ARCADIS
Infrastructure · Water · Environment · Buildings

Imagine the result

Site Specific Health and Safety Plan

Dewey Loeffel Landfill Superfund Site
Nassau, New York

May 15, 2012
Revised July 10, 2012
Revised July 25, 2012

ARCADIS

Site Specific Health and Safety Plan

Dewey Loeffel Landfill
Superfund Site
Nassau, New York

David Groff
Designated H&S Plan Writer

Greg Ertel
Designated H&S Plan Reviewer

Donald Sauda, PE
Project Manager

Prepared by:
ARCADIS, Inc.
6723 Towpath Rd.
Syracuse NY 13214

Tel: 315.446.9120
Fax: 315.446.5807

Our Ref.:
B0031174

Date:
May 15, 2012
Revised July 10, 2012
Revised July 25, 2012

Table of Contents

ARCADIS

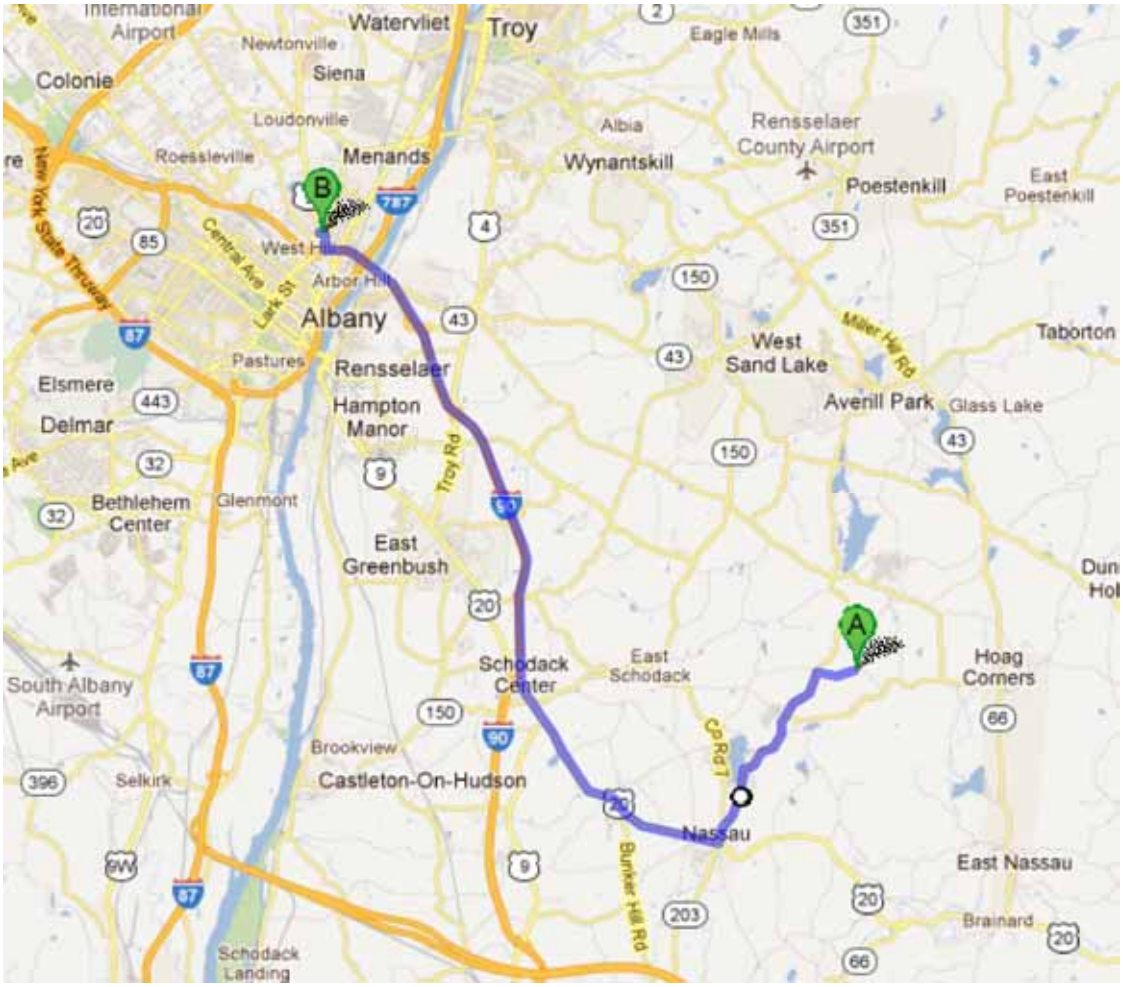
Directions to Hospital

Albany Memorial Hospital
600 Northern Boulevard
Albany NY 12204
518.471.3221

1. Head west on Mead Road toward County Road 15/Nassau-Averill Park Road
   2 minutes / 0.7 mile
2. Turn left onto County Road 15/Nassau-Averill Park Road
   6 minutes / 3.2 miles
3. Continue onto Lake Avenue
   1 minute / 0.3 mile
4. Turn left onto Elm Street
   1 minute / 0.3 mile
5. Turn right onto US Route 20 West
   7 minutes / 4.7 miles
6. Merge onto Interstate 90 West
   9 minutes / 9.0 miles
7. Take Exit 6 for US Route 9 North toward Loudonville
   1 minute / 0.4 mile
8. Follow signs for Northern Boulevard
   1 minute / 0.2 mile
9. Keep left at the fork and follow signs for US Route 9/Interstate 90 East
   1 minute / 0.1 mile
10. Turn left onto Northern Boulevard and destination will be on the left
    1 minute / 0.1 mile

Total is about 30 minutes / 19 miles

Map to Hospital



1. Emergency Contact Information and Procedures

Emergency	911
Ambulance (Hoags Corners)	(518) 766-5474
Ambulance (Nassau)	(518) 931-4160
Fire Department (Hoags Corners)	(518) 766-5474
Fire Department (Nassau)	(518) 766-3343
Fire Department (East Schodack)	(518) 479-3366
Fire Department (Schodack Valley)	(518) 477-4215
Police Department (Nassau)	(518) 766-9293
Police Department (Schodack)	(518) 477-7973
Rensselaer County Sheriff's Department	(518) 270-5448
Albany Memorial Hospital	(518) 471-3221
Rensselaer County HAZMAT	(518) 270-4160
Rensselaer County Division of Environmental Health	(518) 270-2664
Highway Department (Nassau)	(518) 766-9417
Poison Control Center	(800) 332-3073
Chemical Emergency Advice	(800) 424-9300
New York State Emergency Management Office	(518) 292-2200
New York State Emergency Response Hotline	(800) 457-7362
National Spill Response Center	(800) 424-8802
USEPA On-Scene Coordinator (Margaret Alferman)	(732) 321-4424 (office) (908) 421-2624 (mobile)
USEPA Remedial Project Manager (Benedetto Conetta)	(212) 637-3030

The site is located in the Hoags Corners Fire and Ambulance Districts; however, additional local response agencies along the primary truck route provided in Figure 3 of the Transportation and Disposal (T&D) Plan to Interstate 90 have been included in the table above.

