL_m = 0.6 ppm/96 hr, sea water at 71.6 °F (22 °C)

Octanol/Water Partition Coefficient: log K_{ow} = 4.57

Section 13 - Disposal Considerations

Disposal: For treatment of phenanthrene contaminated water, the particulate bound portion can be removed by sedimentation, flocculation, and filtration. Chlorination is not recommended as it has been shown to produce mutagenic substances. The dissolved portion requires oxidation for partial removal. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information**DOT Hazardous Materials Table Data (49 CFR 172.101):****Shipping Name and Description:** Environmentally hazardous substances, solid, n.o.s.**ID:** UN3077**Hazard Class:** 9 - Miscellaneous hazardous material**Packing Group:** III - Minor Danger**Symbols:** G - Technical Name Required**Label Codes:** 9 - Class 9**Special Provisions:** 8, 146, B54, IB8, N20**Packaging:** **Exceptions:** 155 **Non-bulk:** 213 **Bulk:** 240**Quantity Limitations:** **Passenger aircraft/rail:** No limit **Cargo aircraft only:** No limit**Vessel Stowage:** **Location:** A **Other:****Section 15 - Regulatory Information****EPA Regulations:****RCRA 40 CFR:** Not listed**CERCLA 40 CFR 302.4:** Listed per CWA Section 307(a) 5000 lb (2268 kg)**SARA 40 CFR 372.65:** Listed**SARA EHS 40 CFR 355:** Not listed**TSCA:** Listed**Section 16 - Other Information**

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Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Phenol

CAS Number: 108-95-2

Chemical Formula: C₆H₆O

Structural Chemical Formula: C₆H₅OH

EINECS Number: 203-632-7

ACX Number: X1001304-8

Synonyms: ACIDE CARBOLIQUE; BAKER'S P AND S LIQUID AND OINTMENT; BENZENOL; CARBOLIC ACID; CARBOLSAURE; FENOL; FENOLO; HYDROXYBENZENE; IZAL; MONOHYDROXYBENZENE; MONOPHENOL; OXYBENZENE; PHENIC ACID; PHENOL; PHENOL ALCOHOL; PHENOLE; PHENOL,MOLTEN; PHENYL ALCOHOL; PHENYL HYDRATE; PHENYL HYDROXIDE; PHENYLIC ACID; PHENYLIC ALCOHOL

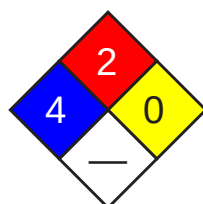
General Use: Used as a general disinfectant, either in solution or mixed with slaked lime, etc., for toilets, stables, cesspools, floors, drains, etc.; for the manufacture of colorless or light-colored artificial resins.

Also used in many medicinal and industrial compounds and dyes; as a reagent in chemical analysis.

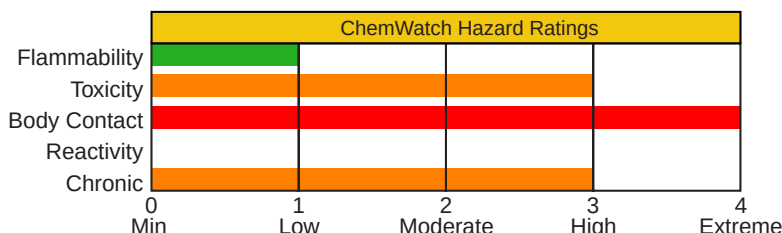
Section 2 - Composition / Information on Ingredients

Name	CAS	%
phenol	108-95-2	>99
OSHA PEL TWA: 5 ppm; 19 mg/m ³ ; skin.	NIOSH REL TWA: 5 ppm (19 mg/m ³); Ceiling: 15.6 ppm (60 mg/m ³) (15-minute); skin.	DFG (Germany) MAK Skin.
ACGIH TLV TWA: 5 ppm; skin.		
EU OEL TWA: 2 ppm.	IDLH Level 250 ppm.	

Section 3 - Hazards Identification



Fire Diamond



ANSI Signal Word

Danger!

HMIS
③ Health
② Flammability
① Reactivity



Poison



Corrosive

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

White, crystalline solid; medicinal odor. Corrosive. Poison. Other Acute Effects: severe neurological effects (shock and coma), liver/kidney damage, absorbed through skin. Combustible.

Potential Health Effects

Target Organs: liver, kidneys, nervous system, skin

Primary Entry Routes: skin absorption, eye contact, ingestion, inhalation

Acute Effects

Inhalation: The vapor is extremely discomforting to the upper respiratory tract, may cause severe mucous membrane damage and may be harmful if inhaled.

Pulmonary absorption may lead to systemic toxicity affecting the cardiovascular and central nervous system.

Inhalation of phenol and some of its derivatives may produce profuse perspiration, intense thirst, nausea, vomiting, diarrhea, cyanosis, hyperactivity, stupor, falling blood pressure, hypernea, abdominal pain, hemolysis, convulsions, coma and pulmonary edema with pneumonia. Respiratory failure and kidney damage may follow.

Inhalation of the vapor causes a sore throat, coughing, shortness of breath and labored breathing.

Systemic effects include paleness, weakness, headache, sweating, ringing of the ears, shock, cyanosis, excitement, dark colored urine, frothing of the nose and mouth.

Pulmonary inflammation and pneumonia, inflammation and necrosis of the myocardium, hepatic centro-lobular necrosis, renal proximal tube swelling and edema and globular degeneration and hind-limb paralysis was observed in guinea-pigs exposed 29 times for 7 hours/day, five days/week to concentrations ranging from 26 to 52 ppm.

Eye: The material is highly corrosive to the eyes and is capable of causing severe burns and capable of causing severe damage with loss of sight.

The vapor from heated material is highly discomforting to the eyes.

The vapor when concentrated has pronounced eye irritation; this gives some warning of high vapor concentrations. If eye irritation occurs seek to reduce exposure with available control measures, or evacuate area.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Some phenol derivatives may produce mild to severe eye irritation with redness, pain and blurred vision. Permanent eye injury may occur; recovery may also be complete or partial.

Skin: The solid/dust is corrosive to the skin, may cause blisters or burns or severe burns and is it is rapidly absorbed by the skin.

Toxic effects may result from skin absorption.

Phenol and some of its derivatives may produce mild to severe skin irritation on repeated or prolonged contact, producing second and third degree chemical burns. Rapid cutaneous absorption may lead to systemic toxicity affecting the cardiovascular and central nervous system.

Absorption through the skin may result in profuse perspiration, intense thirst, nausea, vomiting, diarrhea, cyanosis (following the formation of methemoglobin), hyperactivity, stupor, falling blood pressure, hypernea, abdominal pain, hemolysis, convulsions, coma and pulmonary edema followed by pneumonia. Respiratory failure and kidney damage may follow.

The material may produce severe skin irritation after prolonged or repeated exposure, and may produce a contact dermatitis (nonallergic).

This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis.

Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Prolonged contact is unlikely, given the severity of response, but repeated exposures may produce severe ulceration.

Contact with the skin causes a white, wrinkled discoloration followed by a severe burn or systemic poisoning if not promptly and properly removed.

Intense burning and pain from skin contact may be delayed. Extreme dangers are posed by percutaneous absorption. In one case a 32 year old male who spilled a solution of phenol over his scalp, face, neck, shoulders and back, died 10 minutes later.

There was coagulation necrosis of the skin, left eye and acute dermatitis veneta with acute passive congestion of the lungs, liver, spleen, kidneys.

Skin absorption occurs at low vapor pressure, without apparent discomfort and proceeds with the same efficiency as absorption by inhalation.

Damage to the lungs has been described following percutaneous absorption.

Methemoglobinemia and hemolytic anemia are frequently documented.

Ingestion: The material is corrosive to the gastrointestinal tract, may cause severe mucous membrane damage and may be fatal if swallowed.

Ingestion may result in nausea, abdominal irritation, pain and diarrhea.

Ingestion of phenol causes blotches on the lips and in the mouth.

Some phenol derivatives may produce mild to severe damage within the gastrointestinal tract. Phenolic groups with ortho and para positions free from substitution are reactive; this is because the ortho and para positions on the aromatic ring are highly activated by the phenolic hydroxyl group and are therefore readily substituted.

Severe phenol ingestions cause hypotension, coma, ventricular dysrhythmias, seizures and white coagulative chemical burns.

Absorption may result in profuse perspiration, intense thirst, nausea, vomiting, diarrhea, cyanosis (following the formation of methemoglobin), hyperactivity, stupor, falling blood pressure, hypernea, abdominal pain, hemolysis, convulsions, coma and pulmonary edema followed by pneumonia.

Respiratory failure and kidney damage may follow. Phenol does not uncouple oxidative phosphorylation like dinitrophenol and pentachlorophenol and thus does not cause a heat exhaustion-like syndrome.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Prolonged exposure to some derivatives of phenol may produce dermatitis, anorexia, weight loss, weakness, muscle aches and pain, liver damage, dark urine, ochronosis, skin eruptions, diarrhea, nervous disorders with headache, salivation, fainting, increased skin and scleral pigmentation, vertigo and mental disorders. Liver and

kidney damage may also ensue. Chronic phenol toxicity was first noted in medical personnel in the late 1800s when 5 and 10% phenol was used as a skin disinfectant. The term carbolic (phenol) marasmus was given to this syndrome. Chronic phenol poisoning is very rarely reported, but symptoms include vomiting, difficulty in swallowing, diarrhea, lack of appetite, headache, fainting, dizziness, dark urine, mental disturbances, and possibly skin rash. Death due to liver and kidney damage may occur.

Repeated exposure of animals to phenol vapor at concentrations ranging from 26 to 52 ppm has produced respiratory, cardiovascular, hepatic, renal and neurologic toxicity.

Administration of phenol in the drinking water of mice (2500 ppm for 103 weeks) produced an increased incidence of leukemia and lymphomas.

Phenol has been studied in initiation/promotion protocols with a number of polycyclic hydrocarbons and has been shown to have promoting activity in the two-stage skin model.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

See
DOT
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Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: If spilled on skin remove contaminated clothing, swab repeatedly with glycerin, PEG (polyethylene glycol), or PEG/ methylated spirit mixture or if necessary with methylated spirit alone.

Contamination of skin with phenol and some of its derivatives may produce rapid collapse and death. After skin contamination, keep patient under observation for at least 24-48 hours. Phenol-decontaminating fluid is more effective than water in removing phenol from the skin and retarding absorption; olive oil or vegetable oil may also be used; do not use mineral oil. Alcohols (methylated spirit, for example) may enhance absorption and their use alone may be ill-advised; some authorities, however, continue to advise the use of such treatment. Rapid water dilution of phenol burns may increase systemic absorption by decreasing the extent of the coagulum and thus allowing greater absorption.

Transport to hospital (or doctor).

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: * Provide preplacement and annual medical examinations for employees exposed to phenol.

Persons with a history of convulsive disorders or abnormalities of the skin, respiratory tract, liver or kidneys would be expected to be at increased risk from exposure. Examination of the liver, kidneys and respiratory tract should be stressed. A urinalysis should be performed including at a minimum, specific gravity, albumin, glucose, and a microscopic on centrifuged sediment.

For acute or short-term repeated exposures to phenols/ cresols:

1. Phenol is absorbed rapidly through lungs and skin. Massive skin contact may result in collapse and death.
2. Ingestion may result in ulceration of upper respiratory tract; perforation of esophagus and/or stomach, with attendant complications, may occur. Esophageal stricture may occur.
3. An initial excitatory phase may present. Convulsions may appear as long as 18 hours after ingestion. Hypotension and ventricular tachycardia that require vasopressor and antiarrhythmic therapy, respectively, can occur.
4. Respiratory arrest, ventricular dysrhythmias, seizures and metabolic acidosis may complicate severe phenol exposures so the initial attention should be directed towards stabilization of breathing and circulation with ventilation, intubation, intravenous lines, fluids and cardiac monitoring as indicated.
5. Vegetable oils retard absorption; do NOT use paraffin oils or alcohols. Gastric lavage, with endotracheal intubation, should be repeated until phenol odor is no longer detectable; follow with vegetable oil. A saline cathartic should then be given. ALTERNATELY: Activated charcoal (1g/kg) may be given. A cathartic should be given after oral activated charcoal.
6. Severe poisoning may require slow intravenous injection of methylene blue to treat methemoglobinemia.
7. Renal failure may require hemodialysis.
8. Most absorbed phenol is biotransformed by the liver to ethereal and glucuronide sulfates and is eliminated almost completely after 24 hours

BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

<u>Determinant</u>	<u>Index</u>	<u>Sampling Time</u>	<u>Comments</u>
Total phenol in blood	250 mg/gm creatinine	End of shift	B, NS

B: Background levels occur in specimens collected from subjects NOT exposed
 NS: Non-specific determinant; also seen after exposure to other materials.

Section 5 - Fire-Fighting Measures

Flash Point: 79 °C Closed Cup

Autoignition Temperature: 715 °C

LEL: 1.7% v/v

UEL: 8.6% v/v

Extinguishing Media: Carbon dioxide; dry chemical powder.

Alcohol stable foam.

General Fire Hazards/Hazardous Combustion Products: Combustible. Moderate fire hazard when exposed to heat, flame or oxidizers.

Vapor may readily form an explosive mixture with air.

Decomposes on heating and produces toxic fumes of carbon monoxide (CO), carbon dioxide (CO₂).

Fire Incompatibility: Avoid reaction with strong oxidizing agents and halogens.

Reaction with calcium hypochlorite is exothermic and produces toxic fumes which may ignite. Hot phenol is corrosive to many metals, including aluminum, lead, magnesium and zinc.

Do not heat phenol above 60 °C.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

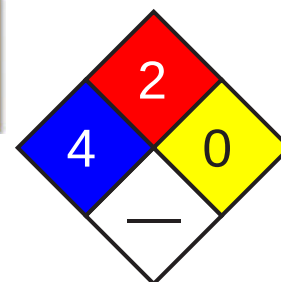
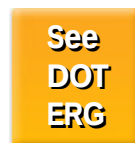
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

Use water delivered as a fine spray to control the fire and cool adjacent area.

Avoid spraying water onto liquid pools.

Cool fire-exposed containers with water spray from a protected location.

If safe to do so, remove containers from path of fire.



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: POLLUTANT -contain spillageEnvironmental hazard - contain spillage.

Wear protective clothing, impervious gloves and safety glasses.

Avoid breathing vapors and contact with skin and eyes.

Use dry clean-up procedures and avoid generating dust.

Place spilled material in clean, dry, sealable, labeled container.

Wash area down with large quantity of water and prevent runoff into drains.

Large Spills: POLLUTANT -contain spillageEnvironmental hazard - contain spillage.

Clear area of personnel and move upwind.

Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways.

If contamination of drains or waterways occurs, advise emergency services.

Shut off all possible sources of ignition and increase ventilation.

Stop leak if safe to do so.

Use dry clean-up procedures and avoid generating dust.

Collect recoverable product into labeled containers for recycling.

Collect residues and seal in labeled drums for disposal.

Wash area down with large quantity of water and prevent runoff into drains.

After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).



Section 7 - Handling and Storage

Handling Precautions: Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Use good occupational work practices.

Avoid breathing vapors and contact with skin and eyes.

Use in a well-ventilated area.

Wear personal protective equipment when handling.

Avoid contact with incompatible materials.

Avoid smoking, bare lights or ignition sources.

Vapor may travel a considerable distance to source of ignition.

Avoid thermal shock.

Avoid physical damage to containers.
 Handle and open container with care.
 When handling, DO NOT eat, drink or smoke.
 Wash hands with soap and water after handling.
 Work clothes should be laundered separately: NOT at home.

Recommended Storage Methods: Polylined drum. Stainless steel.
 Steel drum.

Check that containers are clearly labeled.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: General exhaust is adequate under normal operating conditions.

Local exhaust ventilation may be required in specific circumstances.

If risk of overexposure exists, wear NIOSH-approved respirator.

Correct fit is essential to obtain adequate protection.

Provide adequate ventilation in warehouse or closed storage areas.

Personal Protective Clothing/Equipment:

Eyes: Chemical goggles. Full face shield.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Neoprene gloves; PVC gloves.

Rubber boots.

Respiratory Protection:

Exposure Range >5 to 50 ppm: Air Purifying, Negative Pressure, Half Mask

Exposure Range >50 to <250 ppm: Air Purifying, Negative Pressure, Full Face

Exposure Range 250 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Cartridge Color: black with dust/mist prefilter (use P100 or consult supervisor for appropriate dust/mist prefilter)

Other: Acid-resistant overalls.

PVC apron.

Hard hat with brim.

Ensure there is ready access to a safety shower.

Eyewash unit.

Glove Selection Index:

BUTYL Best selection

BUTYL/NEOPRENE Best selection

NATURAL+NEOPRENE..... Best selection

NEOPRENE/NATURAL..... Best selection

PE/EVAL/PE Best selection

VITON Best selection

VITON/NEOPRENE Best selection

NEOPRENE..... Best selection

TEFLON Best selection

NATURAL RUBBER..... Satisfactory; may degrade after 4 hours continuous immersion

NITRILE..... Poor to dangerous choice for other than short-term immersion

NAT+NEOPR+NITRILE Poor to dangerous choice for other than short-term immersion

PVA Poor to dangerous choice for other than short-term immersion

PVC..... Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: White, crystalline solid with a characteristic sharp medicinal, sweet, tangy odor, which is detectable above 0.05 ppm. Phenol turns pink or red if it contains impurities, or if it is exposed to heat or light. Soluble in benzene. Very soluble in alcohol, chloroform, ether, glycerol, carbon disulfide, petrolatum, volatile and fixed oils, aqueous alkali hydroxides.

Physical State: Divided solid

Odor Threshold: 0.1786 to 22.42 mg/m³

Vapor Pressure (kPa): 101.33 at 181 °C

Vapor Density (Air=1): 3.24

Formula Weight: 94.11

Specific Gravity (H₂O=1, at 4 °C): 1.06 at 20 °C

Boiling Point: 181.8 °C (359 °F) at 760 mm Hg

Freezing/Melting Point: 40.9 °C (105.62 °F)

Volatile Component (% Vol): 100

Water Solubility: 1 g/15 ml water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable under normal handling conditions. Hazardous polymerization will not occur.

Storage Incompatibilities: Segregate from strong oxidizers, halogens, calcium hypochlorite, and metals such as aluminum, lead, zinc, magnesium.

Section 11 - Toxicological Information

Toxicity

Oral (rat) LD₅₀: 317 mg/kg

Oral (human) LD_{Lo}: 140 mg/kg

Inhalation (rat) LC₅₀: 316 mg/m³

Dermal (rabbit) LD₅₀: 850 mg/kg

Irritation

Skin (rabbit): 500 mg/24hr - SEVERE

Skin (rabbit): 500 mg open -SEVERE

Eye (rabbit): 5 mg - SEVERE

Eye (rabbit): 100 mg rinse - mild

See RTECS SJ 3325000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to the environment, the primary removal mechanism is biodegradation which is generally rapid (days). Since it is a benchmark chemical for biodegradability studies, there is a large body of information on its degradation which concludes that it rapidly degrades in sewage, soil, fresh water and seawater. Acclimation of resident populations of microorganisms is rapid. Under anaerobic conditions degradation is slower and microbial adaptation periods longer. If released to soil, it will readily leach and biodegrade. The biodegradation in soil is generally rapid with half-lives of under 5 days even in subsurface soils. Biodegradation is sufficiently rapid that most groundwater is generally free of this pollutant. The exception would be in the cases of spills where high concentrations destroy degrading microbial populations. Biodegradation is also the primary removal process when released into water (half-lives are of the order of hours to days) although sensitized photolysis may also be important. In one study using estuarine water, the combination of biodegradation and photolysis resulted in a half-life in summer and winter of 39 and 94 hr, respectively. Since the pKa is 9.994, it will be partially dissociated at higher pHs in water and moist soils and its transport and reactivity may be pH-dependent. It does not bioconcentrate in aquatic organisms. In the atmosphere, it occurs as a vapor and reacts with photochemically-produced hydroxyl radicals resulting in a half-life of approximately 15 hours. During the nighttime, it reacts with nitrate radicals with a resulting half-life of 12 minutes. It has also been shown to be readily removed from the atmosphere by rain.

Ecotoxicity: LC₅₀ Crangon crangon 5600 mg/l 3 min, 20 mg/l 1 hr, 80 mg/l 3 hr, 40 mg/l 6-24 hr, 30 mg/l 48-72 hr, 25 mg/l 96 hr in sea water at 15 °C /Conditions of bioassay not specified; LC₅₀ Rainbow trout 5.6-11.3 mg/l/24 hr in a static bioassay; LC₅₀ Ophicephalus punctatus 46.0 mg/l/48 hr in a static bioassay; TL_m Mercenaria mercenaria (hard clam) egg 5.263 x10⁴ ppb/48 hr in a static bioassay; Algae: Microcystis aeruginosa inhibition of cell multiplication noted at 4.6 mg/l /Conditions of bioassay not specified; Protozoa: Vorticella campanula perturbation level 3 mg/l /Conditions of bioassay not specified ; Arthropoda: LD₀ Daphnia magna 16 mg/l /Conditions of bioassay not specified; Arthropoda: TL_m Daphnia magna (young) 17/7 mg/l 25-50 hr /Conditions of bioassay not specified ; TL_m Roach 15 mg/l/24 hr /Conditions of bioassay not specified

Henry's Law Constant: 3.33 x10⁻⁷

BCF: goldfish 1.9

Biochemical Oxygen Demand (BOD): 200%, 5 days

Octanol/Water Partition Coefficient: log K_{ow} = 1.46

Soil Sorption Partition Coefficient: K_{oc} = 1 to 3

Section 13 - Disposal Considerations

Disposal: Follow applicable federal, state, and local regulations.