Directions to Hospital

Medical Facility: Albany Memorial Hospital
Address: 600 Northern Boulevard
Albany NY 12204
Phone Number: 518.471.3221

See directions on page 1 and map on page 2.

Emergency Notification Procedure

Step 1: Dial 911 (if necessary) and/or WorkCare 800.455.6155

Step 2: Contact PM – Don Sauda 315.447.2612 (Cell)

Step 3: Contact H&S Manager – Greg Ertel 585.303.0633 (Cell)

Emergency Supplies and Equipment List

Emergency Supplies and Equipment (check all that apply)	Location on Project Site
☒ First Aid Kit (type):	Landfill pole barn or vehicle
☒ Fire Extinguisher	Landfill pole barn or vehicle
☒ Mobile Phone ☐ Satellite Phone	Landfill pole barn or vehicle
☒ Traffic Cones	Landfill pole barn or vehicle
☐ Walkie Talkies	
☒ Water or Other Fluid Replenishment	Landfill pole barn or vehicle
☐ Eye Wash/Quick Drench Station	
☒ Eye Wash Bottle	Landfill pole barn or vehicle
☒ Wash and Dry Towelettes	Landfill pole barn or vehicle
☒ Sunscreen (SPF 15 or higher)	Landfill pole barn or vehicle
☒ Insect Repellant	Landfill pole barn or vehicle
☐ Chemical Spill Kit	
☐ *Other (specify):*	

2. Introduction

All work on this project will be carried out in compliance with ARCADIS (U.S.), Inc.'s (ARCADIS') Health and Safety (H&S) Standards, and the Occupational Safety and Health Administration's (OSHA's) Hazardous Waste Operations and Emergency Response regulation. The design of this Health and Safety Plan (HASP) conforms to the requirements of the ARCADIS HASP Standard (ARC HSFS010). Specific H&S information for the project is contained in this HASP. All personnel working on hazardous operations or in the area of hazardous operations shall read and be familiar with this HASP before doing any work at the project site. All project personnel shall sign the certification page, located in Appendix C, acknowledging that they have read and understand this HASP before performing any work at the project site.

Changes in the scope of the project or introduction of new hazards to the project shall require revision or amendment of the HASP by the HASP Writer and HASP Reviewer, and approval by the Project Manager (PM). The HASP Addendum Form and Addendum Log Table A-1 are included as Appendix A.

3. Project History and Requirements

3.1 Background

This HASP has been prepared for the Dewey Loeffel Landfill Superfund Site located in the Town of Nassau, Rensselaer County, New York (site). The work described herein is being completed pursuant to the Administrative Settlement Agreement and Order on Consent for a Removal Action (CERCLA Index No. 02-2012-2005) (Consent Order) executed by the United States Environmental Protection Agency (USEPA), General Electric Company (GE), and SI Group, Inc. (SI Group), effective April 16, 2012. (GE and SI Group are referred to herein as Respondents.)

The Dewey Loeffel Landfill (landfill) is located along the south side at 350 Mead Road between Nassau-Averill Park Road and Central Nassau Road. A map showing the location of the landfill and surrounding area is presented on Figure 1. Key features are presented on Figure 2.

As described in the Consent Order, from approximately 1952 to 1968, the landfill was owned and operated by several companies including the Loeffel Waste Oil and Removal Service Company (Loeffel Companies) as a waste disposal facility. During this time, the landfill consisted of two waste lagoons located in the western and central portions of the landfill, a 6-foot deep oil pit in the east central portion of the landfill, four 30,000 gallon aboveground storage tanks, and a drum disposal area located in the southeastern portion of the landfill.

Landfill disposal operations reportedly ceased in 1968 by order of the New York State Department of Environmental Conservation (NYSDEC). Between 1970 and 1975, remedial actions undertaken by the Loeffel Companies included covering and grading the drum disposal area, oil pit and lagoons, and constructing a system of drainage ditches around the landfill. From 1974 to 1980, the Loeffel Companies reportedly also operated a waste oil transfer station utilizing the four 30,000 gallon aboveground storage tanks.

On September 23, 1980, GE entered into an agreement with NYSDEC which required GE to perform field investigations, submit an engineering report which discussed the collected data, identify remedial alternatives, and recommend a remedial alternative. A remedy was subsequently selected by NYSDEC and involved the installation of soil-bentonite cutoff wall around the landfill, an underlying clay cap, and a landfill leachate collection system below the cap within the cutoff wall. The design of the remedy was

performed by GE and approved by NYSDEC. The remedy was subsequently implemented by NYSDEC using funding provided by GE, Schenectady Chemicals, Inc. (now SI Group), and Bendix Corporation (now Honeywell International, Inc.). Beginning in 1983, NYSDEC and/or GE performed a variety of response actions at the site, some of which were performed in accordance with Records of Decision (RODs) issued by NYSDEC in January 2001 and January 2002. The response actions included, but were not limited to, the following:

- Installation and operation of a bedrock groundwater recovery well system involving three extraction wells located to the south of the landfill;
- Transportation of landfill leachate and extracted groundwater for off-site treatment;
- Installation, operation, maintenance and monitoring of point-of-use treatment systems for five residential wells (located on four properties) to remove volatile organic compounds (VOCs);
- Routine VOC monitoring of other residential wells located near the landfill; and
- Routine monitoring of many groundwater monitoring wells located outside the landfill's perimeter fence.

The current groundwater extraction system was designed and constructed by NYSDEC, and is located along the approximate centerline of the VOC plume to the south of the landfill and includes three bedrock extraction wells (designated EW-1, EW-2 and EW-3, see Figure 2). Beginning in late March 2008 and through 2010, NYSDEC extracted groundwater from these three extraction wells on a seasonal basis, operating during the spring, summer, and fall months. Along with landfill leachate, extracted groundwater was transported for off-site treatment and disposal. NYSDEC transported landfill leachate for off-site treatment and disposal each year since 1991 with the exception of 1994. NYSDEC continued operation of the landfill leachate collection system through October 2011. Operation of the groundwater extraction system by NYSDEC did not resume after shutdown in the fall of 2010 until July 2011.

At the request of NYSDEC, USEPA proposed the site for inclusion on the National Priorities List (NPL) on March 4, 2010. The site was subsequently added to the NPL on March 10, 2011.

USEPA subsequently took over operation of the landfill leachate collection system and the groundwater extraction system to the south of the landfill on October 31, 2011. USEPA winterized the system, allowing groundwater extraction to continue during the winter months.

Pursuant to the Consent Order, Respondents will assume responsibility from USEPA for continued operation and maintenance of the landfill leachate collection system and the groundwater extraction system. The landfill leachate and extracted groundwater will be transported for off-site treatment and disposal until such time as the planned new treatment system is designed, constructed and approved for operation. Pursuant to the Consent Order, Respondents will design and construct a treatment system to treat landfill leachate and extracted groundwater. Upon USEPA approval that the treatment system discharges will meet the effluent discharge limits set under the Consent Order, transportation of landfill leachate and extracted groundwater for off-site treatment will cease.

3.2 Description

Site Type: (Check as many as applicable}

	Active	X	Secure		Industrial	X	Landfill		Service station
X	Inactive		Unsecured		Commercial		Well field		Water work
			Uncontrolled		Residential		Railroad		Undeveloped
Other specify:									

The capped area of the landfill is roughly triangular in shape and situated in a low-lying area between two wooded hills. The landfill is bound to the north by Mead Road, and to the south, west and east by undeveloped forested land. The rural area surrounding the landfill is sparsely populated and contains few residential properties and a bowhunter's club lodge.

Topography in the area generally slopes downward from east to west. Surface water at the landfill mostly drains to the west toward the Valatie Kill via Tributary T11A. The Valatie Kill flows in a southwesterly direction to Nassau Lake, located approximately three miles downstream. Surface water from a portion of the landfill flows to the south into a small unnamed tributary which discharges into Valley Stream and ultimately Nassau Lake.

The hydraulic gradient of groundwater in overburden soils in the vicinity of the landfill is generally to the west and/or southwest. The hydraulic gradient of groundwater in the

bedrock is similar. However, based on the distribution of VOCs in a groundwater contaminant plume emanating from the landfill to the south, bedrock groundwater flows primarily to the south and is influenced by the presence of fractures within the bedrock.

Based on the Preliminary Basis of Design contained in the Preliminary Design Report, the constituents of concern (COCs) at the site are listed below.

COCs
Acetone
Benzene
Chlorobenzene
Chloroform
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethene
cis-1,2-Dichloroethene
Ethylbenzene
Methylene chloride
4-Methyl-2-pentanone
Tetrachloroethene
Toluene
1,1,1-Trichloroethane
Trichloroethene
Vinyl chloride
Total xylenes
2-Chlorophenol
1,2-Dichlorobenzene
1,4-Dichlorobenzene
2,4-Dimethylphenol
2-Methylphenol
4-Methylphenol
Pentachlorophenol
Phenol
1,2,4-Trichlorobenzene
Polychlorinated biphenyls (PCBs)

3.3 List of Project Tasks

Activities associated with the pump and truck phase of the project:

- General site visits;
- Operation and maintenance (O&M) of the existing groundwater extraction and landfill leachate collection systems;
- Loading vacuum tanker trucks;
- Drum handling;
- Waste sampling;
- Gauging and sampling of groundwater extraction wells, groundwater monitoring wells, groundwater frac tank, vacuum tanker trucks and landfill leachate collection tank;
- Vegetation management (e.g., mowing, trimming, clearing, etc.);
- Access road maintenance (including snow removal);
- Refueling the generator near the pole barn and in the leachate pump station shed (colder months only); and
- Perimeter fence inspection and maintenance.

All personnel conducting vacuum tanker truck loading operations will be trained commensurate with their job responsibilities including hooking up hoses and valve opening/closing sequencing. Any employee or subcontractor working at the site as part of landfill leachate collection and groundwater extraction system O&M will complete a site-specific training program.

Activities associated with the pump and treat pre-design phase of the project:

- Installation of soil borings;
- Gauging and sampling of groundwater extraction wells, groundwater monitoring wells, groundwater frac tank, vacuum tanker trucks and the landfill leachate collection tank;
- Air monitoring in accordance with Section 8 of this HASP; and
- Surveying.

4. ARCADIS Organization and Responsibilities

4.1 All Personnel

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 conflict with these procedures. Prior to initiating site activities, all ARCADIS and subcontractor personnel will receive training in accordance with applicable regulations, and be familiar with the requirements and standards referenced in this HASP. In addition, all personnel will attend daily safety meetings (tailgate meetings) to discuss site-specific hazards prior to beginning each day's work. Every ARCADIS employee, subcontractor, and client representative at the site has the responsibility to stop the work of a coworker or subcontractor if the working conditions or behaviors are considered unsafe.

A buddy system will be used for maintenance activities and vacuum tanker truck loading operations. In some instances (i.e., groundwater loading from frac tanks), the tanker truck driver may be the second person in the buddy system. The buddy system will not be required when only inspections are being completed.

4.2 Project Manager

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 project has the equipment, materials and qualified personnel to fully implement the safety requirements of this HASP, and/or that subcontractors assigned to this project meet the requirements established by ARCADIS. It is also the responsibility of the PM to:

- Review all applicable H&S standards, and ensure that project activities conform to all requirements;
- Communicate with the client(s) on H&S issues;
- Communicate with the Site Safety Officer (SSO) on H&S issues;
- Allocate resources for correction of identified unsafe work conditions;

- Ensure ARCADIS site workers and subcontractors have all training necessary for the project;
- Ensure ARCADIS site workers and subcontractors have access from all applicable property owners; and
- Report all injuries, illnesses and near-misses to the client representatives, lead incident investigations, and ensure that any recommendations made are implemented.

4.3 Site Safety Officer

The SSO has overall responsibility for the technical H&S aspects of the project. Inquiries regarding ARCADIS H&S standards, project procedures, and other technical or regulatory issues should be addressed to this individual. It is also the responsibility of the SSO to:

- Review and work in accordance with the components of this HASP;
- Ensure that this HASP is available to and reviewed by all site personnel including subcontractors;
- Ensure that all ARCADIS and subcontractor personnel have current certifications as per applicable OSHA regulations;
- Ensure that necessary site-specific training is performed (both initial and tailgate safety briefings);
- Ensure site visitors have been informed of the hazards related to ARCADIS' work;
- Ensure that work is performed in a safe manner and ARCADIS site workers and subcontractors have authority to stop work when necessary to protect workers and/or the public;
- Coordinate activities during emergency situations;
- Communicate with the PM on H&S issues;

- Report all injuries, illnesses and near-misses to the PM; and
- Ensure that necessary safety equipment is maintained and used at the site.

The SSO will contact a H&S professional for assistance in establishing the respiratory cartridge change schedule, if required.

5. Project Hazards and Control Measures

5.1 Hazard Analysis

The site's hazards are described in the table below using HIGH (H), MEDIUM (M) or LOW (L) based on current site knowledge. The results of this analysis are used to verify controls in the Job Safety Analysis (JSA) or other supporting documents are adequate to mitigate task hazards. When in the field, the Tailgate H&S Meeting Form (see Appendix C) is used for a specific evaluation of task hazards.

Table 1. Hazard Ranking Chart

Severity	Consequence		Probability				
	Property Damage	Injury	Frequent	Likely	Occasional	Seldom	Unlikely
	> $100,000	Fatality	H	H	H	H	M
	> $10,000	Injury Requiring Hospitalization	H	H	H	M	L
	> $1000	Injury Requiring Medical Treatment Beyond First Aid	H	M	M	L	L
	< $1000	Injury Requiring First Aid	M	L	L	L	L

Hazards are ranked using the ARCADIS internal Hazard Assessment and Risk Constrol (HARC) Process (ARC HSMS002).