Incinerate contaminated waste at an approved site.

Phenol may be recovered by charcoal absorption, solvent extraction or steam stripping. A concentration of 1% by weight is required for economical recovery.

Recycle containers wherever possible, otherwise dispose of in an authorized landfill.

Section 14 - Transport Information**DOT Hazardous Materials Table Data (49 CFR 172.101):****Shipping Name and Description:** Phenol, solid**ID:** UN1671**Hazard Class:** 6.1 - Poisonous materials**Packing Group:** II - Medium Danger**Symbols:** + - Override definitions**Label Codes:** 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B***Special Provisions:** IB8, IP2, IP4, N78, T6, TP2**Packaging:** **Exceptions:** None **Non-bulk:** 212 **Bulk:** 242**Quantity Limitations:** **Passenger aircraft/rail:** 25 kg **Cargo aircraft only:** 100 kg**Vessel Stowage:** **Location:** A **Other:****Section 15 - Regulatory Information****EPA Regulations:****RCRA 40 CFR:** Listed U188 Toxic Waste**CERCLA 40 CFR 302.4:** Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a)
1000 lb (453.5 kg)**SARA 40 CFR 372.65:** Listed**SARA EHS 40 CFR 355:** Listed**RQ:** 1000 lb**TPQ:** 500/10000 lb**TSCA:** Listed**Section 16 - Other Information**

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Polychlorinated Biphenyls (PCBs)

CAS Number: 1336-36-3

Chemical Formula: Unspecified or Variable

Structural Chemical Formula: $(C_{12}H_{10-x})Cl_x$

EINECS Number: 215-648-1

ACX Number: X1004032-9

Synonyms: AROCLOR; AROCLOR 1221; AROCLOR 1232; AROCLOR 1242; AROCLOR 1248; AROCLOR 1254; AROCLOR 1260; AROCLOR 1262; AROCLOR 1268; AROCLOR 2565; AROCLOR 4465; AROCLOR 5442; 1,1'-BIPHENYL, CHLORO DERIVS; BIPHENYL, POLYCHLORO-; CHLOPHEN; CHLOREXTOL; CHLORINATED BIPHENYL; CHLORINATED DIPHENYL; CHLORINATED DIPHENYLENE; CHLORO 1,1-BIPHENYL; CHLORO 1,1-BIPHENYL-; CHLORO BIPHENYL; CLOPHEN; CLOPHEN A 60; DYKANOL; EPA PESTICIDE CHEMICAL CODE 017801; FENCLOR; FENCLOR 42; INERTEEN; KANECHLOR; KANECHLOR 300; KANECHLOR 400; MONTAR; MONTER; NOFLAMOL; PCB; PCBS; PHENOCHLOR; PHENOCOLOR; POLYCHLORINATED BIPHENYL; POLYCHLORINATED BIPHENYLS; POLYCHLORINATED BIPHENYLS (PCBS); POLYCHLOROBIPHENYL; PYRALENE; PYRANOL; SANTOTHERM; SANTOTHERM FR; SOVOL; THERMINOL; THERMINOL FR-1

General Use: Used as dielectric fluids in transformers and capacitors. Prior to 1972, were used as hydraulic and other industrial fluids (e.g., in vacuum pumps, as lubricants and cutting oils), in paints, inks and fire retardants.

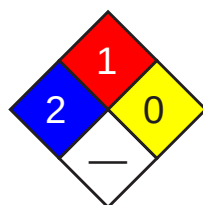
Also used in heat transfer systems; gas-transmission turbines; carbonless reproducing paper; adhesives; as plasticizer in epoxy paints; fluorescent light ballasts; wax extenders; coolants; dedusting agents; pesticide extenders; surface treatment and coatings; sealants; caulking material.

This is one of a group of once widely used industrial chemicals whose high stability contributed both to their commercial usefulness and the long term deleterious environmental health effects. Consequently their use has been phased out. Their manufacture in the U.S.A. was discontinued in 1977.

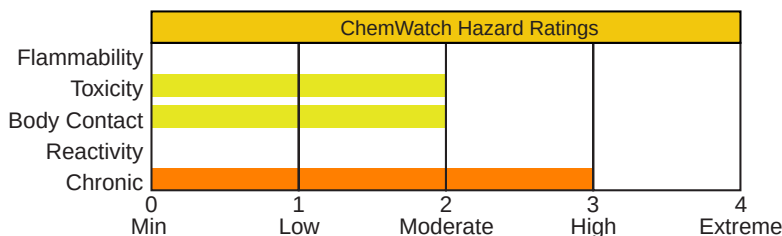
Section 2 - Composition / Information on Ingredients

Name	CAS	%
polychlorinated biphenyls (PCB's)	1336-36-3	100
OSHA PEL		
NIOSH REL		
ACGIH TLV		

Section 3 - Hazards Identification



Fire Diamond



HMIS	
2	Health
1	Flammability
0	Reactivity

ANSI Signal Word

Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Oily liquid, white crystalline solid, or hard resin. Severely irritating. Suspect cancer hazard. Chronic Effects: chloracne, GI disturbances, neurological symptoms, liver enlargement, menstrual changes, bronchitis, possible reproductive/teratogenic effects.

Potential Health Effects

Target Organs: skin, liver, eyes, mucous membranes, respiratory system

Primary Entry Routes: inhalation, skin contact, ingestion

Acute Effects

Inhalation: Not normally a hazard due to nonvolatile nature of product. Inhalation of vapor is more likely at higher than normal temperatures.

The vapor/mist is discomforting and may be extremely toxic if inhaled.

Eye: The vapor/liquid is moderately discomforting and may be harmful to the eyes.

Skin: The liquid is harmful to the skin, it is rapidly absorbed and is capable of causing skin reactions.

Exposure to material may result in a dermatitis, described as chloracne, a persistent acneiform characterized by comedones (white-, and black- heads), keratin cysts, and inflamed papules with hyperpigmentation and an anatomical distribution frequently involving the skin under the eyes and behind the ears. It occurs after acute or chronic exposure to a variety of chlorinated aromatic compounds by skin contact, ingestion or inhalation and may appear within days and months following the first exposure. Other dermatological alterations including hypertrichosis (the growth of excess hair), an increased incidence of actinic or solar elastosis (the degeneration of elastic tissue within muscles or loss of dermal elasticity produced by the effects of sunlight), and Peyrone's disease (a rare progressive scarring of the penile membrane).

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The material is moderately discomforting to the gastrointestinal tract and may be harmful if swallowed in large quantity.

Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Digestion may lead to nausea, vomiting, abdominal pain, anorexia, jaundice and liver damage, coma and death.

Headache, dizziness, lethargy, depression, nervousness, loss of libido, muscle, joint pains may be found.

Symptoms appear after a latent period of 5 to 6 months.

PCB's may appear in breast milk of exposed mothers and in newborn infants.

Carcinogenicity: NTP - Class 2B, Reasonably anticipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals; IARC - Group 2A, Probably carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Not listed.

Chronic Effects: People occupationally exposed to PCB's have relatively high PCB residue levels in blood plasma. Symptoms include chloracne dermatitis and degreasing the skin, pigmentation of skin and nails, excessive eye discharge, swelling of eyelids, transient visual disturbances, distinctive hair follicles, edema of the face and hands. In common with other polyhalogenated aromatic hydrocarbons, the chlorinated biphenyls exhibit dioxin-like behavior. Polyhalogenated aromatic hydrocarbons (PHAHs) comprise two major groups. The first group represented by the halogenated derivatives of dibenzodioxins (the chlorinated form is PCDD), dibenzofurans (PCDF) and biphenyls (PCB) exert their toxic effect (as hepatotoxicants, reproductive toxicants, immunotoxicants and procarcinogens) by interaction with a cytosolic protein known as the Ah receptor. In guinea pigs the Ah receptor is active in a mechanism which "pumps" PHAH into the cell whilst in humans the reverse appears to true. This, in part, may account for species differences often cited in the literature. This receptor exhibits an affinity for the planar members of this group and carries these to the cellular nucleus where they bind, reversibly, to specific genomes on DNA.

This results in the regulation of the production of certain proteins which elicit the toxic response. The potency of the effect is dependent on the strength of the original interaction with the Ah receptor and is influenced by the degree of substitution by the halogen and the position of such substitutions on the parent compound.

The most potent molecule is 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) while the coplanar PCBs (including mono-ortho coplanars) possess approximately 1% of this potency. Nevertheless, all are said to exhibit "dioxin-like" behavior and in environmental and health assessments it has been the practice to assign each a TCDD-equivalence value.

The most subtle and important biological effects of the PHAHs are the effects on endocrine hormones and vitamin homeostasis. TCDD mimics the effect of thyroxine (a key metamorphosis signal during maturation) and may disrupt patterns of embryonic development at critical stages. Individuals from exposed wildlife populations have been observed to have altered sexual development, sexual dysfunction as adults and immune system suppression. Immunotoxic effects of the PHAHs (including the brominated congener, PBB) have been the subject of several studies. No clear pattern emerges in human studies however with T-cell numbers and function (a blood marker for immunological response) increasing in some and decreasing in others.

Three incidences have occurred which have introduced abnormally high levels of dioxin or dioxin-like congeners to humans. The explosion at a trichlorophenol-manufacturing plant in Seveso, Italy distributed TCDD across a large area of the country-side, whilst rice-oil contaminated with heat-transfer PCBs (and dioxin-like contaminants) has been consumed by two groups, on separate occasions (one in Yusho, Japan and another in Yu-cheng, Taiwan). The only symptom which can unequivocally be related to all these exposures is the development of chloracne, a disfiguring skin condition, following each incident. Contaminated oil poisonings also produced eye-discharge, swelling of eyelids and visual disturbances. The Babies born up to 3 years after maternal exposure (so-called "Yusho-babies") were characteristically brown skinned, colored gums and nails and (frequently) produced eye-discharges. Delays in

intellectual development have been noted. It has been estimated that Yu-cheng patients consumed an average level of 0.06 mg/kg body weight/day total PCB and 0.0002 mg/kg/day of PCDF before the onset of symptoms after 3 months. When the oil was withdrawn after 6 months they had consumed 1 gm total PCB containing 3.8 mg PCDF. Preliminary data from the Yusho cohort suggests a six-fold excess of liver cancer mortality in males and a three-fold excess in women.

Recent findings from Seveso indicate that the biological effects of low level exposure (BELLEs), experienced by a cohort located at a great distance from the plant, may be hormetic, i.e. may be protective AGAINST the development of cancer.

TCDD induces carcinogenic effects in the laboratory in all species, strains and sexes tested. These effects are dose-related and occur in many organs.

Exposures as low as 0.001 ug/kg body weight/day produce carcinoma.

Several studies implicate PCBs in the development of liver cancer in workers as well as multi-site cancers in animals.

The second major group of PHAH consists of the non-planar PCB congeners which possess two or more ortho-substituted halogens. These have been shown to produce neurotoxic effects which are thought to reduce the concentration of the brain neurotransmitter, dopamine, by inhibiting certain enzyme-mediated processes.

The specific effect elicited by both classes of PHAH seems to depend on the as much on the developmental status of the organism at the time of the exposure as on the level of exposure over a lifetime.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center. DO NOT induce vomiting. Observe the patient carefully. Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious. Give water (or milk) to rinse out mouth. Then provide liquid slowly and as much as casualty can comfortably drink. Transport to hospital or doctor without delay.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically. If large amounts are ingested, gastric lavage is suggested. For splash in the eyes, a petrolatum-based ophthalmic ointment may be applied to the eye to relieve the irritating effects of PCBs. If electrical equipment arcs over, PCB dielectric fluids may decompose to produce hydrogen chloride (HCl), a respiratory irritant. [Monsanto] Preplacement and annual medical examinations of workers, with emphasis on liver function, skin condition, reproductive history, is recommended.

See
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Section 5 - Fire-Fighting Measures

Flash Point: > 141 °C

Autoignition Temperature: 240 °C

LEL: Not applicable

UEL: Not applicable

Extinguishing Media: Foam. Alcohol stable foam.

Dry chemical powder.

General Fire Hazards/Hazardous Combustion Products: Noncombustible liquid.

POLLUTANT -contain spillage.

Decomposes on heating and produces acrid black soot and toxic fumes of aldehydes, hydrogen chloride (HCl), chlorides and extremely toxic polychlorinated dibenzofuran (PCDF), polychlorinated dibenzodioxin (PCDD).

Fire Incompatibility: Reacts vigorously with chlorine (Cl₂).

Fire-Fighting Instructions: POLLUTANT -contain spillage. Noncombustible.

Clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways.

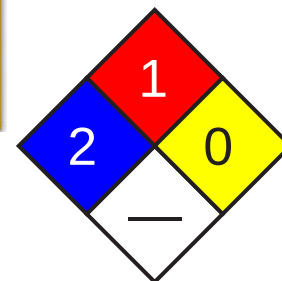
Use fire fighting procedures suitable for surrounding area.

Cool fire-exposed containers with water spray from a protected location.

Avoid spraying water onto liquid pools.

If safe to do so, remove containers from path of fire.

See
DOT
ERG



Fire Diamond

Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: POLLUTANT -contain spillage. Clean up all spills immediately.

Environmental hazard - contain spillage.

Avoid breathing vapors and contact with skin and eyes.

Wear protective clothing, impervious gloves and safety glasses.

Contain spill with sand, earth or vermiculite.

Wipe up and absorb small quantities with vermiculite or other absorbent material.

Place spilled material in clean, dry, sealable, labeled container.

Large Spills: POLLUTANT -contain spillage. Clear area of personnel.

Contact fire department and tell them location and nature of hazard.

Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways.

Stop leak if safe to do so.

Contain spill with sand, earth or vermiculite.

Collect recoverable product into labeled containers for recycling.

Absorb remaining product with sand, earth or vermiculite.

Collect residues and seal in labeled drums for disposal.

After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

If equipment is grossly contaminated, decontaminate and destroy.

If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: Do not allow clothing wet with material to stay in contact with skin Use good occupational work practices. Observe manufacturer's storing and handling recommendations.

Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Avoid all personal contact, including inhalation.

Wear protective clothing and gloves when handling containers.

Avoid physical damage to containers.

Use in a well-ventilated area and Use only in completely enclosed system.

Avoid contact with incompatible materials.

When handling, DO NOT eat, drink or smoke.

Wash hands with soap and water after handling.

Work clothes should be laundered separately: NOT at home.

Recommended Storage Methods: Packaging as recommended by manufacturer.

Check that containers are clearly labeled.

Metal can or metal drum or Steel drum with plastic liner.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Provide adequate ventilation in warehouse or closed storage areas.

If inhalation risk of overexposure exists, wear NIOSH-approved organic-vapor respirator.

In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; chemical goggles.

Full face shield.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Impervious gloves or Viton gloves or Polyethylene gloves or PVC gloves.

Protective footwear.

Other: Impervious protective clothing. Overalls. Impervious apron.

Eyewash unit.

Ensure there is ready access to a safety shower.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, colorless to yellow-green, mobile oily to viscous liquid, or sticky to hard resin, or white crystalline solid, depending on degree of chlorination. Slightly soluble in glycerol and glycols. Soluble in organic solvents and lipids. Viscosity range: 71 - 2500 Saybolt unit sec. at 38 °C. PCBs are resistant to chemical and biological degradation and because of their solubility in fats and oils they tend to be concentrated in living organisms. The highly chlorinated PCBs are retained in animal's bodies longer and seems to delay the excretion of the lower chlorinated PCB's. They have become widely dispersed in the world-wide environment and in the food-chain since their introduction in 1929. They are now recognized internationally to be a major environmental pollutant, their persistence causing ecological damage via water pollution. Consequently loss of PCBs to the environment is to be avoided at all costs.

Physical State: Liquid

Vapor Pressure (kPa): Negligible

Formula Weight: 188.66 - 395

Specific Gravity (H₂O=1, at 4 °C): 1.18 - 1.8

Evaporation Rate: Non Vol. at 38 °C

pH: Not applicable

pH (1% Solution): Not applicable.

Boiling Point: 340 °C (644 °F) to 375 °C (707 °F)

Decomposition Temperature (°C): 375-550

Water Solubility: Solubility in water extremely low

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid storage with oxidizers. Segregate from chlorine.

Avoid contamination of water, foodstuffs, feed or seed.

Section 11 - Toxicological Information

Toxicity

Oral (human) LD₅₀: 500 mg/kg

Oral (rat) LD₅₀: 3980 mg/kg

Irritation

Nil reported

See RTECS TQ1350000, for additional data.

Section 12 - Ecological Information

Environmental Fate: PCBs are mixtures of different congeners of chlorobiphenyl and the relative importance of the environmental fate mechanisms generally depends on the degree of chlorination. In general, the persistence of PCBs increases with an increase in the degree of chlorination. Mono-, di- and trichlorinated biphenyls (Aroclor 1221 and 1232) biodegrade relatively rapidly, tetrachlorinated biphenyls (Aroclors 1016 and 1242) biodegrade slowly, and higher chlorinated biphenyls (Aroclors 1248, 1254, and 1260) are resistant to biodegradation. Although biodegradation of higher chlorinated congeners may occur very slowly on an environmental basis, no other degradation mechanisms have been shown to be important in natural water and soil systems; therefore, biodegradation may be the ultimate degradation process in water and soil.

If released to soil, PCBs experience tight adsorption with adsorption generally increasing with the degree of chlorination. PCBs will generally not leach significantly in aqueous soil systems; the higher chlorinated congeners will have a lower tendency to leach than the lower chlorinated congeners. In the presence of organic solvents PCBs may leach quite rapidly through soil. Vapor loss from soil surfaces appears to be an important fate mechanism with the rate of volatilization decreasing with increasing chlorination. Although the volatilization rate may be low, the total loss by volatilization over time may be significant because of persistence and stability. Enrichment of the low Cl PCBs occurs in the vapor phase relative to the original Aroclor; the residue will be enriched in the PCBs containing high Cl content. If released to water, adsorption to sediment and suspended matter will be an important fate process; PCB concentrations in sediment and suspended matter have been shown to be greater than in the associated water column. Although adsorption can immobilize PCBs (especially the higher chlorinated congeners) for relatively long periods of time, eventual resolution into the water column has been shown to occur. The PCB composition in the water will be enriched in the lower chlorinated PCBs because of their greater water solubility, and the least water soluble PCBs (highest Cl content) will remain adsorbed. In the absence of adsorption, PCBs volatilize relatively rapidly from water. However, strong PCB adsorption to sediment significantly competes with volatilization, with the higher chlorinated PCBs having longer half-lives than the lower chlorinated PCBs. Although the resulting volatilization rate may be low, the total loss by volatilization over time may be significant because of persistence and stability. PCBs have been shown to bioconcentrate significantly in aquatic organisms. If released to the atmosphere, PCBs will primarily exist in the vapor-phase; the tendency to become associated with the particulate-phase will increase as the degree of chlorination of the PCB increases. The dominant atmospheric transformation process is probably the vapor-phase reaction with hydroxyl radicals which has estimated half-lives ranging from 12.9 days for monochlorobiphenyl to 1.31 years for heptachlorobiphenyl. Physical removal from the atmosphere, which is very important environmentally, is accomplished by wet and dry deposition.

Ecotoxicity: Aquatic toxicity: 0.278 ppm/96 hr/bluegill/TL_m/fresh water 0.005 ppm/336-1080 hr/pinfish/TL_m/salt water; Waterfowl toxicity: LD₅₀ 2000 ppm (mallard duck); Food chain concentration potential: High
Henry's Law Constant: 5×10^{-5}
BCF: bioconcentrate in tissue
Biochemical Oxygen Demand (BOD): very low
Soil Sorption Partition Coefficient: $K_{oc} = 510$ to 1.33×10^4

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options.
 Follow applicable federal, state, and local regulations.
 Due to their environmental persistence and potential health hazards, PCBs cannot be disposed of in landfills or dumped at sea. The only environmentally acceptable method for the disposal of PCBs is by high temperature incineration.
 All wastes and residues containing PCB's (e. g. , wiping cloths, absorbent material, used disposable protective gloves, contaminated clothing, etc.) should be collected, placed in proper containers, labelled and disposed of in accordance with applicable regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Polychlorinated biphenyls, liquid

ID: UN2315

Hazard Class: 9 - Miscellaneous hazardous material

Packing Group: II - Medium Danger

Symbols:

Label Codes: 9 - Class 9

Special Provisions: 9, 81, 140, IB3, T4, TP1

Packaging: Exceptions: 155 **Non-bulk:** 202 **Bulk:** 241

Quantity Limitations: Passenger aircraft/rail: 100 L **Cargo aircraft only:** 220 L

Vessel Stowage: Location: A **Other:** 95



Shipping Name and Description: Polychlorinated biphenyls, solid

ID: UN2315

Hazard Class: 9 - Miscellaneous hazardous material

Packing Group: II - Medium Danger

Symbols:

Label Codes: 9 - Class 9

Special Provisions: 9, 81, 140, IB7

Packaging: Exceptions: 155 **Non-bulk:** 212 **Bulk:** 240

Quantity Limitations: Passenger aircraft/rail: 100 kg **Cargo aircraft only:** 200 kg

Vessel Stowage: Location: A **Other:**



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Not listed

CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per CWA Section 307(a) 1 lb (0.454 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Pyrene **CAS Number:** 129-00-0
Chemical Formula: C₁₆H₁₀
EINECS Number: 204-927-3
ACX Number: X1001901-7
Synonyms: BENZO(DEF)PHENANTHRENE; BENZO(D,E,F)PHENANTHRENE; COAL TAR PITCH
 VOLATILES:PYRENE; PYREN; BETA-PYRENE; PYRENE; PYRENE
General Use: Laboratory reference standard.
 Occurs in coal tar or in destructive hydrogenation of hard coals.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
pyrene	129-00-0	>98

OSHA PEL

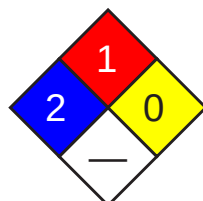
TWA: 0.2 mg/m³; as particulate
 polycyclical aromatic
 hydrocarbon.

NIOSH REL

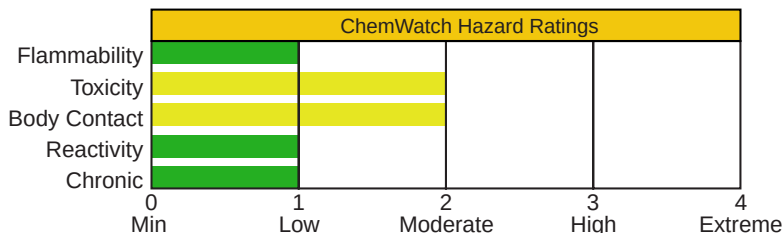
TWA: 0.1 mg/m³, cyclohexane-
 extractable fraction; as particulate
 polycyclic aromatic hydrocarbon.

ACGIH TLV

Section 3 - Hazards Identification



Fire Diamond



HMIS	
2	Health
1	Flammability
0	Reactivity

ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless solid. Irritating to eyes/skin/respiratory tract. Also causes: conjunctival irritation, dermal irritation, ingestion may irritate and burn esophagus/gastrointestinal tract.

Potential Health Effects

Target Organs: skin, eyes, respiratory system

Primary Entry Routes: inhalation, ingestion, skin contact

Acute Effects

Inhalation: The dust may be discomforting to the upper respiratory tract and may be fatal if inhaled.

Persons with impaired respiratory function, airway diseases, and conditions such as emphysema or chronic bronchitis may incur further disability if excessive concentrations of particulate are inhaled.

Animal inhalation studies have demonstrated hepatic, pulmonary and intragastric pathologic changes. The levels of neutrophil, leukocyte and erythrocytes decreased.

Eye: The dust may be discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

Skin: The material may be mildly discomforting to the skin.

Open cuts, abraded or irritated skin should not be exposed to this material.

Toxic effects may result from skin absorption.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Skin application resulted in hyperemia (blood engorgement), weight loss and hematopoietic (blood cell development) changes. Contact dermatitis was also evident.

Ingestion: The solid/dust is discomforting to the gastrointestinal tract and harmful if swallowed.

Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic exposure to pyrene results increase in blood leukocytes (leukocytosis).

The so-called polycyclic aromatic hydrocarbons (PAHs) comprise a large family; some members occur in coal tar, tobacco smoke, petroleum and air pollution. Some substituted derivatives have been identified, in animal studies, as amongst the most highly active carcinogens.

Rodent species are sensitive to some PAHs with skin application producing cancerous growths. Injection produces soft tissue tumors (sarcomas) in rats and mice.

Administration of PAHs to Rhesus monkey on the other hand has not yet proved successful in yielding tumors and there is inadequate data to support the proposition that individual PAHs produce cancer in humans. There are however a number of epidemiology and mortality studies that show increased incidence of cancer in humans exposed to mixtures of PAHs. Evidence exists of lung and genito-urinary cancer mortality amongst coke-oven workers and skin tumors in workers exposed to creosote. Exposures to other chemical mixtures containing PAHs such as cigarette smoke, coal tar, coal tar pitch and bitumens, have been associated with increased incidences of lung cancer in humans. Anthracene, the basic unit on which most PAHs are built, is not carcinogenic whereas benz[a]anthracene appears to have weak carcinogenicity. Additions of other benzene rings to select positions on the benz[a]anthracene skeleton results in agents with powerful carcinogenicity (e.g. dibenz[a,h]anthracene and benz[a]pyrene). Further substitution of methyl groups in position on the rings enhances carcinogenicity (7,12 dimethylbenz[a]anthracene is one of the most powerful PAH carcinogens known). Biotransformation to produce soluble metabolites suitable for excretion appears to transform some PAHs to reactive electrophiles (as epoxides) which bind to DNA. Initiation of carcinogenesis is thought to rely upon such interactions.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Encourage patient to blow nose to ensure clear breathing passages. Rinse mouth with water.

Consider drinking water to remove dust from throat.

Lay patient down. Keep warm and rested.

Seek medical attention if irritation or discomfort persist.

Eye Contact: Immediately hold the eyes open and flush with fresh running water.

Ensure irrigation under the eyelids by occasionally lifting upper and lower lids. If pain persists or recurs seek medical attention.

Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

If more than 15 minutes from a hospital, induce vomiting, preferably using Ipecac Syrup APF.

Note: DO NOT INDUCE VOMITING in an unconscious person.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: Not available; probably combustible

Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.

Water spray or fog - Large fires only.

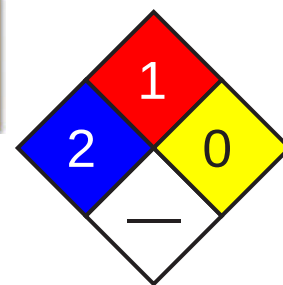
General Fire Hazards/Hazardous Combustion Products: Solid which exhibits difficult combustion or is difficult to ignite.

Avoid generating dust, particularly clouds of dust in a confined or unventilated space.

Dust may form an explosive mixture with air, and any source of ignition, i.e. flame or spark, will cause fire or explosion.

Dry dust can be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport. Build-up of electrostatic charge may be prevented by bonding and grounding.

See
DOT
ERG



Fire Diamond

Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

Wear breathing apparatus plus protective gloves for fire only. Prevent, by any means available, spillage from entering drains or waterways.

Use fire fighting procedures suitable for surrounding area.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protected location.

If safe to do so, remove containers from path of fire.

Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: Clean up all spills immediately. Avoid contact with skin and eyes.

Wear protective clothing, gloves, safety glasses and dust respirator.

Use dry clean-up procedures and avoid generating dust.

Vacuum up or sweep up. Place in clean drum then flush area with water.

Large Spills: Clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

No smoking, bare lights or ignition sources. Increase ventilation.

Stop leak if safe to do so.

Water spray or fog may be used to disperse/absorb vapor.

Contain or absorb spill with sand, earth or vermiculite.

Collect recoverable product into labeled containers for recycling.

Collect solid residues and seal in labeled drums for disposal.

Wash area and prevent runoff into drains.

After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).



See
DOT
ERG

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.

Wear protective clothing when risk of overexposure occurs.

Use in a well-ventilated area. Prevent concentration in hollows and sumps.

DO NOT enter confined spaces until atmosphere has been checked.

DO NOT allow material to contact humans, exposed food or food utensils.

Avoid smoking, bare lights or ignition sources. When handling, DO NOT eat, drink or smoke. Avoid contact with incompatible materials.

Keep containers securely sealed when not in used. Avoid physical damage to containers. Always wash hands with soap and water after handling. Working clothes should be laundered separately.

Launder contaminated clothing before reuse.

Use good occupational work practices. Observe manufacturer's storing/handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Recommended Storage Methods: Glass container; plastic container.

Metal can; metal drum. Packing as recommended by manufacturer.

Check all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Local exhaust ventilation usually required.

If risk of overexposure exists, wear NIOSH-approved respirator.

Correct fit is essential to obtain adequate protection. NIOSH-approved self contained breathing apparatus (SCBA) may be required in some situations.

Provide adequate ventilation in warehouse or closed storage area.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; chemical goggles.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Wear chemical protective gloves, eg. PVC. Wear safety footwear.

Other: Overalls. PVC apron. PVC protective suit may be required if exposure severe.
Eyewash unit. Ensure there is ready access to a safety shower.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless crystalline solid when pure. Contamination by tetracene results in slight yellowing. Solid and solutions have slight blue fluorescence.

Physical State: Divided solid

Vapor Pressure (kPa): Negligible

Formula Weight: 202.24

Specific Gravity (H₂O=1, at 4 °C): 1.271

pH: Not applicable

pH (1% Solution): Not applicable

Boiling Point: 393 °C (739 °F) at 760 mm Hg

Freezing/Melting Point: 156 °C (312.8 °F)

Volatile Component (% Vol): Negligible

Water Solubility: 0.135 mg/L (+ or - 0005 mg/L) in water

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid reaction with oxidizing agents.

Section 11 - Toxicological Information

Toxicity

Oral (rat) LD₅₀: 2700 mg/kg

Inhalation (rat) LC₅₀: 170 mg/m³

Oral (mouse) LD₅₀: 800 mg/kg

Intraperitoneal (mouse) LD₅₀: 514 mg/kg

Conjunctival irritation, excitement and muscle contraction recorded.

NOTE: Substance has been shown to be mutagenic in various assays, or belongs to a family of chemicals producing damage or change to cellular DNA.

Irritation

Skin (rabbit): 500 mg/24h - mild

See RTECS UR 2450000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Although environmental concentrations are highest near sources, its presence in places distant from primary sources indicates that it is reasonably stable in the atmosphere and capable of long distance transport. When released to air it may be subject to direct photolysis, although adsorption to particulates apparently can retard this process. Half-lives for reaction of vapor phase with atmospheric pollutants are: O₃, 0.67 days, NO₂, 14 days; estimated half-life for reaction with photochemically produced hydroxyl radicals is 1.12 days. If released to water, it will adsorb very strongly to sediments and particulate matter, bioconcentrate in aquatic organisms slightly to moderately, but will not hydrolyze. It may be subject to significant biodegradation, and direct photolysis may be important near the surface of waters. Evaporation may be important with a half-life of 4.8 to 39.2 days predicted for evaporation from a river 1 m deep, flowing at 1 m/sec with a wind velocity of 3 m/sec; half-life for evaporation from a model pond was 1176 days. Adsorption to sediments and particulates will limit evaporation. If released to soil it will be expected to adsorb very strongly to the soil and will not be expected to appreciably leach to the groundwater, although its presence in groundwater illustrates that it can be transported there. It will not be expected to hydrolyze or significantly evaporate from soils and surfaces. It may be subject to appreciable biodegradation in soils.

Ecotoxicity: TL_m (Median threshold limit) Mosquito fish 0.0026 mg/l/96 hr at 24-27 °C in a static bioassay

Henry's Law Constant: calculated at 5.42 x10⁻⁵

BCF: rainbow trout 72

Octanol/Water Partition Coefficient: log K_{ow} = 4.88

Soil Sorption Partition Coefficient: K_{oc} = soils 57 to 764

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible or consult manufacturer for recycling options.

Follow applicable federal, state, and local regulations.

Bury residue in an authorized landfill.

Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Toxic solids, organic, n.o.s.

ID: UN2811

Hazard Class: 6.1 - Poisonous materials

Packing Group: I - Great Danger

Symbols: G - Technical Name Required

Label Codes: 6.1 - Poison or Poison Inhalation Hazard *if inhalation hazard, Zone A or B*

Special Provisions: IB7

Packaging: Exceptions: None **Non-bulk:** 211 **Bulk:** 242

Quantity Limitations: Passenger aircraft/rail: 5 kg **Cargo aircraft only:** 50 kg

Vessel Stowage: Location: B **Other:**



Shipping Name and Description: Toxic solids, organic, n.o.s.

ID: UN2811

Hazard Class: 6.1 - Poisonous materials

Packing Group: II - Medium Danger

Symbols: G - Technical Name Required

Label Codes: 6.1 - Poison or Poison Inhalation Hazard *if inhalation hazard, Zone A or B*

Special Provisions: IB8, IP2, IP4

Packaging: Exceptions: None **Non-bulk:** 212 **Bulk:** 242

Quantity Limitations: Passenger aircraft/rail: 25 kg **Cargo aircraft only:** 100 kg

Vessel Stowage: Location: B **Other:**



Shipping Name and Description: Toxic solids, organic, n.o.s.

ID: UN2811

Hazard Class: 6.1 - Poisonous materials

Packing Group: III - Minor Danger

Symbols: G - Technical Name Required

Label Codes: 6.1 - Poison or Poison Inhalation Hazard *if inhalation hazard, Zone A or B*

Special Provisions: IB8, IP3

Packaging: Exceptions: 153 **Non-bulk:** 213 **Bulk:** 240

Quantity Limitations: Passenger aircraft/rail: 100 kg **Cargo aircraft only:** 200 kg

Vessel Stowage: Location: A **Other:**



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Not listed

CERCLA 40 CFR 302.4: Listed per CWA Section 307(a)

SARA 40 CFR 372.65: Not listed

SARA EHS 40 CFR 355: Listed

RQ: 5000 lb

TPQ: 1000/10000 lb

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Perchloroethylene

CAS Number: 127-18-4

Chemical Formula: C₂Cl₄

Structural Chemical Formula: Cl₂C=CCl₂

EINECS Number: 204-825-9

ACX Number: X1000034-7

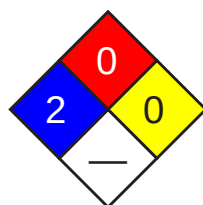
Synonyms: ANKILOSTIN; ANTISAL 1; ANTISOL 1; CARBON BICHLORIDE; CARBON DICHLORIDE; CZTEROCHLOROETYLEN; DIDAKENE; DILATIN PT; DOW-PER; ENT 1,860; EPA PESTICIDE CHEMICAL CODE 078501; ETHENE,TETRACHLORO-; ETHYLENE TETRACHLORIDE; ETHYLENE,TETRACHLORO-; FEDAL-UN; NEMA; PCE; PER; PERAWIN; PERC; PERCHLOORETHYLEEN,PER; PERCHLOR; PERCHLORAETHYLEN,PER; PERCHLORETHYLENE; PERCHLORETHYLENE,PER; PERCHLOROETHYLENE; PERCLEN; PERCLEN D; PERCLOROETILENE; PERCOSOLV; PERCOSOLVE; PERK; PERKLONE; PERSEC; TETLEN; TETRACAP; TETRACHLOORETHEEN; TETRACHLORAETHEN; TETRACHLORETHYLENE; TETRACHLOROETHENE; 1,1,2,2-TETRACHLOROETHYLENE; TETRACHLOROETHYLENE; TETRACHLOROETENE; TETRAGUER; TETRALENO; TETRALEX; TETRAVEC; TETROGUER; TETROPII

General Use: Used as a drycleaning solvent, a vapor-degreasing solvent; a drying agent for metals and certain other solids. Used also as a heat transfer medium and in the manufacture of fluorocarbons.

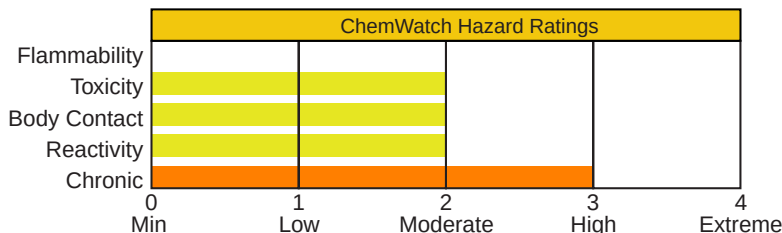
Section 2 - Composition / Information on Ingredients

Name	CAS	%
perchloroethylene	127-18-4	100
OSHA PEL TWA: 100 ppm; Ceiling 200 ppm; 300 ppm, 5-minute maximum peak in any 3 hours.	NIOSH REL Minimize workplace exposure concentrations. IDLH Level 150 ppm.	DFG (Germany) MAK Skin.
ACGIH TLV TWA: 25 ppm; STEL: 100 ppm.		

Section 3 - Hazards Identification



Fire Diamond



HMIS	
2	Health
0	Flammability
0	Reactivity

ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; ether-like odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: headache, dizziness, CNS depression, incoordination, slurred speech. Chronic Effects: liver/kidney damage; possible cancer hazard (animal studies).

Potential Health Effects

Target Organs: liver, kidneys, eyes, upper respiratory system, skin, central nervous system (CNS)

Primary Entry Routes: inhalation, skin contact, eye contact

Acute Effects

Inhalation: Acute intoxication by halogenated aliphatic hydrocarbons appears to take place over two stages. Signs of a reversible narcosis are evident in the first stage and in the second stage signs of injury to organs may become evident. A single organ alone is (almost) never involved.

The vapor is highly discomforting to the upper respiratory tract and lungs.

Inhalation hazard is increased at higher temperatures.

Anesthetic and narcotic effects (with dulling of senses and odor fatigue) are a consequence of exposure to chlorinated solvents.

Individual response varies widely; odor may not be considered objectionable at levels which quickly induce central nervous system effects.

High vapor concentrations may give a feeling of euphoria. This may result in reduced responses, followed by rapid onset of unconsciousness, possible respiratory arrest and death.

Accidental high level exposure has produced lightheadedness, unconsciousness and liver and kidney damage in workers. In at least two cases such exposures were fatal. Subjects exposed to 106 ppm in laboratory studies experienced slight eye irritation; dizziness and sleepiness were reported at 216 ppm; at exposures of 280 ppm or 600 ppm for 10 minutes there was a loss of motor coordination. In another study subjects exposed for 7 hours at 101 ppm complained of eye irritation and subjective symptoms such headache, drowsiness and sleepiness.

Eye: The liquid may produce eye discomfort and is capable of causing temporary impairment of vision and/or transient eye inflammation, ulceration. Eye contact may cause lachrymation (tears) and burning sensation.

The vapor is highly discomforting to the eyes.

The material may be irritating to the eye, with prolonged contact causing inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid is highly discomforting to the skin if exposure is prolonged and may cause drying of the skin, which may lead to dermatitis.

Toxic effects may result from skin absorption.

Absorption by skin may readily exceed vapor inhalation exposure.

Symptoms for skin absorption are the same as for inhalation.

Bare unprotected skin should not be exposed to this material.

The material may accentuate any pre-existing skin condition.

The material may produce severe skin irritation after prolonged or repeated exposure, and may produce a contact dermatitis (nonallergic).

This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis.

Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Prolonged contact is unlikely, given the severity of response, but repeated exposures may produce severe ulceration.

Industrial experience shows localized skin irritation. Prolonged dermal contact can cause chemical burns and blistering.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid is highly discomforting and toxic if swallowed and may be fatal if swallowed in large quantity.

Ingestion may result in nausea, abdominal irritation, pain and vomiting.

When used in the treatment of hookworm (4.5 to 6.5 gm orally) the only adverse effect is inebriation. Transient hepatotoxicity in patients given single oral doses of up to 5 mL have been recorded.

Carcinogenicity: NTP - Class 2B, Reasonably anticipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A3, Animal carcinogen; EPA - Not listed; MAK - Class B, Justifiably suspected of having carcinogenic potential.

Chronic Effects: Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.

Workers inhaling 232 to 385 ppm for 8 hours/day, 5 days/week for 2 to 6 years have shown abnormal hepatic function, including cirrhosis, with lightheadedness, headache, malaise and dizziness.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

See
DOT
ERG

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

Avoid giving milk or oils.

Avoid giving alcohol.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically.

Do not administer sympathomimetic drugs as they may cause ventricular arrhythmias.

For acute or short-term repeated exposures to perchloroethylene:

Tetrachloroethylene/perchloroethylene is well absorbed through the lungs with peak levels more important than duration in determining blood concentration.

Lungs excrete most of the absorbed tetrachloroethylene in an unchanged state; about 3% is converted by the liver to form trichloroacetic acid and subsequently excreted by the kidney. Exhaled material has a biological half-life of 65 hours.

INHALATION:

The treatment of acute inhalation exposures is supportive with initial attention directed to evaluation/support of ventilation and circulation.

As with all hydrocarbons care must be taken to reduce the risk of aspiration by proper positioning and medical observation.

INGESTION:

1.The ingestion level at which emesis should be induced is difficult to predict in the absence of extensive human studies.

2.The role of charcoal and cathartics remains uncertain.

BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

<u>Determinant</u>	<u>Index</u>	<u>Sampling Time</u>	<u>Comments</u>
Perchloroethylene in end-exhaled air	10 ppm	Prior to last shift of work-week	
Perchloroethylene in Blood	1 mg/L	Prior to last shift of work-week	
Trichloroacetic acid in urine	7 mg/L	End of work-week	NS,SQ

NS: Non-specific determinant; also seen after exposure to other materials

SQ: Semi-quantitative determinant - Interpretation may be ambiguous; should be used as a screening test or confirmatory test.

Section 5 - Fire-Fighting Measures

Flash Point: Nonflammable

Autoignition Temperature: 490 °C

LEL: 1.8% v/v

UEL: 11.5% v/v at 740 mm Hg 160 °C

Extinguishing Media: Use extinguishing media suitable for surrounding area.

General Fire Hazards/Hazardous Combustion Products: Nonflammable liquid.

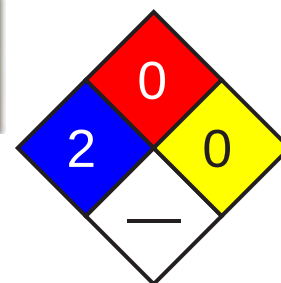
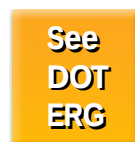
However vapor will burn when in contact with high temperature flame. Ignition ceases on removal of flame.