Biological		***Mechanical***		***Chemical/Radiation***	
M	Biting/stinging insects	L	Cuts on equipment/tools		Not applicable
M	Biting animals	M	Pinch points on equipment		General
L	Poisonous plants		Burns from equipment		Dusts, toxic
	Phys. damaging plants	H	Struck by equipment	L	Dusts, nuisance
					Chemicals, ARCADIS use
Driving		***Motion***			Chemicals, corrosive
	Night driving	M	Lifting/awkward body positions		Chemicals, explosive
M	Off-road driving	L	Struck by vehicle/traffic	L	Chemicals, flammable
	Urban driving				Chemicals, oxidizing
M	All terrain vehicle	***Personal Safety***		L	Chemicals, toxic
	Boat		Working late/night		Chemicals, reactive
			Working alone		Radiation, ionizing
Electrical			High crime area		Radiation, non-ionizing
L	Wet environments				
M	Electrical panels	***Pressure***		***Compound Specific***	
	Electric utilities		Utilities (gas, water, etc)		Asbestos
L	Electric power tools	L	Compressed gas cylinders	L	Benzene
			Compressed air/aerosols		Cadmium
Environment			Hydraulic systems		Hydrogen sulfide
L	Heat				Lead
L	Cold	***Sound***			Silica
L	Lightning	M	Equipment noise		
L	Inclement weather		Tool noise	***Gravity***	
L	High wind		Traffic noise (vehicle/train/etc)	M	Slip, trip, fall
				L	Fall from height
				L	Ladders or scaffolds
				L	Struck by falling object

5.2 Job Safety Analysis, H&S Standards and Personal Protective Equipment

JSAs have been completed for the safety critical tasks and are included in Appendix B. Hazards identified in the table above are addressed specifically in the JSAs as well as control methods to protect employees and property from hazards. The JSA also lists the type of personal protective equipment (PPE) required for the completion of the project. A detailed list of PPE for the project is located in Appendix D.

ARCADIS internal H&S standards applicable to this project are listed below. These standards must be reviewed by the PM, SSO and other ARCADIS personnel performing work at the project site.

- ARC HSCS006 – Heavy and Mechanized Equipment;
- ARC HSFS003 – Confined Space Entry;
- ARC HSFS004 – Control of Hazardous Energy (Lockout/Tagout);
- ARC HSFS006 – Electrical Safety;
- ARC HSFS019 – Utility Clearance; and
- ARC HSIH003 – Benzene.

If confined space entry is required, a JSA for the specific activity will be developed, reviewed, and approved prior to conducting any entry activity. Lockout/tagout will be completed in accordance with the general and equipment-specific procedures in ARC HSFS004.

5.3 Field H&S Handbook

The Field H&S Handbook is an ARCADIS document containing information about topic-specific H&S requirements for the field. This handbook contains relevant general topics and is used as part of the overall HASP process. To aid in the consistency of the HASP process, the handbook will be used as an informational source in conjunction with this HASP and a copy will be located in the landfill pole barn or employee vehicle.

The following handbook sections are required reading by the PM, SSO and other ARCADIS personnel performing work at the project site :

- Section III, Paragraph G – Site Security, Work Zones and Decontamination for HAZWOPER Sites;
- Section III, Paragraph N – Biological Hazards (ticks especially);
- Section III, Paragraph W – All-Terrain Vehicles and Utility Vehicles;

- Section III, Paragraph Y – Confined Spaces;
- Section III, Paragraph DD – Vegetation Management;
- Section III, Paragraph II – Drums and Other Material Handling;
- Section III, Paragraph MM – Utility Location; and
- Section IV, Paragraph E – Heavy Equipment.

6. Hazard Communication

All project required chemicals must be handled in accordance with the ARCADIS Hazardous Communication (HazCom) Standard (ARC HSGE007) and the requirements outlined in the Field H&S Handbook. The table below lists all chemicals that will be brought to, used at, and/or stored on the site by ARCADIS or its subcontractors. Material Safety Data Sheets (MSDS) for these chemicals are included in Appendix E.

List the chemicals anticipated to be used by ARCADIS on this project subject to HazCom requirements.

	Acids/Bases	Qty
☒	Not applicable	
☐	Hydrochloric acid	<500 ml
☐	Nitric acid	<500 ml
☐	Sulfuric acid	<500 ml
☐	Sodium hydroxide	<500 ml
☐	Zinc acetate	<500 ml
☐	Ascorbic acid	<500 ml
☐	Acetic acid	<500 ml
☐	Other:	

	Decontamination	Qty
☐	Not applicable	
☒	Alconox	≤ 5 lbs
☐	Liquinox	≤ 1 gal
☐	Acetone	≤ 1 gal
☐	Methanol	≤ 1 gal
☐	Hexane	≤ 1 gal
☐	Isopropyl alcohol	≤ 4 gal
☐	Nitric acid	≤ 1 L
☐	Other:	

	Calibration	Qty.
☐	Not applicable	
☒	Isobutylene/air	1 cyl
☐	Methane/air	1 cyl
☐	Pentane/air	1 cyl
☐	Hydrogen/air	1 cyl
☐	Propane/air	1 cyl
☐	Hydrogen sulfide/air	1 cyl
☐	Carbon monoxide/air	1 cyl
☒	pH standards (4,7,10)	<1 gal
☐	Conductivity standards	≤ 1 gal
☐	Other:	

	Fuels	Qty.
☐	Not applicable	
☒	Gasoline	≤ 10 gal
☒	Diesel	≤ 60 gal
☐	Kerosene	≤ 5 gal
☒	Propane	≤ 500 gal
☐	Other:	

	Kits	Qty.
☒	Not applicable	
☐	Hach (specify):	1 kit
☐	DTECH (specify):	1 kit
☐	EPA 5035 Soil (specify kit):	1 kit
☐	Other:	

	Remediation	Qty.
☒	Not applicable	
☐	Other:	
☐	Other:	
☐	Other:	
☐	Other:	

	Other:	Qty.
☒	Not applicable	
☐	Spray paint	≤ 6 cans
☐	WD-40	≤ 1 can
☐	Pipe cement	≤ 1 can
☐	Pipe primer	≤ 1 can
☐	Mineral spirits	≤ 1 gal

Material safety data sheets (MSDSs) must be available to field staff. Manufacturer supplied MSDSs are preferred, however, if the manufacturer's MSDS cannot be located, use the source provided below. Indicate below how MSDS information will be provided:

- ☐ Not applicable
- ☐ Printed copy in company vehicle
- ☐ Printed copy in the project trailer/office
- ☒ Printed copy with HASP
- ☐ Electronic copy on field computer

Find an MSDS	
Source:	www.hz.genium.com
Username:	arcadis_library
Password:	library1

Air monitoring will be conducted as outlined in Section 8 of this HASP to collect exposure data for the COCs or for the chemicals brought onto the site for use during the project. Table 2 lists the properties of chemicals that will be encountered at the site.