May form a flammable/explosive mixture in an oxygen enriched atmosphere. Heating may cause expansion/vaporization with violent rupture of containers. Decomposes on heating and produces corrosive fumes of hydrochloric acid, carbon monoxide and small amounts of toxic phosgene.

Fire Incompatibility: Avoid mixing with strong alkalis or powdered metals, particularly zinc as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

Wear breathing apparatus plus protective gloves for fire only. Prevent, by any means available, spillage from entering drains or waterways.



Fire Diamond

Use fire fighting procedures suitable for surrounding area.
 Do not approach containers suspected to be hot.
 Cool fire-exposed containers with water spray from a protected location.
 If safe to do so, remove containers from path of fire.
 Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: Clean up all spills immediately.
 Wear protective neoprene gloves and chemical goggles.
 If risk of overexposure exists, wear NIOSH-approved respirator.
 Wipe up and absorb small quantities with vermiculite or other absorbent material.
 DO NOT discharge into sewer or waterways.
 Place spilled material in clean, dry, sealable, labeled container.

See
DOT
ERG

Large Spills: Minor hazard. Clear area of personnel and move upwind.
 Contact fire department and tell them location and nature of hazard.
 Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
 No smoking, bare lights or ignition sources. Increase ventilation.
 Stop leak if safe to do so. Contain spill with sand, earth or vermiculite.
 Collect recoverable product into labeled containers for recycling.
 Absorb remaining product with sand, earth or vermiculite.
 Collect solid residues and seal in labeled drums for disposal.
 Wash area and prevent runoff into drains.
 If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Avoid all personal contact, including inhalation.
 Wear protective clothing when risk of exposure occurs.
 Use in a well-ventilated area. Prevent concentration in hollows and sumps.
 DO NOT enter confined spaces until atmosphere has been checked.
 DO NOT allow material to contact humans, exposed food or food utensils.
 Avoid contact with incompatible materials.
 When handling, DO NOT eat, drink or smoke.
 Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling. Work clothes should be laundered separately.
 Launder contaminated clothing before reuse.
 Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Recommended Storage Methods: Check that containers are clearly labeled. Glass container.
 Heavy gauge metal packages/heavy gauge metal drums.
 Avoid storage with zinc, galvanized or diecast metal (including bungs).
 DO NOT use aluminum or galvanized containers.
 Packaging as recommended by manufacturer.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear. Use in a well-ventilated area.
 Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.
 If inhalation risk exists, wear NIOSH-approved organic-vapor respirator or air supplied breathing apparatus.

Personal Protective Clothing/Equipment:

Eyes: Chemical goggles. Full face shield.

Hands/Feet: Neoprene gloves; Viton gloves.

PVA gloves.

PVC gloves.

Protective footwear.

Respiratory Protection:

Exposure Range >100 to <150 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask

Exposure Range 150 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Note: poor warning properties

Other: Overalls. Eyewash unit. Ensure there is ready access to an emergency shower.

Glove Selection Index:

PE/EVAL/PE	Best selection
VITON/CHLOROBUTYL	Best selection
VITON/NITRILE.....	Best selection
VITON	Best selection
PVA	Best selection
CPE	Best selection
NITRILE	Satisfactory; may degrade after 4 hours continuous immersion
TEFLON	Satisfactory; may degrade after 4 hours continuous immersion
NITRILE+PVC	Poor to dangerous choice for other than short-term immersion
SARANEX-23 2-PLY	Poor to dangerous choice for other than short-term immersion
SARANEX-23	Poor to dangerous choice for other than short-term immersion
PVC.....	Poor to dangerous choice for other than short-term immersion
BUTYL	Poor to dangerous choice for other than short-term immersion
NEOPRENE.....	Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless liquid, with a chloroform-like odor. Extremely stable, resists hydrolysis. Miscible with alcohol, ether and oils.

Physical State: Liquid

pH: Not applicable

Odor Threshold: Recognition 4.68 ppm

pH (1% Solution): Not applicable.

Vapor Pressure (kPa): 2.11 at 22 °C

Boiling Point: 121 °C (250 °F) at 760 mm Hg

Vapor Density (Air=1): 5.83

Freezing/Melting Point: -19 °C (-2.2 °F)

Formula Weight: 165.82

Volatile Component (% Vol): 100

Specific Gravity (H₂O=1, at 4 °C): 1.63 at 15 °C

Water Solubility: 0.02% by weight

Evaporation Rate: 0.09 Ether=1

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable and hazardous polymerization will not occur.

Storage Incompatibilities: Avoid reaction with oxidizing agents. Segregate from strong alkalis.

Haloalkenes are highly reactive. Some of the more lightly substituted lower members are highly flammable; many members of the group are peroxidizable and polymerizable.

The presence of 0.5% trichloroethylene as an impurity caused generation of dichloroacetylene during unheated drying over solid sodium hydroxide.

Subsequent fractional distillation produced an explosion.

Section 11 - Toxicological Information

Toxicity

Oral (rat) LD₅₀: 2629 mg/kg

Inhalation (man) LD_{Lo}: 2857 mg/kg

Inhalation (human) TC_{Lo}: 96 ppm/7 hrs

Inhalation (man) TC_{Lo}: 280 ppm/2 hrs

Inhalation (man) TC_{Lo}: 600 ppm/10 min

Inhalation (rat) LC_{Lo}: 34200 mg/m³/8 hr

Irritation

Skin (rabbit): 810 mg/24h -SEVERE

Eye (rabbit): 162 mg -mild

See RTECS KX 3850000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If it is released to soil, it will be subject to evaporation into the atmosphere and to leaching to the groundwater. Biodegradation may be an important process in anaerobic soils based on laboratory tests with methanogenic columns. Slow biodegradation may occur in groundwater where acclimated populations of microorganisms exist. If released to water, it will be subject to rapid volatilization with estimated half-lives ranging from <1 day to several weeks. It will not be expected to significantly biodegrade, bioconcentrate in aquatic organisms or significantly adsorb to sediment. It will not be expected to significantly hydrolyze in soil or water under normal environmental conditions. If released to the atmosphere, it will exist mainly in the gas-phase and it will be subject to photooxidation with estimates of degradation time scales ranging from an approximate half-life of 2 months to complete degradation in an hour. Some in the atmosphere may be subject to washout in rain based on the solubility in water.

Ecotoxicity: LC₅₀ Tanytarsus dissimilis (midge) 30, 840 ug/l/48 hr, static bioassay; LC₅₀ Poecilia reticulata (guppy) 18 ppm/7 days /Conditions of bioassay not specified; LC₅₀ Daphnia magna (water flea) 18 mg/l/48 hr, static bioassay, at 22 °C; LC₅₀ Salmo gairdneri (rainbow trout) 5 mg/l/96 hr, static bioassay at 12 °C

Henry's Law Constant: 2.87 x10⁻²

BCF: fathead minnow 38.9

Biochemical Oxygen Demand (BOD): none

Octanol/Water Partition Coefficient: log K_{ow} = 3.40

Soil Sorption Partition Coefficient: K_{oc} = 209

Section 13 - Disposal Considerations

Disposal: Reclaim solvent at an approved site.

Allow absorbed spillage to evaporate in an open top container, away from habitation.

Incinerate residue at an approved site.

Used containers should be left upside down with bungs out.

Return containers to drum reconditioner or recycler.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Tetrachloroethylene

ID: UN1897

Hazard Class: 6.1 - Poisonous materials

Packing Group: III - Minor Danger

Symbols:

Label Codes: 6.1 - Poison or Poison Inhalation Hazard if inhalation hazard, Zone A or B

Special Provisions: IB3, N36, T4, TP1

Packaging: Exceptions: 153 **Non-bulk:** 203 **Bulk:** 241

Quantity Limitations: **Passenger aircraft/rail:** 60 L **Cargo aircraft only:** 220 L

Vessel Stowage: **Location:** A **Other:** 40



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U210 Toxic Waste

CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Toluene

CAS Number: 108-88-3

Chemical Formula: C₇H₈

Structural Chemical Formula: C₆H₅CH₃

EINECS Number: 203-625-9

ACX Number: X1001512-0

Synonyms: ANTISAL 1A; BENZENE,METHYL-; CP 25; METHACIDE; METHANE,PHENYL-; METHYL BENZENE; METHYL BENZOL; METHYLBENZENE; METHYLBENZOL; PHENYL METHANE; PHENYLMETHANE; TOLUEEN; TOLUEN; TOLUENE; TOLUENO; TOLUOL; TOLUOLO; TOLU-SOL

General Use: Used as a solvent for paint, resins, lacquers inks & adhesives. Component of solvent blends and thinners; in gasoline and aviation fuel. Used in the manufacture of chemicals, dyes, explosives, benzoic acid.

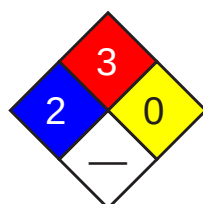
Some grades of toluene may contain traces of xylene and benzene.

Odor threshold: 2 ppm approx. Odor is not a reliable warning property due to olfactory fatigue.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
toluene	108-88-3	> 99.5
OSHA PEL TWA: 200 ppm; Ceiling: 300 ppm; 500 ppm, 10-minute maximum peak.	NIOSH REL TWA: 100 ppm (375 mg/m ³); STEL: 150 ppm (560 mg/m ³). IDLH Level 500 ppm.	DFG (Germany) MAK TWA: 50 ppm; PEAK: 200 ppm; skin.
ACGIH TLV TWA: 50 ppm; skin.		
EU OEL TWA: 192 mg/m ³ (50 ppm); STEL: 384 mg/m ³ (100 ppm).		

Section 3 - Hazards Identification



Fire Diamond

	ChemWatch Hazard Ratings				
Flammability	3	2	1	0	
Toxicity	2	1	0		
Body Contact	2	1	0		
Reactivity	0	0	0	0	
Chronic	0	0	0	0	
	0 Min	1 Low	2 Moderate	3 High	4 Extreme

ANSI Signal Word

Danger!

HMIS	
2	Health
3	Flammability
0	Reactivity



Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; sickly, sweet odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: weakness, headache, dizziness, confusion, insomnia. Chronic Effects: liver/kidney damage, may cause birth defects. Flammable.

Potential Health Effects

Target Organs: Skin, liver, kidneys, central nervous system.

Primary Entry Routes: Inhalation, skin contact/absorption.

Acute Effects

Inhalation: The vapor is highly discomforting to the upper respiratory tract.

Inhalation hazard is increased at higher temperatures.

Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Central nervous system (CNS) depression may include nonspecific discomfort, symptoms of giddiness, headache, dizziness, nausea, anesthetic effects, slowed reaction time, slurred speech and may progress to unconsciousness.

Serious poisonings may result in respiratory depression and may be fatal.

Eye: The liquid produces a high level of eye discomfort and is capable of causing pain and severe conjunctivitis.

Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.

The vapor is discomforting to the eyes if exposure is prolonged.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid may produce skin discomfort following prolonged contact.

Defatting and/or drying of the skin may lead to dermatitis and it is absorbed by skin.

Toxic effects may result from skin absorption.

Open cuts, abraded or irritated skin should not be exposed to this material.

The material may accentuate any pre-existing skin condition.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid may produce gastrointestinal discomfort and may be harmful if swallowed. Ingestion may result in nausea, pain and vomiting. Vomiting entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.

Chronic toluene habituation occurs following intentional abuse (glue-sniffing) or from occupational exposure. Ataxia, incoordination and tremors of the hands and feet (as a consequence of diffuse cerebral atrophy), headache, abnormal speech, transient memory loss, convulsions, coma, drowsiness, reduced color perception, frank blindness, nystagmus (rapid, involuntary eye-movements), decreased hearing leading to deafness and mild dementia have all been associated with chronic abuse.

Peripheral nerve damage, encephalopathy, giant axonopathy, electrolyte disturbances in the cerebrospinal fluid and abnormal computer tomographic (CT) scans are common amongst toluene addicts. Although toluene abuse has been linked with kidney disease, this does not commonly appear in cases of occupational toluene exposures. Cardiac and hematological toxicity are however associated with chronic toluene exposure. Cardiac arrhythmia, multifocal and premature ventricular contractions and supraventricular tachycardia are present in 20% of patients who abused toluene-containing paints.

Previous suggestions that chronic toluene inhalation produced human peripheral neuropathy have largely been discounted. However central nervous system (CNS) depression is well documented where blood toluene levels exceed 2.2 mg%. Toluene abusers can achieve transient circulating concentrations of 6.5 mg%. Amongst workers exposed for a median time of 29 years to toluene no subacute effects on neurasthenic complaints and psychometric test results could be established.

The prenatal toxicity of very high toluene concentrations has been documented for several animal species and man. Malformations indicative of specific teratogenicity have not generally been found. The toxicity described in the literature takes the form of embryo death or delayed fetal growth and delayed skeletal system development. Permanent damage of children has been seen only when mothers had suffered from chronic intoxication as a result of "sniffing".

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

See
DOT
ERG

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Following acute or short-term repeated exposures to toluene:

1. Toluene is absorbed across to alveolar barrier, the blood/air mixture being 11.2/15.6 (at 37 °C) The order of toluene, in expired breath, is of the order of 18 ppm following sustained exposure to 100 ppm.

The tissue/blood proportion is 1/3 except in adipose where the proportion is 8/10.

2. Metabolism by microsomal mono-oxygenation, results in the production of hippuric acid. This may be detected in the urine in amounts between 0.5 and 2.5 g/24hr which represents, on average 0.8 gm/gm of creatinine.

The biological half life of hippuric acid is in the order of 1-2 hours.

3. Primary threat to life from ingestion and/or inhalation is respiratory failure.

4. Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases ($pO_2 < 50$ mm Hg or $pCO_2 > 50$ mm Hg) should be intubated.

5. Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.

6. A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.

7. Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.

Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.

8. Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

<u>Determinant</u>	<u>Index</u>	<u>Sampling Time</u>	<u>Comments</u>
Hippuric acid in urine	2.5 gm/gm creatinine	End of shift Last 4 hrs of shift	B,NS
Toluene in venous blood	1 mg/L	End of shift	SQ
Toluene in end-exhaled air		End of shift	SQ

NS: Non-specific determinant; also observed after exposure to other material

SQ: Semi-quantitative determinant - Interpretation may be ambiguous; should be used as a screening test or confirmatory test.

B: Background levels occur in specimens collected from subjects NOT exposed.

Section 5 - Fire-Fighting Measures

Flash Point: 4 °C Closed Cup

Autoignition Temperature: 480 °C

LEL: 1.2% v/v

UEL: 7.1% v/v

Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.

Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.

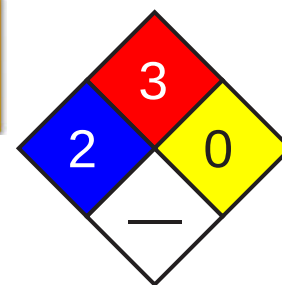
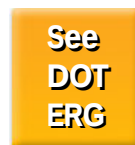
Severe fire hazard when exposed to heat, flame and/or oxidizers.

Vapor forms an explosive mixture with air.

Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.

Heating may cause expansion/decomposition with violent rupture of containers.

On combustion, may emit toxic fumes of carbon monoxide (CO) and carbon dioxide (CO₂).



Fire Diamond

Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.

Nitric acid with toluene, produces nitrated compounds which are explosive.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

Fight fire from a safe distance, with adequate cover.

If safe, switch off electrical equipment until vapor fire hazard removed.

Use water delivered as a fine spray to control the fire and cool adjacent area. Avoid spraying water onto liquid pools.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protective location.

If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.

Avoid breathing vapors and contact with skin and eyes.

Control personal contact by using protective equipment.

Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

See
DOT
ERG

Large Spills: Clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

No smoking, bare lights or ignition sources. Increase ventilation.

Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.

Use only spark-free shovels and explosion proof equipment.

Collect recoverable product into labeled containers for recycling.

Absorb remaining product with sand, earth or vermiculite.

Collect solid residues and seal in labeled drums for disposal.

Wash area and prevent runoff into drains.

If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.

Wear protective clothing when risk of exposure occurs.

Use in a well-ventilated area. Prevent concentration in hollows and sumps.

DO NOT enter confined spaces until atmosphere has been checked.

Avoid smoking, bare lights, heat or ignition sources.

When handling, DO NOT eat, drink or smoke.

Vapor may ignite on pumping or pouring due to static electricity.

DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.

Avoid contact with incompatible materials.

Keep containers securely sealed. Avoid physical damage to containers.

Always wash hands with soap and water after handling.

Work clothes should be laundered separately.

Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

Recommended Storage Methods: Metal can; Metal drum; Metal safety cans. Packing as supplied by manufacturer.

Plastic containers may only be used if approved for flammable liquid.

Check that containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area; local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.

General exhaust is adequate under normal operating conditions.

Local exhaust ventilation may be required in special circumstances.

If risk of overexposure exists, wear NIOSH-approved respirator. Correct fit is essential to ensure adequate protection.

Provide adequate ventilation in warehouses and enclosed storage areas.

In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; chemical goggles. Full face shield.

DO NOT wear contact lenses. Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Wear chemical protective gloves, eg. PVC. Wear safety footwear.

Respiratory Protection:

Exposure Range >200 to <500 ppm: Air Purifying, Negative Pressure, Half Mask

Exposure Range 500 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Cartridge Color: black

Other: Overalls. Barrier cream. Eyewash unit.

Glove Selection Index:

PE/EVAL/PE Best selection

VITON/CHLOROBUTYL Best selection

VITON Best selection

PVA Best selection

TEFLON Satisfactory; may degrade after 4 hours continuous immersion

SARANEX-23 2-PLY Poor to dangerous choice for other than short-term immersion

CPE Poor to dangerous choice for other than short-term immersion

VITON/NEOPRENE Poor to dangerous choice for other than short-term immersion

SARANEX-23 Poor to dangerous choice for other than short-term immersion

NEOPRENE/NATURAL Poor to dangerous choice for other than short-term immersion

NITRILE+PVC Poor to dangerous choice for other than short-term immersion

NITRILE Poor to dangerous choice for other than short-term immersion

BUTYL Poor to dangerous choice for other than short-term immersion

PVC Poor to dangerous choice for other than short-term immersion

NEOPRENE Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear highly flammable liquid with a strong aromatic odor; floats on water. Mixes with most organic solvents.

Physical State: Liquid

pH: Not applicable

Odor Threshold: 2.14 ppm

pH (1% Solution): Not applicable.

Vapor Pressure (kPa): 2.93 at 20 °C

Boiling Point: 111 °C (232 °F) at 760 mm Hg

Vapor Density (Air=1): 3.2

Freezing/Melting Point: -95 °C (-139 °F)

Formula Weight: 92.14

Volatile Component (% Vol): 100

Specific Gravity (H₂O=1, at 4 °C): 0.87 at 20 °C

Water Solubility: < 1 mg/mL at 18 °C

Evaporation Rate: 2.4 (BuAc=1)

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Segregate from strong oxidizers.

Section 11 - Toxicological Information

Toxicity

Oral (human) LD₅₀: 50 mg/kg

Oral (rat) LD₅₀: 636 mg/kg

Inhalation (human) TC_{Lo}: 100 ppm

Inhalation (man) TC_{Lo}: 200 ppm

Inhalation (rat) LC₅₀: > 26700 ppm/1h

Dermal (rabbit) LD₅₀: 12124 mg/kg

Reproductive effector in rats

Irritation

Skin (rabbit): 20 mg/24h-moderate

Skin (rabbit): 500 mg - moderate

Eye (rabbit): 0.87 mg - mild

Eye (rabbit): 2 mg/24h - SEVERE

Eye (rabbit): 100 mg/30sec - mild

See RTECS XS 5250000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it will be lost by evaporation from near-surface soil and by leaching to the groundwater. Biodegradation occurs both in soil and groundwater, but it is apt to be slow especially at high concentrations, which may be toxic to microorganisms. The presence of acclimated microbial populations may allow rapid biodegradation. It will not significantly hydrolyze in soil or water under normal environmental conditions. If released into water, its concentration will decrease due to evaporation and biodegradation. This removal can be rapid or take several weeks, depending on temperature, mixing conditions, and acclimation of microorganisms. It will not significantly adsorb to sediment or bioconcentrate in aquatic organisms. If released to the atmosphere, it will degrade by reaction with photochemically produced hydroxyl radicals (half-life 3 hr to slightly over 1 day) or be washed out in rain. It will not be subject to direct photolysis.

Ecotoxicity: LC₅₀ Aedes aegypti-4th instar (mosquito larvae) 22 mg/l /Conditions of bioassay not specified; LC₅₀ Cyprinodon variegatus (sheepshead minnow) 277-485 mg/l 96 hr /Conditions of bioassay not specified; LC₅₀ Calandra granaria (grain weevil) 210 mg/l /in air; LC₅₀ Cancer magister (crab larvae stage I) 28 ppm/96 hr /Conditions of bioassay not specified; LC₅₀ Crangon franciscorum (shrimp) 4.3 ppm 96 hr /Conditions of bioassay not specified; LC₅₀ Artemia salina (brine shrimp) 33 mg/l 24 hr /Conditions of bioassay not specified; LC₅₀ Morone saxatilis (striped bass) 7.3 mg/l 96 hr /Conditions of bioassay not specified; LC₅₀ Pimephales promelas (fathead minnows) 55-72 mg/l (embryos), 25-36 mg/l (1-day posthatch protolaryvae), and 26-31 mg/l (30-day-old minnows)/ 96 hour /Conditions of bioassay not specified

Henry's Law Constant: 0.0067

BCF: eels 13.2

Biochemical Oxygen Demand (BOD): 0%, 5 days

Octanol/Water Partition Coefficient: log K_{ow} = 2.69

Soil Sorption Partition Coefficient: K_{oc} = silty loam 37

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.

Follow applicable federal, state, and local regulations.

Incinerate residue at an approved site.

Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Toluene

ID: UN1294

Hazard Class: 3 - Flammable and combustible liquid

Packing Group: II - Medium Danger

Symbols:

Label Codes: 3 - Flammable Liquid

Special Provisions: IB2, T4, TP1

Packaging: Exceptions: 150 Non-bulk: 202 Bulk: 242

Quantity Limitations: Passenger aircraft/rail: 5 L Cargo aircraft only: 60 L

Vessel Stowage: Location: B Other:



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U220 Toxic Waste

CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a) 1000 lb (453.5 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: trans-Acetylene Dichloride

CAS Number: 156-60-5

Chemical Formula: C₂H₂Cl₂

Structural Chemical Formula: ClCH=CHCl

EINECS Number: 205-860-2

ACX Number: X1003965-9

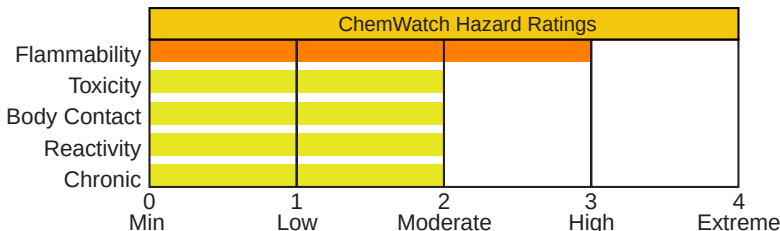
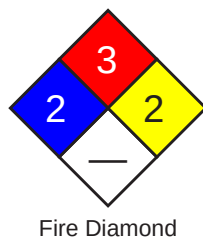
Synonyms: TRANS-ACETYLENE DICHLORIDE; 1,2-DICHLORO-(E)-ETHENE; TRANS-1,2-DICHLOROETHENE; 1,2-DICHLORO-(E)-ETHYLENE; 1,2-TRANS-DICHLOROETHYLENE; SYM-DICHLOROETHYLENE; TRANS-1,2-DICHLOROETHYLENE; TRANS-DICHLOROETHYLENE; ETHYLENE,1,2-DICHLORO-

General Use: solvent for fats, phenols, camphor, etc.; retards fermentation; rubber manufacturing; refrigerants; additive to dye and lacquer solutions; low temperature solvent for heat sensitive substances; constituent of perfumes, thermoplastics; used in organic synthesis and medicine

Section 2 - Composition / Information on Ingredients

Name	CAS	%
trans-acetylene dichloride	156-60-5	>98
OSHA PEL TWA: 200 ppm; 790 mg/m ³ .	NIOSH REL	DFG (Germany) MAK TWA: 200 ppm; PEAK: 400 ppm.
ACGIH TLV TWA: 200 ppm.		

Section 3 - Hazards Identification



HMIS	
2	Health
3	Flammability
2	Reactivity

ANSI Signal Word

Warning!



☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless, light liquid; sweetish odor. Irritating to eyes/skin/respiratory tract. Harmful. Other Acute Effects: narcotic effect. Flammable.

Potential Health Effects

Target Organs: eyes, skin, respiratory system, nervous system, liver, kidneys

Primary Entry Routes: inhalation of vapor, skin/eye contact

Acute Effects

Inhalation: There is a single report of an industrial poisoning, a fatality caused by the inhalation of a vapor in a small enclosure. Acute intoxication by halogenated aliphatic hydrocarbons appears to take place over two stages. Signs of a reversible narcosis are evident in the first stage and in the second stage signs of injury to organs may become evident, a single organ alone is (almost) never involved. Depression of the central nervous system is most outstanding effect of most halogenated aliphatic hydrocarbons. Inebriation and excitation, passing into narcosis, is a typical reaction. In severe acute exposures there is always a danger of death from respiratory failure or cardiac arrest due to a tendency to make the heart more susceptible to catecholamines (adrenalin). The most important effects of exposure are narcosis and irritation of the central nervous system. Liver responses may occur after repeated narcotic doses and involves fatty liver degeneration. Vapor exposure may produce central nervous system depression or in milder exposures, nausea, vomiting, weakness, tremor and epigastric cramps. Recovery is usually rapid. At high concentrations the trans-isomer is twice as strong a CNS depressant as the cis isomer.

Eye: The vapor when concentrated has pronounced eye irritation effect; this gives some warning of high vapor concentrations. If eye irritation occurs seek to reduce exposure with available control measures, or evacuate area. The material may produce moderate eye irritation leading to inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis. Exposure to the trans isomer at 2200 ppm caused burning of the eyes, vertigo, nausea. Reversible corneal clouding has been described in exposures to acetylene dichloride.

Skin: The liquid may produce skin discomfort following prolonged contact. Defatting and/ or drying of the skin may lead to dermatitis. The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: The liquid is discomforting to the gastrointestinal tract and toxic if swallowed. Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: The material may accumulate in the human body and progressively cause tissue damage.

Section 4 - First Aid Measures

Inhalation: • If fumes or combustion products are inhaled, remove to fresh air.

- Lay patient down. Keep warm and rested.
- If breathing is shallow or has stopped, ensure clear airway and apply resuscitation, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
- Transport to hospital or doctor.

Eye Contact: • Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

- Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- Transport to hospital or doctor without delay.
- Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: • Immediately remove all contaminated clothing, including footwear (after rinsing with water).

- Wash affected areas thoroughly with water (and soap if available).
- Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center. Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treatment should follow that practiced in carbon tetrachloride exposures:

- Acute exposures to carbon tetrachloride present, initially, with CNS depression followed by hepatic and renal dysfunction.
- Respiratory depression and cardiac dysrhythmias are an immediate threat to life.
- Since a major fraction of absorbed carbon tetrachloride is exhaled in first hour, good tidal volumes should be maintained in severely poisoned patients; hyperventilation may be an additional therapeutic modality.
- Ipecac syrup, lavage, activated charcoal or catharsis may all be used in the first 4 hours.
- Since reactive metabolites may cause hepatorenal toxicity, administration of N-acetyl-L-cysteine may reduce complications. Experience with this therapy is limited.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: 6 °C

Autoignition Temperature: 1,2-dichloroethylene 460 °C

LEL: 9.7% v/v

UEL: 12.8% v/v

Extinguishing Media: Foam. Dry chemical powder. BCF (where regulations permit). Carbon dioxide. Water spray or fog - Large fires only.

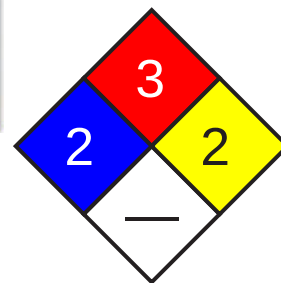
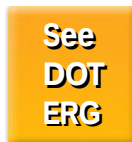
General Fire Hazards/Hazardous Combustion Products: • Liquid and vapor are highly flammable.

- Severe fire hazard when exposed to heat, flame and/or oxidizers.
- Vapor forms an explosive mixture with air.
- Severe explosion hazard, in the form of vapor, when exposed to flame or spark.
- Vapor may travel a considerable distance to source of ignition.
- Heating may cause expansion/decomposition with violent rupture of containers.
- On combustion, may emit toxic fumes of carbon monoxide (CO). Other combustion products include hydrogen chloride and phosgene.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e., nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: • Contact fire department and tell them location and nature of hazard.

- May be violently or explosively reactive.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or waterways.
- Consider evacuation (or protect in place).
- Fight fire from a safe distance, with adequate cover.
- If safe, switch off electrical equipment until vapor fire hazard removed.
- Use water delivered as a fine spray to control the fire and cool adjacent area.
- Avoid spraying water onto liquid pools.
- Do not approach containers suspected to be hot.
- Cool fire-exposed containers with water spray from a protected location.
- If safe to do so, remove containers from path of fire.



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: • Remove all ignition sources.

- Clean up all spills immediately.
- Avoid breathing vapors and contact with skin and eyes.
- Control personal contact by using protective equipment.
- Contain and absorb small quantities with vermiculite or other absorbent material.
- Wipe up.
- Collect residues in a flammable waste container.

Large Spills: • Clear area of personnel and move upwind.

- Contact fire department and tell them location and nature of hazard.
- May be violently or explosively reactive.
- Wear breathing apparatus plus protective gloves.
- Prevent, by any means available, spillage from entering drains or waterways.
- No smoking, bare lights or ignition sources.
- Increase ventilation.
- Stop leak if safe to do so.
- Water spray or fog may be used to disperse/absorb vapor.
- Contain spill with sand, earth or vermiculite.
- Use only spark-free shovels and explosion proof equipment.
- Collect recoverable product into labeled containers for recycling.
- Absorb remaining product with sand, earth or vermiculite.
- Collect solid residues and seal in labeled drums for disposal.
- Wash area and prevent runoff into drains.
- If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).



Section 7 - Handling and Storage

Handling Precautions: • Avoid all personal contact, including inhalation.

- Wear protective clothing when risk of exposure occurs.
- Use in a well-ventilated area.
- Prevent concentration in hollows and sumps.

- DO NOT enter confined spaces until atmosphere has been checked.
- Avoid smoking, bare lights or ignition sources.
- Avoid contact with incompatible materials.
- When handling, DO NOT eat, drink or smoke.
- Keep containers securely sealed when not in use.
- Avoid physical damage to containers.
- Always wash hands with soap and water after handling.
- Work clothes should be laundered separately.
- Follow good occupational work practices.
- Observe manufacturer's storage and handling recommendations.
- Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

Recommended Storage Methods: Check that containers are clearly labeled. Packaging as recommended by manufacturer. DO NOT use aluminum or galvanized containers.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Local exhaust ventilation usually required. If risk of overexposure exists, wear NIOSH-approved respirator. Provide adequate ventilation in warehouse or closed storage area.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields or, as required, chemical goggles. Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Butyl rubber gloves. Neoprene gloves.

Respiratory Protection: Respirator protection may be required. Consult your supervisor.

Other: • Overalls.

• Barrier cream.

• Eyewash unit.

Glove Selection Index:

VITON Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless liquid with pleasant chloroform-like odor.

Physical State: colorless, light liquid

Specific Gravity (H₂O=1, at 4 °C): 1.2565 at

Odor Threshold: 0.3357 to 1975.00 ppm

20 °C/4 °C

Vapor Pressure (kPa): 200 mm Hg at 14 °C

Boiling Point: 48 °C (118 °F) to 48.5 °C (119 °F) at 760 mm Hg

Vapor Density (Air=1): 3.34

Freezing/Melting Point: -50 °C (-58 °F)

Formula Weight: 96.95

Water Solubility: < 1 mg/mL at 18 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid reaction with oxidizing agents. Acetylene dichloride in contact with solid caustic alkalis or their concentrated solutions will form chloroacetylene which ignites in air. Haloalkenes are highly reactive.

Section 11 - Toxicological Information

Toxicity

Oral (rat) LD₅₀: 1235 mg/kg

Intraperitoneal (rat) LD₅₀: 7411 mg/kg

Oral (mouse) LD₅₀: 2122 mg/kg

Inhalation (mouse) LC₅₀: 75000 mg/m³/2 hr

Intraperitoneal (mouse) LD₅₀: 3952 mg/kg

Dermal Rabbit) LD₅₀: >5000 mg/kg

Inhalation (human) TC₁₀: 4800 mg/m³/10m

Hamster lung cell mutagen in vitro.

Irritation

Skin (rabbit): 500 mg/24 hr - mod

Eye (rabbit): 10 mg - moderate

See RTECS KV9400000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released on soil, it should evaporate and leach into the groundwater where very slow biodegradation should occur. If released into water, it will be lost mainly through volatilization (half-life 3 hr in a model river). Biodegradation, adsorption to sediment, and bioconcentration in aquatic organisms should not be significant. In the atmosphere, it will be lost by reaction with photochemically produced hydroxyl radicals (half-life 3.6 days) and scavenged by rain. Because it is relatively long-lived in the atmosphere, considerable dispersal from source areas should occur.

Ecotoxicity: LC_{50} *Lepomis machrochirus* (bluegill) 135,000 ug/l/96 hr in a static unmeasured bioassay

Henry's Law Constant: estimated at 0.00672

BCF: calculated at 22

Octanol/Water Partition Coefficient: $\log K_{ow} = 2.06$

Soil Sorption Partition Coefficient: $K_{oc} = 36$

Section 13 - Disposal Considerations

Disposal: • Consult manufacturer for recycling options and recycle where possible.

- Follow applicable local, state, and federal regulations.
- Incinerate residue at an approved site.
- Recycle containers if possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: 1,2-Dichloroethylene

ID: UN1150

Hazard Class: 3 - Flammable and combustible liquid

Packing Group: II - Medium Danger

Symbols:

Label Codes: 3 - Flammable Liquid

Special Provisions: IB2, T7, TP2

Packaging: Exceptions: 150 Non-bulk: 202 Bulk: 242

Quantity Limitations: Passenger aircraft/rail: 5 L Cargo aircraft only: 60 L

Vessel Stowage: Location: B Other:



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U079 Toxic Waste

CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a) 1000 lb (453.5 kg)

SARA 40 CFR 372.65: Not listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Trichloroethylene

CAS Number: 79-01-6

Chemical Formula: C₂HCl₃

Structural Chemical Formula: ClCH=CCl₂

EINECS Number: 201-167-4

ACX Number: X1000039-2

Synonyms: ACETYLENE TRICHLORIDE; ALGYLEN; ANAMENTH; BENZINOL; BLACOSOLV; BLANCOSOLV; CECOLENE; CHLORILEN; 1-CHLORO-2,2-DICHLOROETHYLENE; CHLORYLEA; CHLORYLEA, CHORYLEN, CIRCOSOLV, CRAWHASPOL, DOW-TRI, DUKERON, PER-A-CLOR, TRIAD, TRIAL, TRI-PLUS M, VITRAN; CHLORYLEN; CHORYLEN; CIRCOSOLV; CRAWHASPOL; DENSINFLUAT; 1,1-DICHLORO-2-CHLOROETHYLENE; DOW-TRI; DUKERON; EPA PESTICIDE CHEMICAL CODE 081202; ETHENE, TRICHLORO-; ETHINYL TRICHLORIDE; ETHYLENE TRICHLORIDE; ETHYLENE, TRICHLORO-; FLECK-FLIP; FLOCK FLIP; FLUATE; GEMALGENE; GERMALGENE; LANADIN; LETHURIN; NARCOGEN; NARKOGEN; NARKOSOID; NIALK; NSC 389; PERM-A-CHLOR; PERM-A-CLOR; PETZINOL; PHILEX; TCE; THRETHYLEN; THRETHYLENE; TRETHYLENE; TRI; TRIAD; TRIAL; TRIASOL; TRICHOORETHEEN; TRICHOORETHYLEEN, TRI; TRICHLORAETHEN; TRICHLORAETHYLEN, TRI; TRICHLORAN; TRICHLOREN; TRICHLORETHENE; TRICHLORETHYLENE; TRICHLORETHYLENE, TRI; TRICHLOROETHENE; 1,1,2-TRICHLOROETHYLENE; TRICHLOROETHYLENE; TRICHLOROETHYLENE; 1,2,2-TRICHLOROETHYLENE; TRI-CLENE; TRICLENE; TRICLORETENE; TRICLOROETILENE; TRIELENE; TRIELIN; TRIELINA; TRIELINE; TRIKLONE; TRILEN; TRILENE; TRILINE; TRIMAR; TRIOL; TRI-PLUS; TRI-PLUS M; VESTROL; VITRAN; WESTROSOL

General Use: Mainly used for vapor degreasing; solvent in textile and electronics industries; for adhesives, lubricants and consumer products (such as spot removers and rug cleaners).

Until recently, it was used to make hop extracts for beer, decaffeinated coffee and spice extracts.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
trichloroethylene	79-01-6	> 99

OSHA PEL

TWA: 100 ppm; Ceiling: 200 ppm;
 300 ppm, 5-minute maximum
 peak in any 2 hours.

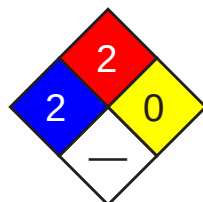
NIOSH REL

IDLH Level
 1000 ppm.

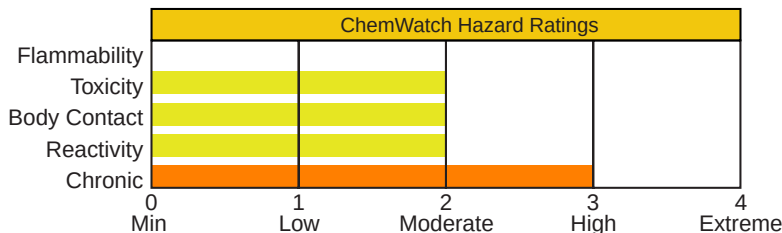
ACGIH TLV

TWA: 50 ppm; STEL: 100 ppm.

Section 3 - Hazards Identification



Fire Diamond



HMIS	
2	Health
2	Flammability
0	Reactivity

ANSI Signal Word

Warning!



Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear, colorless liquid; sweet odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: irregular heart beat, drunkenness. Chronic Effects: heart/liver/kidney damage, dermatitis, birth defects, cancer (animal studies). Flammable.

Potential Health Effects

Target Organs: respiratory system, central nervous system (CNS), peripheral nervous system, cardiovascular system, liver, kidneys, skin

Primary Entry Routes: inhalation, skin contact, eye contact, ingestion (rarely)

Acute Effects

Inhalation: The vapor is mildly discomforting to the upper respiratory tract.

Inhalation hazard is increased at higher temperatures.

Anesthetics and narcotic effects (with dulling of senses and odor fatigue) are a consequence of exposure to chlorinated solvents.

Individual response varies widely; odor may not be considered objectionable at levels which quickly induce central nervous system effects.

High vapor concentrations may give a feeling of euphoria. This may result in reduced responses, followed by rapid onset of unconsciousness, possible respiratory arrest and death.

Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Evidence of acute human toxicity comes mainly from the use of TCE as an anesthetic. Tachypnea and ventricular arrhythmias are experienced at inhaled concentrations exceeding 15000 ppm. Systemic toxicity is low following anesthesia. Occasional hepatotoxicity (liver dysfunction) has been reported; this is probably due to the breakdown of TCE to dichloroacetylene and phosgene by soda-lime present in some anesthetic devices. The effects of TCE appear to be enhanced in some individuals by simultaneous exposure to caffeine, ethanol and other drugs. "Degreasers Flush" describes a reddening of facial, neck, and back skin and is seen after intake of substantial quantities of ethanol by certain individuals after exposures to TCE.

Eye: The liquid is highly discomforting to the eyes and is capable of causing pain and severe conjunctivitis.

Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.

The vapor is discomforting to the eyes.

The material may produce moderate eye irritation leading to inflammation.

Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid is discomforting to the skin and may cause drying of the skin, which may lead to dermatitis.

Toxic effects may result from skin absorption.

Bare unprotected skin should not be exposed to this material. The material may accentuate any pre-existing skin condition.

The material may produce severe skin irritation after prolonged or repeated exposure, and may produce a contact dermatitis (nonallergic).

This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis.

Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Repeated exposures may produce severe ulceration.

Localized application may produce pustular eruptions, pruritus and erythema. A permeability coefficient of 1.6×10^{-2} cm/hr has been calculated by the US EPA. Percutaneous absorption is unlikely to contribute significantly to total body burdens unless dermatitis is present.

Ingestion: The liquid is highly discomforting and toxic if swallowed.

Ingestion may result in nausea, abdominal irritation, pain and vomiting.

Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A5, Not suspected as a human carcinogen; EPA - Not listed; MAK - Class B, Justifiably suspected of having carcinogenic potential.

Chronic Effects: Sensitive humans may experience anesthetic effects from short exposures.

Chronic effects of exposure include fatigue, headache, irritability, vomiting, skin flush and intolerance to alcohol.

Liver, kidney, heart and neurological damage may also result from chronic overexposure.

Alcohol intake may increase the toxic effects of the material.

A variety of disturbances have been seen among workers exposed at concentrations ranging from 1 to 335 ppm. These disturbances increased with the length of exposure (to 5 years or more) and were more prominent when exposures exceeded 40 ppm. Increased complaints of alcohol intolerance, tremors, giddiness and anxiety were amongst symptoms recorded. Variation in effects in different occupational settings may be due to different physical workloads. There appeared to be no increase in the expected rates of congenital defects in children born to women exposed to TCE over a 13 year period.

Epidemiological studies consistently fail to show a link between cancers and TCE exposure. This is significant because of the tens of thousands of exposed workers monitored.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

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Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

Avoid giving milk or oils.

Avoid giving alcohol.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically.

Do not administer sympathomimetic drugs as they may cause ventricular arrhythmias.

Following acute or short-term continued exposures to trichloroethylene:

1. Trichloroethylene concentration in expired air correlates with exposure. 8 hours exposure to 100 ppm produces levels of 25 ppm immediately and 1 ppm 16 hours after exposures.

2. Most mild exposure respond to removal from the source and supportive care.

Serious toxicity most often results from hypoxemia or cardiac dysrhythmias so that oxygen, intubation, intravenous lines and cardiac monitoring should be started initially as the clinical situation dictates.

3. Ipecac syrup should be given to alert patients who ingest more than a minor amount and present within 2 hours.

4. The efficacy of activated charcoal and cathartics is unclear.

5. The metabolites, trichloroacetic acid, trichloroethanol and to a lesser degree, chloral hydrate, may be detected in the urine up to 16 days postexposure.

BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

<u>Determinant</u>	<u>Index</u>	<u>Sampling Time</u>	<u>Comments</u>
Trichloroacetic acid in urine	10 mg/gm creatinine	End of work-week	NS
Trichloroacetic acid AND Trichloroethanol in urine	300 mg/mg creatinine	End of shift at end of work-week	NS
Free Trichloroethanol in blood	4 mg/L	End of shift at end of work-week	NS
Trichloroethylene in end-exhaled air			SQ
Trichloroethylene in blood			SQ

NS: Non-specific determinant; also seen after exposure to other materials

SQ: Semi-quantitative determinant - Interpretation may be ambiguous; should be used as a screening test or confirmatory test.

Section 5 - Fire-Fighting Measures

Flash Point: 32.222 °C Closed Cup

Autoignition Temperature: 420 °C

LEL: 8% v/v

UEL: 10.5% v/v

Extinguishing Media: Water spray or fog; foam, dry chemical powder, or BCF (where regulations permit).
Carbon dioxide.

General Fire Hazards/Hazardous Combustion Products: Vapor will burn when in contact with high temperature flame.

May form a flammable/explosive mixture in an oxygen enriched atmosphere. Heating may cause expansion/vaporization with violent rupture of containers. Decomposes on heating and produces corrosive fumes of hydrochloric acid, carbon monoxide and small amounts of toxic phosgene.

Fire Incompatibility: Avoid reaction with strong oxidizing agents (particularly oxygen in gas or liquid form and nitrogen dioxide), strong bases, sodium and sodium-potassium alloys. Powdered metals; magnesium, zinc and aluminum.

Contact with water may result in the slow formation of hydrochloric acid.

Attacks natural rubber.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

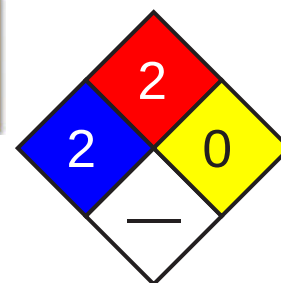
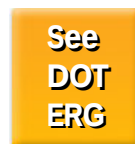
Use water delivered as a fine spray to control fire and cool adjacent area.

Avoid spraying water onto liquid pools.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protected location.

If safe to do so, remove containers from path of fire.



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.

Avoid breathing vapors and contact with skin and eyes.

Control personal contact by using protective equipment.

Contain and absorb spill with sand, earth, inert material or vermiculite.

Wipe up. Place in a suitable labeled container for waste disposal.

Large Spills: Clear area of personnel and move upwind.

Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

Increase ventilation.

No smoking or bare lights within area.

Stop leak if safe to do so.

Contain and absorb spill with sand, earth, inert material or vermiculite.

Collect and seal in labeled drums for disposal.

If contamination of drains or waterways occurs, advise emergency services.

After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).



Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.

Wear protective clothing when risk of overexposure occurs.

Use in a well-ventilated area. Prevent concentration in hollows and sumps.

DO NOT enter confined spaces until atmosphere has been checked.

DO NOT allow material to contact humans, exposed food or food utensils.

Avoid smoking, bare lights or ignition sources. When handling, DO NOT eat, drink or smoke. Avoid contact with incompatible materials.

Keep containers securely sealed when not in used. Avoid physical damage to containers. Always wash hands with soap and water after handling. Working clothes should be laundered separately.

Launder contaminated clothing before reuse.

Observe manufacturer's storing/handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Recommended Storage Methods: Inhibited grades may be stored in metal drums.

DO NOT use aluminum or galvanized containers. Check that containers are clearly labeled and free from leaks.

Packaging as recommended by manufacturer.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Local exhaust ventilation usually required.

If risk of overexposure exists, wear NIOSH-approved respirator.

Correct fit is essential to obtain adequate protection. NIOSH-approved self contained breathing apparatus (SCBA) may be required in some situations.

Provide adequate ventilation in warehouse or closed storage area.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; chemical goggles. Full face shield.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: PVA gloves. Polyethylene gloves.

Viton gloves.

PVC boots.

Respiratory Protection:

Exposure Range >100 to <1000 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask

Exposure Range 1000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Note: odor threshold unknown

Other: Overalls. Eyewash unit. Barrier cream. Skin cleansing cream.

Glove Selection Index:

PE/EVAL/PE Best selection

PVA Best selection

TEFLON Best selection

VITON Satisfactory; may degrade after 4 hours continuous immersion

VITON/NEOPRENE Poor to dangerous choice for other than short-term immersion

VITON/NITRILE..... Poor to dangerous choice for other than short-term immersion

HYPALON Poor to dangerous choice for other than short-term immersion

NEOPRENE..... Poor to dangerous choice for other than short-term immersion

PVC..... Poor to dangerous choice for other than short-term immersion

NITRILE Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless liquid with a sweetish, chloroform-like odor, miscible with most organic solvents.

Physical State: Liquid

pH: Not applicable

Odor Threshold: 10 mg/l

pH (1% Solution): Not applicable.

Vapor Pressure (kPa): 7.87 at 20 °C

Boiling Point: 87 °C (189 °F)

Vapor Density (Air=1): 4.54

Freezing/Melting Point: -73 °C (-99.4 °F)

Formula Weight: 131.38

Volatile Component (% Vol): 100

Specific Gravity (H₂O=1, at 4 °C): 1.47 at 15 °C

Water Solubility: < 1 mg/mL at 21 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Decomposes in the presence of moisture to produce corrosive acid.

Product is considered stable under normal handling conditions. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid storage with strong oxidizers (particularly oxygen in gas or liquid form and nitrogen dioxide), strong bases, acetone, sodium/sodium-potassium alloys, magnesium, zinc and aluminum.

Avoid contact with water as the slow formation of hydrochloric acid results.

Attacks natural rubber.

Haloalkenes are highly reactive. Some of the more lightly substituted lower members are highly flammable; many members of the group are peroxidizable and polymerizable.

Section 11 - Toxicological Information

Toxicity

Oral (human) LD_{Lo}: 7000 mg/kg
 Oral (man) TD_{Lo}: 2143 mg/kg
 Oral (rat) LD₅₀: 5650 mg/kg
 Inhalation (man) LC_{Lo}: 2900 ppm
 Inhalation (human) TD_{Lo}: 812 mg/kg
 Inhalation (human) TC_{Lo}: 6900 mg/m³/10 m
 Inhalation (man) TC_{Lo}: 2900 ppm
 Inhalation (man) TC_{Lo}: 110 ppm/8h
 Inhalation (man) TC_{Lo}: 160 ppm/83 m

Irritation

Skin (rabbit): 500 mg/24h - SEVERE
 Eye (rabbit): 20 mg/24h - SEVERE

See RTECS KX 4550000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.

Ecotoxicity: LC₅₀ Sheepshead minnow 20 mg/l/96 hr. /Conditions of bioassay not specified; LC₅₀ Mexican axolotl (3-4 wk after hatching) 48 mg/l/48 hr /Conditions of bioassay not specified; LC₅₀ Clawed toad (3-4 wk after hatching) 45 mg/l/48 hr /Conditions of bioassay not specified; LC₅₀ Pimephales promelas (fathead minnow) 40.7 mg/l/96 hr (95% confidence limits 31.4-71.8 mg/l) /Flow-through test; EC₁₀ Pimephales promelas (fathead minnow) 15.2 mg/l/24 hr; 16.9 mg/l/48 hr; 15.5 mg/l/72 hr; 13.7 mg/l/96 hr; Toxic effect for all concentrations specified: loss of equilibrium. /Flow-through bioassay; Toxicity Threshold (Cell Multiplication Inhibition Test) Scenedesmus quadricauda (green algae) >1000 mg/l /Time not specified, conditions of bioassay not specified; Toxicity Threshold (Cell Multiplication Inhibition Test) Pseudomonas putida (bacteria) 65 mg/l ; LC₅₀ Grass shrimp 2 mg/l/96 hr. /Conditions of bioassay not specified

Henry's Law Constant: 1 x10⁻²

BCF: bluegill 17 to 39

Biochemical Oxygen Demand (BOD): 0%, 20 days

Octanol/Water Partition Coefficient: log K_{ow} = 2.29

Soil Sorption Partition Coefficient: K_{oc} = 2.0

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options.

Follow applicable federal, state, and local regulations.

Reclaim solvent at an approved site.

Evaporate or incinerate residue at an approved site.

Recycle containers if possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Trichloroethylene

ID: UN1710

Hazard Class: 6.1 - Poisonous materials

Packing Group: III - Minor Danger

Symbols:

Label Codes: 6.1 - Poison or Poison Inhalation Hazard if inhalation hazard, Zone A or B

Special Provisions: IB3, N36, T4, TP1

Packaging: Exceptions: 153 **Non-bulk:** 203 **Bulk:** 241

Quantity Limitations: Passenger aircraft/rail: 60 L **Cargo aircraft only:** 220 L

Vessel Stowage: Location: A **Other:** 40



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U228 Toxic Waste

CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)

SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Vinyl Chloride

CAS Number: 75-01-4

Chemical Formula: C₂H₃Cl

Structural Chemical Formula: CH₂=CHCl

EINECS Number: 200-831-0

ACX Number: X1003494-5

Synonyms: CHLORETHENE; CHLORETHYLENE; CHLOROETHENE; CHLOROETHYLENE; CHLORURE DE VINYLE; CLORURO DI VINILE; ETHENE,CHLORO-; ETHYLENE MONOCHLORIDE; ETHYLENE,CHLORO-; MONOCHLOROETHENE; MONOCHLOROETHYLENE; MONOCHOROETHENE; MONOVINYL CHLORIDE (MVC); TROVIDUR; VC; VCM; VINILE (CLORURO DI); VINYL C MONOMER; VINYL CHLORIDE; VINYL CHLORIDE MONOMER; VINYL CHLORIDE MONOMER (VCM); VINYL CHLORIDE,INHIBITED; VINYLCHLORID; VINYLE(CHLORURE DE); WINYLU CHLOREK

General Use: Used in the plastics industry; as a refrigerant; in organic syntheses

Section 2 - Composition / Information on Ingredients

Name	CAS	%
vinyl chloride	75-01-4	>98

OSHA PEL

TWA: 1 ppm; Ceiling: 5 ppm, 15-minute; 1910.1017.

NIOSH REL

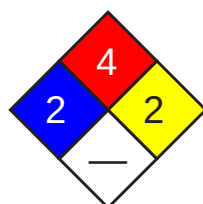
ACGIH TLV

TWA: 1 ppm.

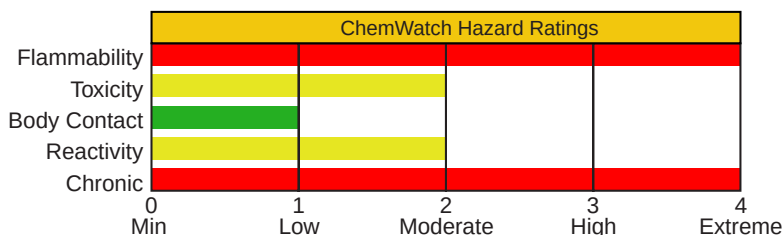
EU OEL

TWA: 7.77 mg/m³.

Section 3 - Hazards Identification



Fire Diamond



ANSI Signal Word

Danger!

HMIS	
③ Health	
④ Flammability	
② Reactivity	



Flammable



Compressed Gas

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless gas; pleasant ethereal odor. Compressed gas can cause frostbite. Toxic. Other Acute Effects: CNS depression. Chronic Effects: reproductive effects, skin/blood changes, arthralgias, bone effects (hand), vascular disorder (fingers/toes). Cancer hazard. Flammable

Potential Health Effects

Target Organs: liver, central nervous system (CNS), respiratory system, lymphatic system, bone, connective tissue of the skin

Primary Entry Routes: inhalation, skin contact, eye contact

Acute Effects

Inhalation: The gas is highly discomforting and may be fatal if inhaled.

Acute intoxication by halogenated aliphatic hydrocarbons appears to take place over two stages. Signs of a reversible narcosis are evident in the first stage and in the second stage signs of injury to organs may become evident. A single organ alone is (almost) never involved.

Depression of the central nervous system is the most outstanding effect of most halogenated aliphatic hydrocarbons. Inebriation and excitation, passing into narcosis, is a typical reaction. In severe acute exposures there is always a danger of death from respiratory failure or cardiac arrest due to a tendency to make the heart more susceptible to catecholamines (adrenalin).

A single 5 minute inhalation exposure of 8000-25000 ppm caused nausea, headache and dizziness among volunteers. After cessation of exposure only 3-5% of the parent compound was exhaled unchanged. Metabolism by microsomal cytochrome P-450 results in the production of chloroethylene oxide and 2-chloroacetaldehyde and subsequent urinary elimination as thiodiglycolic acid. Half-life is 4-5 hours.

Vinyl chloride and related vinyl monomers possess narcotic action and produce depending upon concentration, characteristic neurological effects, a state of euphoria, followed by a state of inebriation, similar to ethanol intoxication.

Exposure of mice, rats and guinea pigs at 100,000-300,000 ppm caused concentration-dependent mortality. Pulmonary edema, inflammation, hyperemia, congestion and engorgement were recorded - liver and kidney involvement was surprisingly low. Deaths were due to central arrest in narcosis.

Eye: The vapor is discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

Skin: The vapor is mildly discomforting to the skin.

Toxic effects may result from skin absorption.

Vinyl chloride acts upon the skin and produces a sensation of heat.

Vaporizing liquid causes rapid cooling and contact may cause cold burns, frostbite.

Ingestion: Not normally a hazard due to physical form of product.

Carcinogenicity: NTP - Class 1, Known to be a carcinogen; IARC - Group 1, Carcinogenic to humans; OSHA - Listed as a carcinogen; NIOSH - Listed as carcinogen; ACGIH - Class A3, Animal carcinogen; EPA - Listed; MAK - Class A1, Capable of inducing malignant tumors as shown by experience with humans.

Chronic Effects: Repeated exposure of laboratory animals to vinyl chloride produced little liver or kidney damage. Repeated exposures produce neurological effects in man with somnolence prominent. Dyspeptic disturbances include epigastric pain, swelling, discomfort, heaviness in the right hypochondrium and anorexia. Congestive hepatomegaly may mimic toxic hepatitis without jaundice. Some cases become chronic. Allergic dermatitis and scleroderma and Raynaud's syndrome have been observed. Repeated exposure of workers has caused increased liver enzyme concentrations, restricted blood flow, bone degeneration in the fingers, liver and spleen enlargement, nervous system disturbance, CNS depression, decreased respiratory function and emphysema.

A dose-dependent relationship between exposure and the incidence of several tumor types has been established.

Exposures to high concentrations have little additional effect because the action of metabolites is responsible for the carcinogenicity rather than the action of the parent molecule. Formation rates of the metabolites are limited and dose-dependent and once the enzyme systems responsible for vinyl chloride activation are saturated, greater doses do not produce a corresponding increase in tumor incidence. Reports of hepatic angiosarcoma and respiratory cancers in vinyl chloride workers have appeared over many years. Cancers of the respiratory system (primarily angiosarcoma), brain as well as lymphomas occur more often than might be expected among men occupationally exposed to vinyl chloride for at least one year.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately flush body and clothes with large amounts of water, using safety shower if available.

Quickly remove all contaminated clothing, including footwear.

Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor.

In case of cold burns (frostbite): Bathe the affected area immediately in cold water for 10 to 15 minutes, immersing if possible and without rubbing.

Do not apply hot water or radiant heat. Apply a clean, dry dressing.

Transport to hospital or doctor.

Ingestion: Not normally a hazard due to physical form of product. DO NOT delay. Immediately transport to hospital or doctor.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically. Do not give adrenalin (epinephrine) or related drugs.

See
DOT
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Section 5 - Fire-Fighting Measures

Flash Point: -78 °C Open Cup

Autoignition Temperature: 472 °C

LEL: 3.6% v/v

UEL: 33% v/v

Extinguishing Media: Dry chemical powder. DANGER: Deliver media remotely.

For minor fires: Flooding quantities only.

For large fires: Do not attempt to extinguish.

General Fire Hazards/Hazardous Combustion Products: WARNING: Long standing in contact with air and light may result in the formation of potentially explosive peroxides.

Liquid and vapor are highly flammable.

Dangerous hazard when exposed to heat or flame.

Severe vapor explosion hazard, when exposed to flame or spark.

Heating may cause expansion or decomposition leading to violent rupture of containers.

Decomposition may produce toxic fumes of hydrogen chloride.

Fire Incompatibility: Avoid reaction with copper, aluminum, oxidizing agents and certain catalytic impurities.

Explosion hazard may follow contact with incompatible materials. Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

Fight fire from a safe distance, with adequate cover.

May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Consider evacuation.

If safe to do so, switch off electrical equipment until vapor fire hazard is removed.

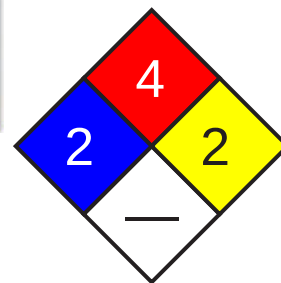
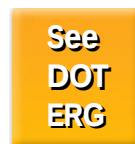
If safe to do so, stop flow of gas.

Do not approach cylinders suspected to be hot.

Cool fire-exposed containers with water spray from a protected location.

Use water delivered as a fine spray to control the fire and cool adjacent area.

Given its high vapor density spilled vinyl chloride is slow to disperse and will collect in low lying areas.



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Erect warning notices and seal off area.

1. Avoid breathing vapor and any contact with liquid or gas. Protective equipment including respirator should be used.

2. Do NOT enter confined spaces where gas may have accumulated.

3. Shut off all sources of possible ignition and increase ventilation.

4. Clear area of personnel.

5. Stop leak only if safe to do so.

6. Remove leaking cylinders to safe place. Release pressure under safe controlled conditions by opening valve.

7. Keep area clear of personnel until gas has dispersed.

Large Spills: Supply maximum air ventilation (explosion proof equipment) to keep concentration well below lower flammability limit.

1. Clear area of all unprotected personnel and move upwind.

2. Contact fire department and advise them of the location and nature of hazard.

3. May be violently or explosively reactive.

4. Wear full body clothing with breathing apparatus.

5. Consider evacuation.

6. Shut off all possible sources of ignition and increase ventilation.

7. No smoking or bare lights within area.

8. Use extreme caution to prevent violent reaction.

9. Stop leak only if safe to do so.

10. Water spray or fog may be used to disperse vapor.

11. Do NOT enter confined space where gas may have collected.

12. Keep area clear until gas has dispersed.

When leaking containers have been removed or leak has been stopped, hose spill area down with copious quantities of water. Allow any liquid to evaporate prior to wash down.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).



Section 7 - Handling and Storage

Handling Precautions: Used in closed pressurized systems, fitted with safety relief valve.

Vented gas is flammable, denser than air and will spread. Vent path must not contain ignition sources, pilot lights, bare flames.

Atmospheres must be tested and O.K. before work resumes after leakage.
 Obtain a work permit before attempting any repairs.
 Do not attempt repair work on lines, vessels under pressure.
 Handle and open container with care.
 Avoid all personal contact, including inhalation.
 Wear protective clothing when risk of exposure occurs.
 Use in a well-ventilated area. Prevent concentration in hollows and sumps.
 DO NOT enter confined spaces until atmosphere has been checked.
 Avoid smoking, bare lights, heat or ignition sources.
 When handling, DO NOT eat, drink or smoke.
 Vapor may ignite on pumping or pouring due to static electricity.
 DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
 Avoid contact with incompatible materials.
 Keep containers securely sealed. Avoid physical damage to containers.
 Always wash hands with soap and water after handling.
 Work clothes should be laundered separately.
 Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
 DO NOT transfer gas from one cylinder to another.

Recommended Storage Methods: Check that containers are clearly labeled.
 Cylinder fitted with valve protector cap.
 Ensure the use of equipment rated for cylinder pressure.
 Ensure the use of compatible materials of construction.
 Cylinder valve must be closed when not in use or when empty.
 Cylinder must be properly secured either in use or in storage.
 WARNING: Suckback into cylinder may result in rupture.
 Use back-flow preventive device in piping.
 Aerosol pack.
 Vacuum insulated container.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Fans and electrical equipment must be explosion-proof to meet TLV requirements. Approved respirators must be available for non-routine and emergency situations.
 Areas where gas cylinders are stored/used require discrete, controlled exhaust ventilation.
 Local exhaust ventilation usually required.
 If risk of overexposure exists, wear NIOSH-approved respirator.
 Correct fit is essential to obtain adequate protection. NIOSH-approved self contained breathing apparatus (SCBA) may be required in some situations.
 Provide adequate ventilation in warehouse or closed storage area.

Personal Protective Clothing/Equipment:

Eyes: Close fitting gas tight goggles and DO NOT wear contact lenses.
 Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Neoprene rubber gloves.

Respiratory Protection:

Exposure Range >1 to 50 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask
 Exposure Range >50 to 1000 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face
 Exposure Range >1000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
 Note: poor warning properties

Other: Protective overalls, closely fitted at neck and wrist. Eye-wash unit.

IN CONFINED SPACES:

1. Non-sparking protective boots
2. Static-free clothing.

Glove Selection Index:

VITON Best selection
 NITRILE Satisfactory; may degrade after 4 hours continuous immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: A colorless poisonous gas at ambient temperature, with a mild sweet odor in high concentrations. It liquefies readily under increased pressure or at reduced temperatures. Soluble in alcohol, ether, carbon tetrachloride and benzene.