Table 2. Chemical Hazard Information

Chemical Name	IP (eV)[1]	Odor Threshold	Routes of Entry/ Exposure Symptoms[2]	8-hr TWA[3] (ppm)	IDLH[4] (NIOSH) (ppm)	STEL[5] (ppm)	Source[6]
1,1,1-Trichloroethane (Methyl chloroform) [71-55-6]	11.0	NA	Inh, Ing, Con/ Irritated eyes, skin; headache, lassitude, CNS depression, poor equilibrium, dermatitis, cardiac arrhythmia; liver damage	350	700	C 350	PEL REL
1,1-Dichloroethane [75-34-3]	11.6	110-200	Inh, Con/Irritated eyes/skin/respiratory tract, dizziness, coughing, staggering, disturbed vision, irregular heartbeat, unconsciousness, coma, pulmonary edema	100	3,000	100	PEL REL
1,1-Dichloroethene (Vinylidene chloride) [75-35-4]	10.0	ND	Inh, Abs, Ing, Con/Irritated eyes, skin, throat; dizziness, headache, nausea; dyspnea; liver, kidney dysfunction	5	Ca	Ca	TLV
1,2-Dichlorobenzene [95-50-1]	9.06	2-50	Inh, Abs, Ing, Con/Irritation to eyes, nose; liver and kidney damage; skin blisters	C 50	200	C 50	PEL TLV REL
1,2-Dichloroethane (Ethylene dichloride) [107-06-02]	11.05	ND	Inh, Abs, Ing, Con/Depressed CNS, nausea, vomiting, dermatitis, irritated eyes, corneal opacity	1	50	2	REL
1,2,4-Trichlorobenzene [120-82-1]	ND	3	Inh, Abs, Ing, Con/Irritation to eyes, skin, mucous membrane	NA	ND	C 5	PEL REL

1,4-Dichlorobenzene [106-46-7]	8.98	15-30	Inh, Abs, Ing, Con/ Irritation to eyes, swelling around eyes, profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis	75	Ca 150	ND	PEL
2-Chlorophenol [95-57-8]	ND	NA	Inh, Abs, Con/Irritation to eyes, respiratory tract; weakness, headache, dizziness, convulsions or collapse	ND	ND	ND	
2-Methylphenol [95-48-7]	8.93	5	Inh, Abs, Ing, Con/Irritation to eyes, skin, mucous membrane; central nervous system effects: confusion, depression, respiratory failure; dyspnea, irregular rapid respiration, weak pulse; eye, skin burns; dermatitis; lung, liver, pancreas damage	5	250	2.3	PEL REL
2,4-Dimethylphenol [105-67-9]	ND	0.0001-0.08	Inh, Con/Irritation to eyes, respiratory tract, skin	ND	ND	ND	
4-Methylphenol [1319-77-3]	ND	0.003-5	Con/Irritating to respiratory tract, corrosive to eyes and skin	5	ND	2.3	PEL REL
4-Methyl-2-pentanone [108-10-1]	9.30	0.1-47	Inh, Ing, Con/Irritation to eyes, skin, mucous membrane; headache, narcosis, coma; dermatitis	50	500	75	PEL REL
Acetone [67-64-1]	9.69	20-679	Inh, Ing, Con/Irritation to eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis	250	2,500	750	TLV REL
Benzene [71-43-2]	9.24	34-119	Inh, Abs, Ing, Con/Irritated eyes, nose, and respiratory system; giddiness; headache; nausea; staggered gait; fatigue; anorexia; lassitude; dermatitis; bone marrow depression	0.5	Ca 500	2.5	TLV
Chlorobenzene [108-90-7]	9.07	ND	Inh, Ing, Con/Irritated eyes, skin, and nose; drowsiness, incoherence; CNS depression	10	1,000	NA	TLV
Chloroform (Trichloromethane) [67-66-3]	11.42	51-205	Inh, Ing, Con/Dizziness; mental dullness; nausea; disorientation; headache; fatigue; anesthesia; liver enlargement; irritated eyes, skin	10	Ca 50	2	TLV REL
cis-1,2-Dichloroethene [156-59-2]	ND	0.085	Inh, Con/Irritation to eyes and skin; depression of central nervous system, nausea, vomiting, weakness, tremor and epigastric cramps	200	ND	ND	PEL
Ethylbenzene [100-41-4]	8.76	2-200	Inh, Ing, Con/Irritation to eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	100	800	125	PEL REL
Methylene chloride [75-09-2]	11.32	NA	Inh, Abs, Ing, Con/Irritation to eyes and skin; lassitude, drowsiness, dizziness; numb, tingling limbs; nausea	25	Ca 2,300	125	PEL

Pentachloroethene [87-86-5]	NA	78	Inh, Abs, Ing, Con/Irritation to eyes, nose, throat; sneezing, cough; lassitude, anorexia, weight loss; sweating; headache, dizziness; nausea, vomiting; dyspnea, chest pain; high fever; dermatitis	0.05	2.5	0.05	PEL
Phenol [108-95-2]	8.50	0.047-6	Inh, Abs, Ing, Con/Irritation to eyes, nose, throat; anorexia, weight loss; lassitude, muscle ache, pain; dark urine; cyanosis; liver, kidney damage; skin burns; dermatitis; ochronosis; tremor, convulsions, twitching	5	250	C 16	REL
Tetrachloroethene [127-18-4]	9.32	5	Inh, Abs, Ing, Con/Irritation to eyes, skin, nose, throat, respiratory system; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema; liver damage	25	Ca 150	100	TLV
Toluene [108-88-3]	8.82	2	Inh, Abs, Ing, Con/Irritation to eyes, nose; lassitude, confusion, euphoria, dizziness, headache; dilated pupils, lacrimation; anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage	100	500	150	REL
Trichloroethene [79-01-6]	9.45	21	Inh, Ing, Con/Headache, vertigo; visual disturbance, tremors, somnolence, nausea, vomiting; irritated eyes; dermatitis; cardiac arrhythmia, paresthesia	50	Ca 1,000	100	TLV
Vinyl chloride [75-01-4]	9.99	25	Inh, Con/Intoxication, weakness; abdominal pain; GI bleeding; enlarged liver; pallor; cyanosis of extremities	1	Ca	C 5	PEL TLV
Xylenes [1330-20-7]	ND	0.00005	Inh, Abs, Ing, Con/Depression of central nervous system, headache, fatigue, lassitude; irritating to eyes, skin	100	ND	150	PEL TLV REL
PCBs [1336-36-3]	ND	NA	Inh, Abs, Ing, Con/Irritation to eyes, skin, nose, throat, respiratory system; dizziness, headache, lethargy; liver damage; dermatitis	0.5	5	NA	PEL TLV REL

[1]IP = Ionization potential (electron volts)

[2]Route = Inh, Inhalation; Abs, Skin absorption; Ing, Ingestion; and Con, Skin and/or eye contact. Information based on MSDSs in Appendix E.

[3]TWA = Time-weighted average. The TWA concentration for a normal workday (usually 8 or 10 hours) and a 40-hour work week, to which nearly all workers any be repeatedly exposed, day after day without adverse effect.

[4]IDLH (NIOSH) = Immediately dangerous to life or health (NIOSH). Represents the maximum concentration from which, in the event of respirator, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects.

[5]STEL = Short-term exposure limit. A 15-minute TWA exposure that should not be exceeded at any time during a workday, even if the TWA is not exceeded.
PEL = OSHA permissible exposure limit (29 CFR 1910.1000, Table Z).
TLV = American Conference of Governmental Industrial Hygiene (ACGIH) threshold limit value – TWA.
REL = National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit.
C = Ceiling limit value which should not be exceeded at any time.
Ca = Carcinogen (based on information provided in the MSDSs).
NA = Not applicable
ND = Not determined

See Section 8 for information on air monitoring requirements.

7. Tailgate Meetings

Tailgate safety briefings must be conducted at least once daily and may be conducted twice daily (at the start of the job and after mid-day meal break), or as tasks/hazards change. Each tailgate safety briefing must be documented on the form included in Appendix C and maintained with the project files. The tailgate safety briefing will serve as a final review for hazard identification and controls to be utilized. JSAs and the ARCADIS Field H&S Handbook controls should be reviewed as part of the briefing to ensure hazard controls are adequate for planned work. At the tailgate safety meeting, it should be confirmed that all new ARCADIS or subcontractor personnel have current certifications as per applicable OSHA regulations and have reviewed this HASP (see acknowledgement forms in Appendix C).

8. Personal Exposure Monitoring and Respiratory Protection

Personal and area exposure monitoring will be documented on the Real Time Exposure Monitoring Data Collection Form provided in Appendix C. All monitoring equipment will be maintained and calibrated in accordance with manufacturer's recommendations. All pertinent monitoring data will be logged on the form and maintained by the SSO for the duration of project activities. Calibration of all monitoring equipment will be conducted daily and logged on the same form.

Table 3 lists exposure monitoring requirements and associated action levels for site exposure hazards (e.g., chemical, noise, radiation, etc). Action levels have been developed for exposure monitoring with real-time air monitoring instruments as specified in the table. Air monitoring data will determine the required respiratory protection levels at the site during the listed activities. The action levels are based on sustained readings indicated by the instrument(s). Air monitoring will be performed and recorded at up to 30-minute intervals.

If elevated concentrations are indicated, the monitoring frequency will be increased, as appropriate. If sustained measurements are observed during this time, the following actions will be instituted, and the PM and SSO will be notified. For purposes of this HASP, sustained readings are defined as the average airborne concentration maintained for a period of one minute.

Table 3. Exposure Monitoring Requirements

TASK - Vegetation management, surveying, access road maintenance (snow removal), and perimeter fence maintenance - Is exposure monitoring required for the completion of this task?

☐ YES ☒ NO If yes, complete the following:

Exposure Hazard	Monitoring Equipment	Monitoring Frequency	Action Level	Required Action

TASK – Installation of soil borings, soil sampling, extracted groundwater and landfill leachate gauging and sampling, waste sampling - Is exposure monitoring required for the completion of this task? ☒ YES ☐ NO If yes, complete the following:				
Exposure Hazard	**Monitoring Equipment**	**Monitoring Frequency**	**Action Level**	**Required Action**
Fire/Explosion	Lower Explosive Limit (LEL) Meter	Continuous when within 50 feet of flammable/combustible	<10 % of LEL >10 % LEL	Normal operations Stop work, ventilate area Evacuate area if readings do not immediately reduce below 10% of LEL contact SSO
Total VOCs	Photoionization Detector (PID) (10.6 eV lamp or greater)	Continuous in breathing zone	≤ 0.5 ppm > 0.5 ppm > 0.5ppm to ≤ 20 ppm > 20 ppm ≥ 200 ppm	Normal operations Begin monitoring for benzene with colorimetric tubes Normal operations (if benzene concentration is ≤ 0.5 ppm) Upgrade to level C PPE Stop work and investigate cause of reading; contact SSO
Benzene	Draeger Tubes (or equivalent)	Periodically during tasks if total VOCs are exceeded	≤ 0.5 ppm ≥0.5 ppm to 10 ppm (sustained) > 10 ppm	Normal operations Upgrade to Level C PPE; leave area if Level C PPE is not available Stop work; investigate cause of reading; contact SSO

Particulate (only during installation of soil borings and soil sampling)	MIE PDR 1000 Data RAM	Continuous in breathing zone if visible dust present (readings relative to background)	≤ 0.5 mg/m^3	Normal operations
			> 0.5 mg/m^3 to 5 mg/m^3	Institute wetting procedures; dust masks for affected personnel if wetting techniques fail to keep below action level
			> 5 mg/m^3	Stop work; contact SSO; investigate source of dust; corrective action will be taken to reduce readings to below 2.5 mg/m^3 before work is allowed to resume
		Work zone perimeter	> 0.250 mg/m^3	Stop work; contact SSO; investigate source of dust; corrective action will be taken to reduce readings to below 0.250 mg/m^3 before work is allowed to resume

TASK – O&M of groundwater extraction and landfill leachate collection systems, loading tanker trucks, drum handling (during activities with the potential for fire/explosion or exposure to VOCs) – Is exposure monitoring required for the completion of this task?

☒ YES ☐ NO If yes, complete the following:

Exposure Hazard	Monitoring Equipment	Monitoring Frequency	Action Level	Required Action
Fire/Explosion	Lower Explosive Limit (LEL) Meter	Continuous when within 50 feet of flammable/combustible	<10 % of LEL	Normal operations
			>10 % LEL	Stop work, ventilate area Evacuate area if readings do not immediately reduce below 10% of LEL contact SSO

Total VOCs	Photoionization Detector (PID) (10.6 eV lamp or greater)	Periodically in work area	≤ 0.5 ppm > 0.5 ppm > 0.5ppm to ≤ 20 ppm > 20 ppm ≥ 200 ppm	Normal operations Begin monitoring for benzene with colorimetric tubes Normal operations (if benzene concentration is ≤ 0.5 ppm) Upgrade to level C PPE Stop work and investigate cause of reading; contact SSO
Benzene	Draeger Tubes (or equivalent)	Periodically in work area if total VOCs are exceeded	≤ 0.5 ppm ≥0.5 ppm to 10 ppm (sustained) > 10 ppm	Normal operations Upgrade to Level C PPE; leave area if Level C PPE is not available Stop work; investigate cause of reading; contact SSO

TASK – Access road maintenance (during potential dust producing activities) - Is exposure monitoring required for the completion of this task? ☒ **YES** ☐ **NO If yes, complete the following:**				
Exposure Hazard	**Monitoring Equipment**	**Monitoring Frequency**	**Action Level**	**Required Action**
Particulate	MIE PDR 1000 Data RAM	Continuous in breathing zone if visible dust present (readings relative to background)	≤ 0.5 mg/m3	Normal operations
			> 0.5 mg/m3 to 5 mg/m3	Institute wetting procedures; dust masks for affected personnel if wetting techniques fail to keep below action level
			> 5 mg/m3	Stop work; contact SSO; investigate source of dust; corrective action will be taken to reduce readings to below 2.5 mg/m^3 before work is allowed to resume
		Work zone perimeter	> 0.250 mg/m3	Stop work; contact SSO; investigate source of dust; corrective action will be taken to reduce readings to below 0.250 mg/m^3 before work is allowed to resume

Respirators will be stored in clean containers (i.e., self-sealing bag) when not in use. If respirators are required to be worn based on the action levels established above, respirator cartridges will be replaced in accordance with the change-out schedule presented below.