Physical State: Liquefied gas

Vapor Pressure (kPa): 343.5 at 20 °C

Vapor Density (Air=1): 2.2**Formula Weight:** 62.5**Specific Gravity (H₂O=1, at 4 °C):** 0.912 at 20 °C**Evaporation Rate:** Not applicable**pH:** Not applicable**pH (1% Solution):** Not applicable.**Boiling Point:** -13.37 °C (8 °F)**Freezing/Melting Point:** -153.8 °C (-244.84 °F)**Volatile Component (% Vol):** 100**Water Solubility:** Slightly soluble

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Presence of heat source and direct sunlight (ultra-violet radiation).

Presence of elevated temperatures.

Presence of an ignition source.

Storage in unsealed containers.

Stable under normal storage conditions. Polymerization may occur at elevated temperatures and in the presence of ignition sources.

Storage Incompatibilities: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Avoid peroxides, copper and copper alloys and plastics.

Haloalkenes are highly reactive. Some of the more lightly substituted lower members are highly flammable; many members of the group are peroxidizable and polymerizable.

If peroxidation occurs, vinyl chloride tends to self-polymerize violently and this has resulted in several industrial accidents.

Accidental exposure of the recovered monomer to atmospheric oxygen for a long period resulted in the formation of an unstable polyperoxide which initiated explosion. A 20-30% aqueous solution has been used to destroy the peroxide.

An explosion in a valve in a liquid monomer line appears to have been caused by traces of nitrogen oxides remaining after passivation of the line by nitric acid.

Section 11 - Toxicological Information

Toxicity

Oral (rat) LD₅₀: 500mg/kgOral (rat) TD_{Lo}: 3463mg/kg/52wInhalation (rat) TC_{Lo}: 1ppm/4h/52wInhalation (man) TC_{Lo}: 200ppm/14y

Tumors of the sense organs, vascular system, respiratory system, gastrointestinal system, skin and liver, lymphoma, paternal effects, effects on fertility, fetotoxicity, specific developmental abnormalities involving the musculoskeletal system recorded.

Irritation

Nil reported

See RTECS YZ 3200000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it will be subject to rapid volatilization with reported half-lives of 0.2 and 0.5 days for evaporation from soil at 1 and 10 cm incorporation, respectively. Any which does not evaporate will be expected to be highly to very highly mobile in soil and it may leach to the groundwater. It may be subject to biodegradation under anaerobic conditions such as exists in flooded soil and groundwater. If released to water, it will not be expected to hydrolyze, to bioconcentrate in aquatic organisms or to adsorb to sediments. It will be subject to rapid volatilization with an estimated half-life of 0.805 hr for evaporation from a river 1 m deep with a current of 3 m/sec and a wind velocity of 3 m/sec. In waters containing photosensitizers such as humic acid, photodegradation will occur fairly rapidly. Limited existing data indicate that it is resistant to biodegradation in aerobic systems and therefore, it may not be subject to biodegradation in aerobic soils and natural waters. It will not be expected to hydrolyze in soils or natural waters under normal environmental conditions. If released to the atmosphere, it can be expected to exist mainly in the vapor-phase in the ambient atmosphere and to degrade rapidly in air by gas-phase reaction with photochemically produced hydroxyl radicals with an estimated half-life of 1.5 days.

Ecotoxicity: No data found.**Henry's Law Constant:** 0.0560**BCF:** estimated at 7**Biochemical Oxygen Demand (BOD):** none**Octanol/Water Partition Coefficient:** log K_{ow} = calculated at 0.6**Soil Sorption Partition Coefficient:** K_{oc} = estimated at 56

Section 13 - Disposal Considerations

Disposal: The gas should be burned in a high temperature furnace equipped with an afterburner and scrubber to remove HCl formed.

Follow applicable federal, state, and local regulations.

Return all damaged and empty cylinders and containers to the supplier.

Section 14 - Transport Information**DOT Hazardous Materials Table Data (49 CFR 172.101):**

Shipping Name and Description: Vinyl chloride, stabilized

ID: UN1086

Hazard Class: 2.1 - Flammable gas

Packing Group:

Symbols:

Label Codes: 2.1 - Flammable Gas

Special Provisions: 21, B44, T50

Packaging: Exceptions: 306 **Non-bulk:** 304 **Bulk:** 314, 315

Quantity Limitations: **Passenger aircraft/rail:** Forbidden

Cargo aircraft only: 150 kg

Vessel Stowage: **Location:** B **Other:** 40

**Section 15 - Regulatory Information****EPA Regulations:**

RCRA 40 CFR: Listed U043 Toxic Waste

CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a), per CAA Section 112 1 lb (0.454 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

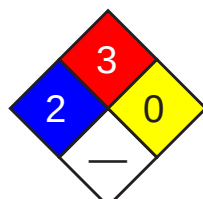
61

Material Name: Xylene **CAS Number:** 1330-20-7
Chemical Formula: C₈H₁₀
Structural Chemical Formula: C₆H₄(CH₃)₂
EINECS Number: 215-535-7
ACX Number: X1001166-8
Synonyms: BENZENE,DIMETHYL-; COMPONENT 1 (83%): XYLENES; COMPONENT 2 (17%): ETHYL BENZENE; DIMETHYLBENZENE; DIMETHYLBENZENES; EPA PESTICIDE CHEMICAL CODE 086802; KSYLEN; METHYL TOLUENE; METHYLTOLUENE; VIOLET 3; XILOLI; XYLENE; XYLENEN; XYLOL; XYLOLE
General Use: A strong solvent for general use in the manufacture of paints, varnishes, lacquers, thinners, inks, rubber, pesticides, herbicides and paint strippers.

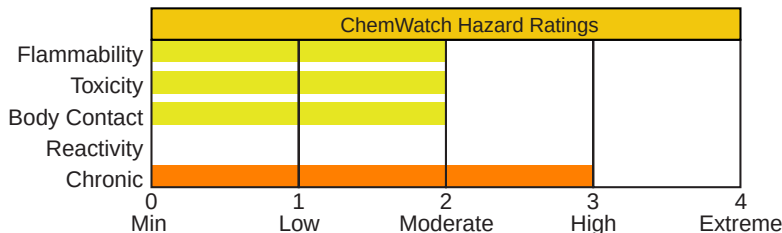
Section 2 - Composition / Information on Ingredients

Name	CAS	%
xylene	1330-20-7	> 95
OSHA PEL TWA: 100 ppm; 435 mg/m ³ .	NIOSH REL TWA: 100 ppm, 435 mg/m ³ ; STEL: 150 ppm, 655 mg/m ³ .	DFG (Germany) MAK TWA: 100 ppm; PEAK: 200 ppm; skin.
ACGIH TLV TWA: 100 ppm; STEL: 150 ppm.		
EU OEL TWA: 50 ppm; STEL: 100 ppm.		

Section 3 - Hazards Identification



Fire Diamond



ANSI Signal Word

Warning!

HMIS	
2	Health
3	Flammability
0	Reactivity



Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear, sweet smelling liquid. Irritating to eyes/skin/respiratory tract. Other Acute Effects: dizziness, nausea, drowsiness. Chronic Effects: dermatitis, kidney/liver/peripheral nerve damage. May cause birth defects (animal data). Flammable.

Potential Health Effects

Target Organs: central nervous system (CNS), eyes, gastrointestinal (GI) tract, liver, kidneys, skin

Primary Entry Routes: inhalation, skin absorption (slight), eye contact, ingestion

Acute Effects

Inhalation: Xylene is a central nervous system depressant. The vapor is discomforting to the upper respiratory tract and may be harmful if inhaled.

Inhalation hazard is increased at higher temperatures.

Toxic effects are increased by consumption of alcohol.

Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Headache, fatigue, lassitude, irritability and gastrointestinal disturbances (e.g., nausea, anorexia and flatulence) are the most common symptoms of xylene overexposure. Injury to the heart, liver, kidneys and nervous system has also been noted among workers. Transient memory loss, renal impairment, temporary confusion and some evidence of disturbance of liver function was reported in three workers overcome by gross exposure to xylene (10000 ppm). One worker died and autopsy revealed pulmonary congestion, edema, and focal alveolar hemorrhage.

Volunteers inhaling xylene at 100 ppm for 5 to 6 hours showed changes in manual coordination, reaction time and slight ataxia. Tolerance developed during the workweek but was lost over the weekend. Physical exercise may antagonize this effect. Xylene body burden in humans exposed to 100 or 200 ppm xylene in air depends on the amount of body fat with 4% to 8% of total absorbed xylene accumulating in human adipose tissues.

Eye: The liquid is highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is highly discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Corneal changes have been reported in furniture polishers exposed to xylene.

Skin: The liquid is highly discomforting to the skin and may cause drying of the skin, which may lead to dermatitis and it is absorbed by the skin.

Toxic effects may result from skin absorption.

Open cuts, abraded or irritated skin should not be exposed to this material.

The material may accentuate any pre-existing skin condition.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid may produce gastrointestinal discomfort and may be harmful if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.

Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.

Small excess risks of spontaneous abortion and congenital malformation was reported amongst women exposed to xylene in the first trimester of pregnancy. In all cases however the women had also been exposed to other substances. Evaluation of workers chronically exposed to xylene has demonstrated a lack of genotoxicity. Exposure to xylene has been associated with increased risks of hemopoietic malignancies but, again simultaneous exposure to other substances (including benzene) complicate the picture. A long-term gavage study of mixed xylenes (containing 17% ethyl benzene) found no evidence of carcinogenic activity in rats and mice of either sex.

Exposure to the material for prolonged periods may cause physical defects in the developing embryo (teratogenesis).

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to xylene:

1. Gastrointestinal absorption is significant with ingestions.

See
DOT
ERG

For ingestions exceeding 1-2 mL (xylene)/kg, intubation and lavage with cuffed endotracheal tube is recommended. The use of charcoal and cathartics is equivocal.

2. Pulmonary absorption is rapid with about 60-65% retained at rest.

3. Primary threat to life from ingestion and/or inhalation is respiratory failure.

4. Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases ($pO_2 < 50$ mm Hg or $pCO_2 > 50$ mm Hg) should be intubated.

5. Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.

6. A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.

7. Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.

Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.

BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

<u>Determinant</u>	<u>Index</u>	<u>Sampling Time</u>	<u>Comments</u>
Methylhippuric acids in urine	1.5 gm/gm creatinine 2 mg/min	End of shift Last 4 hrs of shift.	

Section 5 - Fire-Fighting Measures

Flash Point: 25.6 °C

Autoignition Temperature: 241 °C

LEL: 1.0% v/v

UEL: 7.0% v/v

Extinguishing Media: Alcohol stable foam; dry chemical powder; carbon dioxide.

Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.

Moderate fire hazard when exposed to heat or flame.

Vapor forms an explosive mixture with air.

Moderate explosion hazard when exposed to heat or flame.

Vapor may travel a considerable distance to source of ignition.

Heating may cause expansion or decomposition leading to violent rupture of containers.

On combustion, may emit toxic fumes of carbon monoxide (CO).

Other combustion products include carbon dioxide (CO₂).

Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

If safe, switch off electrical equipment until vapor fire hazard removed.

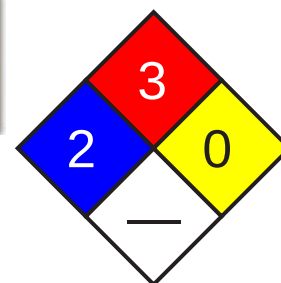
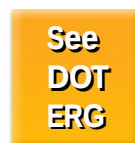
Use water delivered as a fine spray to control fire and cool adjacent area.

Avoid spraying water onto liquid pools.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protected location.

If safe to do so, remove containers from path of fire.



Fire Diamond

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.

Avoid breathing vapors and contact with skin and eyes.

Control personal contact by using protective equipment.

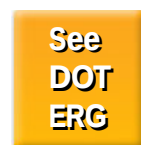
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: Clear area of personnel and move upwind.

Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

No smoking, bare lights or ignition sources. Increase ventilation.



Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
 Use only spark-free shovels and explosion proof equipment.
 Collect recoverable product into labeled containers for recycling.
 Absorb remaining product with sand, earth or vermiculite.
 Collect solid residues and seal in labeled drums for disposal.
 Wash area and prevent runoff into drains.
 If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.

Wear protective clothing when risk of overexposure occurs.

Use in a well-ventilated area. Prevent concentration in hollows and sumps.

DO NOT enter confined spaces until atmosphere has been checked.

Avoid smoking, bare lights or ignition sources.

Avoid generation of static electricity. DO NOT use plastic buckets.

Ground all lines and equipment. Use spark-free tools when handling.

Avoid contact with incompatible materials.

When handling, DO NOT eat, drink or smoke.

Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling.

Work clothes should be laundered separately.

Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.

Check all containers are clearly labeled and free from leaks.

Plastic containers may only be used if approved for flammable liquids.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.

CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear.

General exhaust is adequate under normal operating conditions.

Local exhaust ventilation may be required in specific circumstances.

If risk of overexposure exists, wear NIOSH-approved respirator.

Correct fit is essential to obtain adequate protection.

Provide adequate ventilation in warehouse or closed storage areas.

In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields; or as required, chemical goggles.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Barrier cream with polyethylene gloves; Butyl rubber gloves or Neoprene gloves or PVC gloves.

Safety footwear.

Do NOT use this product to clean the skin.

Other: Overalls. Impervious protective clothing.

Eyewash unit.

Ensure there is ready access to an emergency shower.

Glove Selection Index:

PE/EVAL/PE Best selection

PVA Best selection

VITON Best selection

TEFLON Best selection

PVDC/PE/PVDC Poor to dangerous choice for other than short-term immersion

NATURAL+NEOPRENE..... Poor to dangerous choice for other than short-term immersion

NEOPRENE/NATURAL..... Poor to dangerous choice for other than short-term immersion

NITRILE+PVC Poor to dangerous choice for other than short-term immersion

HYPALON Poor to dangerous choice for other than short-term immersion

NAT+NEOPR+NITRILE Poor to dangerous choice for other than short-term immersion

BUTYL Poor to dangerous choice for other than short-term immersion

BUTYL/NEOPRENE Poor to dangerous choice for other than short-term immersion

NITRILE..... Poor to dangerous choice for other than short-term immersion
 NEOPRENE..... Poor to dangerous choice for other than short-term immersion
 PVC..... Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear colorless flammable liquid with a strong aromatic odor; floats on water. Mixes with most organic solvents.

Physical State: Liquid

pH: Not applicable

Odor Threshold: 5.00 x10⁻⁵ ppm

pH (1% Solution): Not applicable.

Vapor Pressure (kPa): 0.5 at 15 °C

Boiling Point: 137 °C (279 °F) to 140 °C (284 °F)

Vapor Density (Air=1): 3.66 at 15 °C

Freezing/Melting Point: -47 °C (-53 °F)

Formula Weight: 106.18

Volatile Component (% Vol): 100

Specific Gravity (H₂O=1, at 4 °C): 0.87 at 15 °C

Water Solubility: Practically insoluble in water

Evaporation Rate: 0.7 Bu Ac=1

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Toxicity

Oral (human) LD₅₀: 50 mg/kg

Oral (rat) LD₅₀: 4300 mg/kg

Inhalation (human) TC_{Lo}: 200 ppm

Inhalation (man) LC_{Lo}: 10000 ppm/6h

Inhalation (rat) LC₅₀: 5000 ppm/4h

Reproductive effector in rats

Irritation

Skin (rabbit): 500 mg/24h moderate

Eye (human): 200 ppm irritant

Eye (rabbit): 87 mg mild

Eye (rabbit): 5 mg/24h SEVERE

See RTECS ZE 2100000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Most of the xylenes are released into the atmosphere where they may photochemically degrade by reaction with hydroxyl radicals (half-life 1-18 hr). The dominant removal process in water is volatilization. Xylenes are moderately mobile in soil and may leach into groundwater where they are known to persist for several years, despite some evidence that they biodegrade in both soil and groundwater. Bioconcentration is not expected to be significant.

Ecotoxicity: LC₅₀ Rainbow trout 13.5 mg/l/96 hr /Conditions of bioassay not specified; LD₅₀ Goldfish 13 mg/l/24 hr /Conditions of bioassay not specified

Henry's Law Constant: 0.22

BCF: estimated at 2.14 to 2.20

Octanol/Water Partition Coefficient: log K_{ow} = 3.12 to 3.20

Soil Sorption Partition Coefficient: K_{oc} = 48 to 68

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.

Follow applicable federal, state, and local regulations.

Incinerate residue at an approved site.

Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Xylenes

ID: UN1307

Hazard Class: 3 - Flammable and combustible liquid

Packing Group: II - Medium Danger

Symbols:

Label Codes: 3 - Flammable Liquid

Special Provisions: IB2, T4, TP1

Packaging: Exceptions: 150 **Non-bulk:** 202 **Bulk:** 242

Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L

Vessel Stowage: **Location:** B **Other:**



Shipping Name and Description: Xylenes

ID: UN1307

Hazard Class: 3 - Flammable and combustible liquid

Packing Group: III - Minor Danger

Symbols:

Label Codes: 3 - Flammable Liquid

Special Provisions: B1, IB3, T2, TP1

Packaging: Exceptions: 150 **Non-bulk:** 203 **Bulk:** 242

Quantity Limitations: **Passenger aircraft/rail:** 60 L **Cargo aircraft only:** 220 L

Vessel Stowage: **Location:** A **Other:**



Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U239 Ignitable Waste

CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001 100 lb (45.35 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification

61

Material Name: Zinc

CAS Number: 7440-66-6

Chemical Formula: Zn

EINECS Number: 231-175-3

ACX Number: X1002588-8

Synonyms: ASARCO L 15; BLUE POWDER; C.I. 77945; C.I. PIGMENT BLACK 16; C.I. PIGMENT METAL 6; EMANAY ZINC DUST; GRANULAR ZINC; HODGSONS ZINC DUST - HYFINE & STANDARD; JASAD; MERRILLITE; PASCO; ZINC; ZINC DUST

Derivation: Manufactured by concentrating zinc ore, roasting the concentrate, followed with thermal smelting (reduction with carbon); by reducing the zinc oxide with carbon in retorts from which the resultant zinc is distilled and condensed; or by the hydrometallurgical or electrolytical process where the zinc oxide is leached from the roasted or calcined material with sulfuric acid to form zinc sulfate solution which is then leached from electrolyzed cells to deposit zinc on the cathodes.

General Use: Used in alloys (dental amalgams, brass), metallic driers, mixed-metal stabilizers, automotive parts, electrical fuses, storage and dry-cell batteries, in vacuum fluorescence displays, in electrical contact grease, in bearings, in paper defoxing, galvanizing iron and other metals, protective coating, desilverizing agent for lead, deoxidizing bronze, reducing agent in organic chemistry, reagent in analytical chemistry, extracting gold, electroplating, metal spraying, anodic inhibitors, fungicides, nutrition, roofing, gutters, engravers' plates, cable wrappings, railroad car linings, purifying fats, bleaching glue, canteens, and organ pipes.

Section 2 - Composition / Information on Ingredients

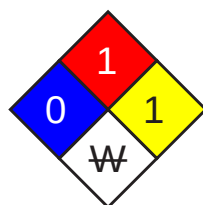
Name	CAS	%
Zinc	7440-66-6	special high-grade (99.990%), high-grade (99.95%), intermediate (99.5%), brass special (99%), prime western (98%).
Trace Impurities: Tin, lead, iron, cadmium, arsenic, cesium, antimony, and zinc chloride (increases corrosion resistance).		

OSHA PEL

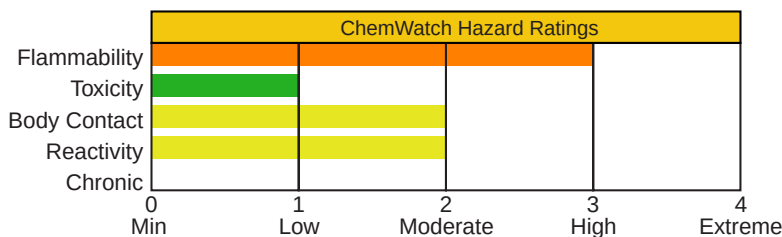
NIOSH REL

ACGIH TLV

Section 3 - Hazards Identification



Fire Diamond



HMIS	
① Health	
① Flammability	
① Reactivity	

ANSI Signal Word

Warning!



Explosive



Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Bluish-white lustrous metal with white coating of basic carbonate on exposure to moist air. Dust forms explosive mixtures with water. Dust is flammable, may ignite spontaneously in air.

Potential Health Effects

Target Organs: Respiratory system, eyes, and skin

Primary Entry Routes: Inhalation and eye and skin contact

Acute Effects

Inhalation: Exposure to dust may result in cough. Heated zinc may give off zinc oxide (ZnO) fumes. Characteristics of exposure include sweet taste, dry throat, injury to mucous membrane, cough, weakness, aches, chills, fever, nausea, and vomiting. Concentrations of ZnO particulates at 45 to 870 mg/m³ cause "metal fume fever," a transient condition characterized by fever, chills, muscle pain, and vomiting. Recovery normally occurs within 24 to 48 hours. Tolerance may develop but is generally lost over a weekend.

Eye: Zinc dust particles can irritate the eyes. Zinc salts will precipitate eye protein and cause corneal and lens changes.

Skin: A human skin irritant.