Type of Cartridge	Cartridge Change-out Schedule
Particulate (i.e., High Efficiency Particulate Air)	At least weekly or whenever the employee detects an increase in breathing resistance. This will occur as the filter becomes loaded with particulate matter.
Sorbent (i.e., organic vapor)	At the end of each day's use or sooner, if the respirator manufacturer change-out schedule software program dictates otherwise. The SSO or the PM must be consulted regarding the gas/vapor cartridge change-out schedule. This will be determined per the ARCADIS internal Respiratory Protection Standard (ARC HSGE017).

Personnel who wear respirators must be trained in their use, including the cartridge change-out procedures and schedule, must have successfully passed a qualitative respiratory fit test within the last 12 months, and must have medical clearance for APR use.

With the exception of protection against particulates*, if the action plan outlined above calls for an upgrade to an air-purifying respirator (for protection against organic vapors and other gaseous chemicals), the following will apply:

- The respirator cartridge will be equipped with an end-of-service-life indicator (ESLI) certified by NIOSH for the contaminant; or

- If there is no ESLI appropriate for a contaminant, the project will implement a change schedule for cartridges to ensure that they are changed before the end of their service life.

**Note – A Cartridge Change Schedule is not necessary for cartridges used in the protection against particulates provided that the cartridges are changed out when there is a perceived resistance in breathing experienced by the user.*

9. Medical Surveillance

Medical surveillance requirements are outlined in the ARCADIS internal Medical Monitoring Program Standard (ARC HSGE010). All medical surveillance requirements as indicated must be completed and site personnel medically cleared before being permitted on the project site.

10. General Site Access and Control

The SSO will coordinate access and control security at the work site. Visitors must be escorted by ARCADIS personnel whenever inside the fenced areas around the landfill or the extraction wells. The visitor log sheet is included in Appendix C. USEPA and NYSDEC personnel and subcontractors are specifically excluded from this HASP and will be responsible for their own H&S requirements.

Personnel should be aware that activities will take place on other landowner's property with access agreements in place. Additionally, project activities, including those related to and in the vicinity of the extraction wells and groundwater monitoring wells to the south and west of the landfill, will take place on property that is used by a local bow hunting club and contains a 3-D archery range. These activities include O&M and sampling that are described in the Pump and Truck Work Plan and the Preliminary Design Plan. ARCADIS' Pump and Truck Task Manager will be responsible for checking the club's website (www.tri-villagebowhunters.com) to obtain the schedule for events on the 3-D archery range, which are usually on Sundays. If field activities are planned on the hunting club property, ARCADIS personnel will confirm that target activities are not taking place by checking with any members at the bowhunter's club lodge. If the 3-D archery range is being used, activities on that property will be delayed until the conclusion of such club activities. Personnel conducting activities on hunting club property must wear a high visibility vest at all times.

An adequate supply of potable water must be provided on the site. The SSO will make provisions for bottled water to be available for site personnel. On a temporary basis based on project activities, the SSO will make provisions for one portable toilet facility to be available. Additionally, smoking will not be permitted within the fenced area of the landfill, on the trails leading to the extraction wells and within the fenced area around the extraction wells.

11. Decontamination Control Zones and Procedures

The decontamination procedures outlined in the ARCADIS Field H&S Handbook are provided for typical Level D and Level C ensembles and vehicles (Section III, Paragraph G). As the work dictates, the SSO will establish a work area perimeter. The size of the perimeter will be based on the daily task activities and will be discussed with all project personnel during the tailgate meeting and then documented on the Tailgate H&S Meeting Form in Appendix C. The zones for Level C and above will be designated by traffic cones, barricades, signs, caution tape, or other means effective in identifying the different areas. The SSO will establish control boundaries for the exclusion zone, contamination reduction zone, and the support zone. The zones will be identified by the SSO during tailgate meetings and documented on the meeting form. Entrance and exit to any exclusion zone will only be through controlled access points established for each work area. Non-ARCADIS personnel or subcontractors, including all visitors, will not be allowed into any exclusion or contamination reduction zones.

12. Emergency Action Plan

In the event that an injury, overexposure or spill has occurred, the Emergency Action Plan (EAP) located at the front of this HASP will be implemented as well as the Evacuation Plan provided in the Contingency Plan, which has also been prepared for this project and is included with the T&D Plan. The Evacuation Plan states that in the event of an emergency incident, evacuation procedures will consist of exiting the landfill via the gate to the north. Evacuated personnel will assemble outside the landfill fence near the Mead Road entrance to the landfill and determine, using the sign-in sheets from this HASP, if any personnel remain at the site. The signal for evacuation is three blasts of a horn (e.g., air horn or vehicle horn).

All personnel will be familiar with the requirements and procedures outlined in the EAP and Contingency Plan prior to conducting activities at the site. Additionally, in the event of a fire or explosion at or in the vicinity of the site, the Emergency Procedures described in the Contingency Plan must be followed. Copies of this HASP and the Contingency Plan included in the T&D Plan will be maintained in the pole barn and leachate pump station shed at the landfill and by the Emergency Coordinators. All ARCADIS employees working on this project must be shown the location and proper use of all emergency equipment prior to beginning work on the project.

13. Ground or Air Shipments of Hazardous Materials

All samples, electronic equipment with batteries, powders, gases, liquids, magnetized materials or radioactive materials being shipped by air or ground transport will be evaluated using the ARCADIS Shipping Determination process to determine if the material or equipment being shipped is hazardous for transport. A Shipping/Transportation Determination Template is included in Appendix G

All materials identified as hazardous materials (HazMat) will be shipped according to applicable Department of Transportation (DOT) and International Air Transport Association (IATA) regulations and requirements as prescribed by the ARCADIS internal transportation safety program. All employees preparing HazMat packages or offering HazMat to a third-party carrier such as FedEx will have current HazMat training as prescribed by the ARCADIS internal transportation safety program.

14. H&S Orientation and Task Improvement Process

As part of any project, no matter how simple or complex, a Task Improvement Process (TIP) should be conducted when practical and able to integrate into normal business activities. A TIP is part of ARCADIS' behavior-based health and safety program and involves a short observation of work being done by an ARCADIS employee or subcontractor. The goal of a TIP is to identify safe practices that the person is performing and also identify any actions that might be potentially unsafe. TIPs should be scheduled based on the risk of the tasks being performed, and should be conducted for different tasks and at different times. Completion of TIPs should be documented on the Tailgate H&S Meeting Form in Appendix C.

15. Subcontractors

A copy of this HASP is to be provided to all subcontractors prior to the start of work at the project site so that each subcontractor and its field personnel are informed of the hazards at the site. While the ARCADIS HASP will be the minimum H&S requirements for the work completed by ARCADIS and its subcontractors, each subcontractor, in coordination with ARCADIS H&S personnel, is expected to perform its operations in accordance with its own HASP, policies and procedures unique to the subcontractor's work to ensure that hazards associated with the performance of the work activities are properly controlled. Copies of any required safety documentation for a subcontractor's work activities will be provided to ARCADIS for review prior to the start of any on-site activities. Hazards not listed in this HASP, but known to the subcontractor or known to be associated with the subcontractor's services, must be identified to and addressed by ARCADIS' PM and SSO prior to beginning on-site work involving any such hazards.

If the subcontractor prefers to adopt this HASP, the Subcontractor Acknowledgement form in Appendix C must be signed and dated by the subcontractor's management and placed in the project file. Subcontractors are responsible for the H&S of their employees at all times, and have the authority to stop work if unsafe conditions arise.

The PM and SSO (or authorized representative) has the authority to halt the subcontractor's operations and to remove the subcontractor or subcontractor's employee(s) from the site for failure to comply with established H&S procedures or for operating in an unsafe manner.

16. Project Personnel HASP Certification

All site project personnel will sign the appropriate signature page provided in Appendix C certifying that they have read, and will abide by the safety requirements outlined in this HASP.

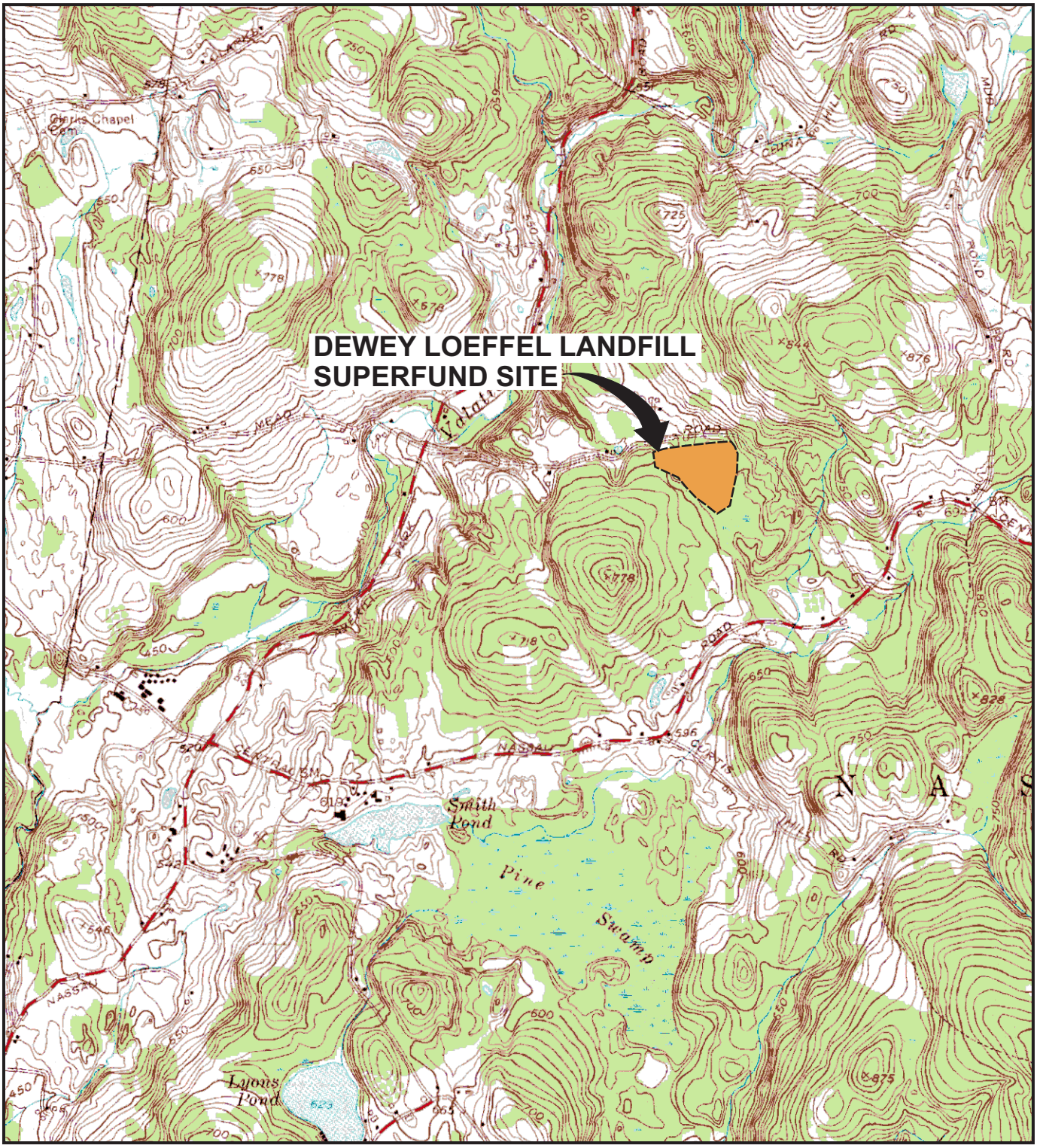
17. Roadway Work Zone Safety

All project work performed in a public or private roadway, regardless of work duration, will require either a written Traffic Control Plan (TCP) or a Site Traffic Awareness and Response (STAR) Plan. Projects having work activities on both public and private roadways will operate under a TCP approved by an employee designated with Engineering Judgment.

The public roadway to the site, Mead Road, consists of a lightly travelled gravel and dirt access drive. Most of the activities will occur on site access roads so it is expected that personnel will conduct minimal work on or adjacent to Mead Road. If site activities require personnel to conduct tasks on or adjacent to Mead Road, a STAR Plan will be prepared prior to the work activity. A TCP/STAR Plan Template is included in Appendix F.

ARCADIS

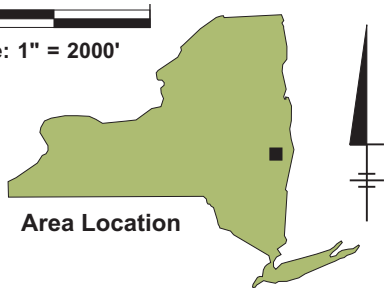
Figures



REFERENCE: BASE MAP USGS 7.5 MIN. QUAD., NASSAU, NY, 1953, PHOTOREVISED 1978.

2000' 0 2000'

Approximate Scale: 1" = 2000'