Ingestion: Relatively non-toxic, though significant ingestion (12 g) of metallic zinc was reported to cause lethargy, light headedness, staggering gait, and difficulty writing, suggesting cerebellar dysfunction. Ingestion of acidic food or beverages stored in zinc or galvanized containers can lead to nausea, vomiting, diarrhea, and abdominal pain.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: Abnormally large amounts of zinc may enter and leave the body for years without resulting in symptoms or clinical evidence. Zinc poisoning has been associated with prolonged consumption of water from galvanized pipes. Symptoms include irritability, muscular stiffness and pain, loss of appetite and nausea. Ingestion of excessive doses for prolonged periods alters the immune response and causes copper and iron deficiency, anemia, headache, vomiting, chills, fever, malaise, and abdominal pain.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed. Apply artificial respiration if victim is not breathing. Administer oxygen if breathing is difficult.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult a physician or ophthalmologist if pain or irritation develop.

Skin Contact: Remove contaminated clothing and rinse with flooding amounts of water. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Maintain hydration and observe for metabolic acidosis, hypocalcemic tetany, anuria, liver damage, gastric perforation, and pyloric stenosis. For pulmonary edema (noncardiogenic), maintain ventilation and oxygenation with close arterial blood gas monitoring. Early use of PEEP and mechanical ventilation may be needed to maintain pO₂ greater than 50 mm Hg with FIO₂ less than 60%. For eye exposure, rinse with 0.05 M neutral sodium edetate to help prevent or reverse a portion of the protein precipitation.

See
DOT
ERG

Section 5 - Fire-Fighting Measures

Flash Point: Not applicable, combustible solid

Autoignition Temperature: Cloud, 1256 °F (680 °C); dust layer, 860 °F (460 °C); powder 650 mJ spark.

LEL: Dust cloud explosion, 0.5 oz/ft³

UEL: None reported.

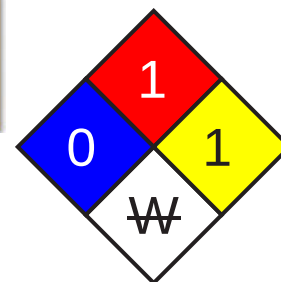
Flammability Classification: Combustible solid

Extinguishing Media: *Do not* use water or foam. Use a Class D fire extinguisher, dry chemical, dry ground limestone, dry clay, soda ash, lime, or sand, or withdraw from area and let fire burn.

General Fire Hazards/Hazardous Combustion Products: Fire will produce irritating, corrosive and/or toxic gases. Inhalation or contact with vapors, substance, or decomposition products may cause severe injury or death. Zinc dust reacts vigorously or explosively on contact with water. It produces flammable gases on contact with water or moist air. It may be ignited by heat, sparks or flames and may re-ignite after fire is extinguished. Dust forms explosive mixtures with air.

Fire-Fighting Instructions: *Do not* get water inside containers. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank as rupture or explosion may be imminent. *Do not* release runoff from fire control methods to sewers or waterways as runoff may create fire or explosion hazard. Corrosive solutions may be produced on contact with water. Move containers from fire area if it can be done without undue risk. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in

See
DOT
ERG



Fire Diamond

pressure-demand or positive-pressure mode. Structural firefighters' protective clothing will only provide limited protection.

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Eliminate all ignition sources (no smoking, flares, sparks or flames). Isolate spill or leak area immediately for at least 160 to 330 feet (50 to 100 meters) in all directions. *Do not* walk through or touch spilled material. For large spills consider downwind evacuation for at least 800 feet (250 meters). Keep unauthorized personnel away, stay upwind, keep out of low areas, and ventilate area before entry.

See
DOT
ERG

Small Spills: Cover with dry earth, dry sand, or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain. With a clean shovel, carefully scoop material into a dry, sealed container and move container from spill area. Cleanup personnel should protect against dust inhalation and skin and eye contact.

Large Spills: For large spills, dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Bulk dust in damp state may heat spontaneously and ignite on exposure to air. . Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Protect against physical damage. Store in a cool, dry ventilated place away from heat and ignition sources and incompatibles.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Routinely evaluate exposure to zinc by collecting personal and area air samples. Prevention of metal fume fever is a matter of keeping exposure of workers below the level of zinc oxide concentration currently accepted as satisfactory for working with metal in the industry (15 mg/m³) by employment of proper local exhaust ventilation to collect fumes at their source. Enclose operations and/or provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Post hazard and warning information in the work area. In addition, educate, train, and communicate all information on the health and safety hazards of zinc to potentially exposed workers.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator equipped with particulate (dust/fume/mist) filters. Particulate filters must be checked daily before work for physical damage and replaced as needed. If, while wearing a filter cartridge or canister respirator, you can smell, taste, or otherwise detect zinc, or in the case of a full facepiece respirator you experience eye irritation, leave the area immediately. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. *Do not* take contaminated work clothes home. Launder before reuse. Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to zinc dust. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Bluish-white lustrous metal or dark powder.

Physical State: Solid

Vapor Pressure (kPa): 1 mm Hg at 908.6 °F (487 °C);
60 mm Hg at 1292 °F (700 °C)

Formula Weight: 65.38

Specific Gravity (H₂O=1, at 4 °C): 7.14 at 77 °F
(25°C)

Boiling Point: 1666.4 °F (908 °C)

Freezing/Melting Point: 787.1 °F (419.5 °C)

Ionization Potential (eV): 9.39405 eV

Water Solubility: Insoluble**Other Solubilities:** Soluble in acid, alkalies, acetic acid

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Zinc powder is stable at room temperature in closed containers under normal storage and handling conditions. However, moist zinc can react exothermically and ignite spontaneously in air. Hazardous polymerization cannot occur. Avoid exposure to moisture, heat, and ignition sources (flares, sparks, cigarettes, and open flames).

Storage Incompatibilities: Avoid contact with acids, alkali hydroxides (e.g., sodium hydroxide), ammonium nitrate, ammonium sulfide, arsenic oxide, barium dioxide, barium oxide, barium nitrate, cadmium, carbon disulfide, catalytic metals, chlorates, chlorides, chlorine, chlorinated rubber, chromium (VI) oxide, ethyl acetoacetate + tribromoneopentyl alcohol, fluorine, halogenated hydrocarbons, hydrazine mononitrate, hydroxylamine, lead azide, lead nitride, magnesium nitrate, manganese chloride, nitric acid, *o*-nitroanisole, nitrobenzene, nonmetals, oxidizing agents (sulfur, oxygen), paint primer base, pentacarbonyliron, performic acid, potassium chlorate, potassium nitrate, potassium peroxide, seleninyl bromide, selenium, sodium chlorate, sodium peroxide, tellurium, transition metal halides, and water.

Hazardous Decomposition Products: Thermal oxidative decomposition of zinc metal/powder can produce hydrogen gas and zinc oxide fumes (of particle diameter $\leq 1 \mu\text{m}$).

Section 11 - Toxicological Information

Irritation Effects:

Human, skin, standard Draize test, 300 μg over 3 days intermittently caused mild irritation.

Other Effects:

Acute Inhalation Effects: Human, inhalation, 124 $\text{mg}/\text{m}^3/50$ minutes, resulted in toxic effects on lung, thorax, or respiration - cough and dyspnea, and skin and appendages - sweating.

See RTECS ZG8600000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Bioaccumulation may be significant (Biological Concentration Factor (BCF) ranges from 85 to 100,000). Zinc can persist in water indefinitely.

Ecotoxicity: Chronic aquatic toxicity limits: 0.04 ppm; toxicity to aquatic plants: 25 ppm. Rainbow trout, $\text{LC}_{50} = 4$ ppm/48 hrs; zebrafish (embryo), $\text{LC}_{50} = 19$ ppm/72 hrs. Zinc accumulates in gill tissue and bone. Zinc is thought to exert its toxic action by forming insoluble compounds with the mucous that covers the gills, by damage to the gill epithelium, or by an internal poison.

Section 13 - Disposal Considerations

Disposal: Reclaim for salvage or reuse. Unsalvageable waste may be buried in an approved landfill. Maximum concentration in effluent to sewer or stream is 1 ppm. Criteria for land treatment or burial disposal practices are under significant review. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Zinc powder or Zinc dust

ID: UN1436

Hazard Class: 4.3 - Dangerous when wet material

Packing Group: I - Great Danger

Symbols:

Label Codes: 4.3 - Dangerous When Wet, 4.2 - Spontaneously Combustible

Special Provisions: A19, IB4, IP1, N40

Packaging: Exceptions: None **Non-bulk:** 211 **Bulk:** 242

Quantity Limitations: Passenger aircraft/rail: Forbidden

Cargo aircraft only: 15 kg

Vessel Stowage: Location: A **Other:**



Shipping Name and Description: Zinc powder *or* Zinc dust**ID:** UN1436**Hazard Class:** 4.3 - Dangerous when wet material**Packing Group:** II - Medium Danger**Symbols:****Label Codes:** 4.3 - Dangerous When Wet, 4.2 - Spontaneously Combustible**Special Provisions:** A19, IB7, IP2**Packaging:** **Exceptions:** None **Non-bulk:** 212 **Bulk:** 242**Quantity Limitations:** **Passenger aircraft/rail:** 15 kg **Cargo aircraft only:** 50 kg**Vessel Stowage:** **Location:** A **Other:****Shipping Name and Description:** Zinc powder *or* Zinc dust**ID:** UN1436**Hazard Class:** 4.3 - Dangerous when wet material**Packing Group:** III - Minor Danger**Symbols:****Label Codes:** 4.3 - Dangerous When Wet, 4.2 - Spontaneously Combustible**Special Provisions:** IB8, IP4**Packaging:** **Exceptions:** None **Non-bulk:** 213 **Bulk:** 242**Quantity Limitations:** **Passenger aircraft/rail:** 25 kg **Cargo aircraft only:** 100 kg**Vessel Stowage:** **Location:** A **Other:**

Section 15 - Regulatory Information

EPA Regulations:**RCRA 40 CFR:** Not listed**CERCLA 40 CFR 302.4:** Listed per CWA Section 307(a) 1000 lb (453.5 kg)**SARA 40 CFR 372.65:** Listed**SARA EHS 40 CFR 355:** Not listed**TSCA:** Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

ARCADIS

Attachment E

Incident/Near-Miss Investigation
Report

☐ OSHA Recordable	☐ First Aid Injury	☐ Fire	Date of Incident:
☐ Lost Workday Injury	☐ Vehicle Accident	☐ Spill / Leak	
☐ Restricted Duty Injury	☐ Equipment Damage	☐ Near Miss	Incident Number:

Every employee injury, accident, and near miss must be reported within 24 hours of the injury. If the incident results in hospitalization, an immediate report must be made by telephone to the Project Manager and the Health and Safety Officer.

Project Information

Project Name:	Project #

Location of Incident:

Employee

Name:	Employee Number:

Employment Status: ☐ Regular ☐ Part Time	How long in present job?

Injury or Illness Information

Where did the incident / near miss occur? (number, street, city, state, zip):

Employee's specific activity at the time of the incident / near miss:

Equipment, materials, or chemicals the employee was using when the incident / near miss occurred (e.g., the equipment employee struck against or that struck the employee; the vapor inhaled or material swallowed; what the employee was lifting, pulling, etc.):

Describe the specific injury or illness (e.g., cut, strain, fracture, etc.):

Body part(s) affected (e.g., back, left wrist, right eye, etc.):

Name and address of treatment provider (e.g., physician or clinic):	Phone No.:

If hospitalized, name and address of hospital:	Phone No.:

Date of injury or onset of illness: / /	Time of event or exposure: ☐ AM ☐ PM

Did employee miss at least one full shift's work? ☐ No ☐ Yes, 1st date absent (MM/DD/YYYY)	/ /

Has employee returned to work? ☐ Regular work ☐ Restricted work ☐ No
☐ Yes, date returned (MM/DD/YYYY) / /

To whom reported:	Other workers injured / made ill in this event?
	☐ Yes ☐ No

Description of Incident / Near Miss: (Describe what happened and how it happened.)

Motor Vehicle Accident (MVA)				Company Vehicle?	☐ Yes ☐ No					
Accident Location (street, city, state)										
Vehicle Towed?	☐ Yes ☐ No	Other Vehicle?	☐ Yes ☐ No	# Vehicles Towed:		# of Injuries:				
Spill										
Material Spilled:				Quantity:			Source:			
Agency Notifications:										
Cost of Incident \$										
Third Party Incidents										
Name of Owner:		Address:				Telephone:				
Description of Damage:										
Witness Name:		Address:				Telephone:				
Witness Name:		Address:				Telephone:				
#	Root Cause and Contributing Factors: Conclusion (Describe in Detail Why Incident / Near Miss Occurred)									
1										
2										
3										
Root Cause(s) Analysis (RCA):										
1. Employee lacks the skill or knowledge to carry out duties					5. Lack of or inadequate procedures					
2. Employee chose not to take the time or put forth the effort to do the job properly					6. Inadequate communication of expectations or procedures					
3. Supervisor did not require the employee to follow the standard procedure					7. Inadequate tools or equipment					
4. Employee doesn't see any advantage to doing the job to standard, and had completed in the past without incident					8. Uncontrollable/External Factors.					
#	RCA #	Solution(s): How to Prevent Incident / Near Miss From Reoccurring			Person Responsible	Due Date	Closure Date			
Investigation Team Members										
Name					Job Title		Date			

Results of Solution Verification and Validation

Reviewed By

Name	Job Title	Date
	Project Manager	
	Health and Safety Reviewer	

Attachment F

Loss Prevention Observation
Form



Print displays saved information only.

Loss Prevention Observation LPO004865

Section 1: General	
Date and Time	8/7/2008 12:00 PM
Status	Initial
Company	ARCADIS
Division	ENCSCOCs (US) EN:CS:CO:CS - CONSTR/FIELD SVCS - DENVER, CO
Project Location	
LPO Type	LPO Form - Multi-Task
Task Observed	Field Work
Observee Name	
Observer	
Observee Supervisor	
Project	B00706100000 ADDITIONAL PSM-RELATED Gregory N. Ertel
	Other personnel (or any equipment) on site that is involved/part of task being observed.
Equipment	
Personnel	
Other	

Input Location
From Orig
Down Menu

Section 2: Background Information and Miscellaneous Comments	
Weather Conditions	
Other	

Section 3: *Observer's Positive Comments	
Positive Comments	

Section 5: Solutions and Root Cause Analysis	
Conclusion (Detail of Why the Questionable Item(s) Occurred).	
Explanation of Root Cause(s) Analysis Numbers (RCA No):	
1 Lack of SKILL or KNOWLEDGE	5 Lack of or inadequate operational PROCEDURES or work standards
2 Doing the job according to procedures or acceptable practices takes more TIME or EFFORT	6 Inadequate COMMUNICATION OF EXPECTATIONS regarding procedures or acceptable practices

3	Short-cutting procedures or acceptable practices is POSITIVELY REINFORCED or TOLERATED, rewarded or appreciated	7	Inadequate TOOLS or EQUIPMENT
4	IN THE PAST, did not follow procedures or acceptable practices and NO INCIDENT occurred	8	EXTERNAL factors

Item No	RCA No	Solution(s): How to Prevent Questionable Behavior From Recurring	Person Responsible	Due Date	Completed	Verified / Validated

Results of Solution Verification & Validation

Section 6: Feedback and Review

Feedback Conducted By

Date and Time

Standard Review

Reviewed By

Position/Title

Date

Desktop Quality Review

Reviewed By

Position/Title

Date

Field Verification & Validation

Reviewed By

Position/Title

Date

Initial - 08/20/2008 08:56 AM EST

Section 4: Observation				
	Pre-Task Preparation	Correct	Questionable	Comments
1	WORK AUTHORIZATION AND DOCUMENTATION - HASP, permits, training records, utility clearance, client or management authorization			
2	JSA, procedure or other work standard reviewed			
3	SPSA performed prior to beginning work/task			
4	PPE - Hand Protection			
5	PPE - Eye Protection			
6	PPE - Head Protection			
7	PPE - Body Protection/Clothing/Tyvek			
8	PPE - Reflective Vest/High Visibility Clothing			
9	PPE - Respiratory Protection			
10	Other PPE (Specify)			
	Performing Task	Correct	Questionable	Comments
11	COMMUNICATION - communicating with coworkers, giving and following instructions and signals, buddy system			
12	SPSA performed when task or conditions change			
13	STOP WORK AUTHORITY used when needed to address potential hazards			
14	CHEMICAL/BIO/RAD PROTECTION- Decontamination, exclusion zones, air monitoring, contamination prevention and control			
15	LIFTING/PULLING/PUSHING - BODY POSITION - no awkward positions or postures, no twisting or excessive reaching			
16	LIFTING/PULLING/PUSHING - EXERTION - no excessive weight or force, no straining, load under control, stability			
17	SLIP/TRIP PREVENTION (other than housekeeping) - selecting path, eyes on path, speed, footing			
18	FALL PREVENTION (elevated work) - 3 points of contact, ladders, stairs, mounting or dismounting equipment, fall arrest			
19	PINCH POINTS/LACERATIONS - hands and body clear or protected from being caught between objects or equipment,			

	and striking or contacting sharp edges			
20	STRUCK BY/LINE OF FIRE - Protection or exposure control from traffic, heavy equipment, falling or flying objects, mechanical equipment			
21	TOOLS AND EQUIPMENT - selection, inspection and use of hand and power tools, electrical cords, hand augers, pumps, hoses, etc.			
22	HEAVY EQUIPMENT AND DRILLING - set-up, inspection, operation, safe work practices, eyes on task			
23	OVERHEAD AND UNDERGROUND UTILITIES - protecting and protection from; mark out, clearance distances, hand clearing, spotters			
24	TRENCHING AND EXCAVATION - inspection, shoring, sloping, ladders, protection of structures, fall prevention			
25	WORKING IN, ON OR NEAR WATER - work practices, boating safety, flotation devices			
26	ENERGY CONTROL - equipment shutdown, lockout, depressurizing, isolating, securing			
27	FLORA AND FAUNA - protection from poison ivy, bees, dogs, ticks, thorns, snakes, mosquitoes			
28	HOUSEKEEPING AND WASTE DISPOSAL - walking and working areas, storage, cleaning, waste storage and disposal			
29	Other (Specify)			
Total				% Safe

LPO004865 - Initial - 08/20/2008 08:56 AM EST

Attachment G

Real Time Air Monitoring Data
Collection Form

Real Time Exposure Monitoring Data Collection Form

Document all air monitoring conducted on the Site below based on Section E of the HASP. Keep this form with the project files.

Site Name: _____ Date: _____

Instrument: _____ Model: _____ Serial #: _____

Calibration Method: (Material used settings, etc.)	
Calibration Results:	
Calibrated By:	

Activity Being Monitored	Compounds/Hazards Monitored	Time	Reading	Action Required? Y/N

Describe Any Actions Taken as a Result of this Air Monitoring and Why (does it match Table 5-1):

Attachment H

Site Activities Tailgate Safety
Briefing Sign-in Log



SITE ACTIVITIES TAILGATE HEALTH & SAFETY BRIEFING FORM

This briefing form documents the tailgate briefing conducted in accordance with the HASP. Personnel who perform work operations on site are required to attend each briefing and to acknowledge receipt of each briefing, at least daily.

Project Number:		Project Name:
Date:	Time:	Briefing Conducted by:
Company:		Signature/Title:

TRACKING the Tailgate Briefing

Think through the Tasks (list the tasks for the day):

1 _____	3 _____	5 _____
2 _____	4 _____	6 _____

Recognize the hazards (check all those that are discussed) and Assess the Risks (Low, Medium, High-circle risk level)

☐ Confined Space (L M H)	☐ Buried/Overhead Utilities (L M H)	☐ Excavation (L M H)
☐ Walking/Working surfaces (L M H)	☐ Chemical Exposure (L M H)	☐ Noise (L M H)
☐ Thermal Stress (Hot/Cold) (L M H)	☐ Overhead Hazards (L M H)	☐ Traffic/Roadway/Railway (L M H)
☐ Severe Weather (L M H)	☐ Chemical Usage (L M H)	☐ Elevated work (L M H)
☐ Hazardous Energy (L M H)	☐ Heavy Machinery (L M H)	☐ Biological/Animals (L M H)
☐ Ergonomic (L M H)	☐ Personal Safety/Security (L M H)	☐ Mining (L M H)
☐ Client/Other Site Activities <u>List</u>	☐ Chemical Exposure <u>List</u>	☐ Other <u>Specify</u>
_____ (L M H)	_____ (L M H)	_____ (L M H)
_____ (L M H)	_____ (L M H)	_____ (L M H)
_____ (L M H)	_____ (L M H)	_____ (L M H)

Control the hazards (Check all those methods to control the hazards that apply):

☒ STOP WORK AUTHORITY (Must be addressed in every Tailgate meeting-See H&S Handbook for definition)		
☐ General PPE Usage	☐ Hearing Conservation	☐ Respiratory Protection
☐ Personal Hygiene	☐ Exposure Guidelines	☐ Decon Procedures
☐ Emergency Action Plan	☐ Fall Protection	☐ Work Zones/Site Control
☐ JSA to be developed/used (<u>specify</u>)	☐ LPO conducted (<u>specify job/JSA</u>)	☐ Other (<u>specify</u>)
_____	_____	_____
_____	_____	_____
_____	_____	_____

Personnel Sign-in List

Printed Name	Signature

Keep H&S 1st in all things

Use the back to add comments such as recent near misses, injuries or property damage, visitors to the site, etc

SITE ACTIVITIES TAILGATE HEALTH & SAFETY BRIEFING FORM

Additional Comments:

Discussion of recent results of LPOs conducted on the project:

Discussion of recent Near-miss, injuries, and/or property damage on the project:

List Visitors to Site Today:
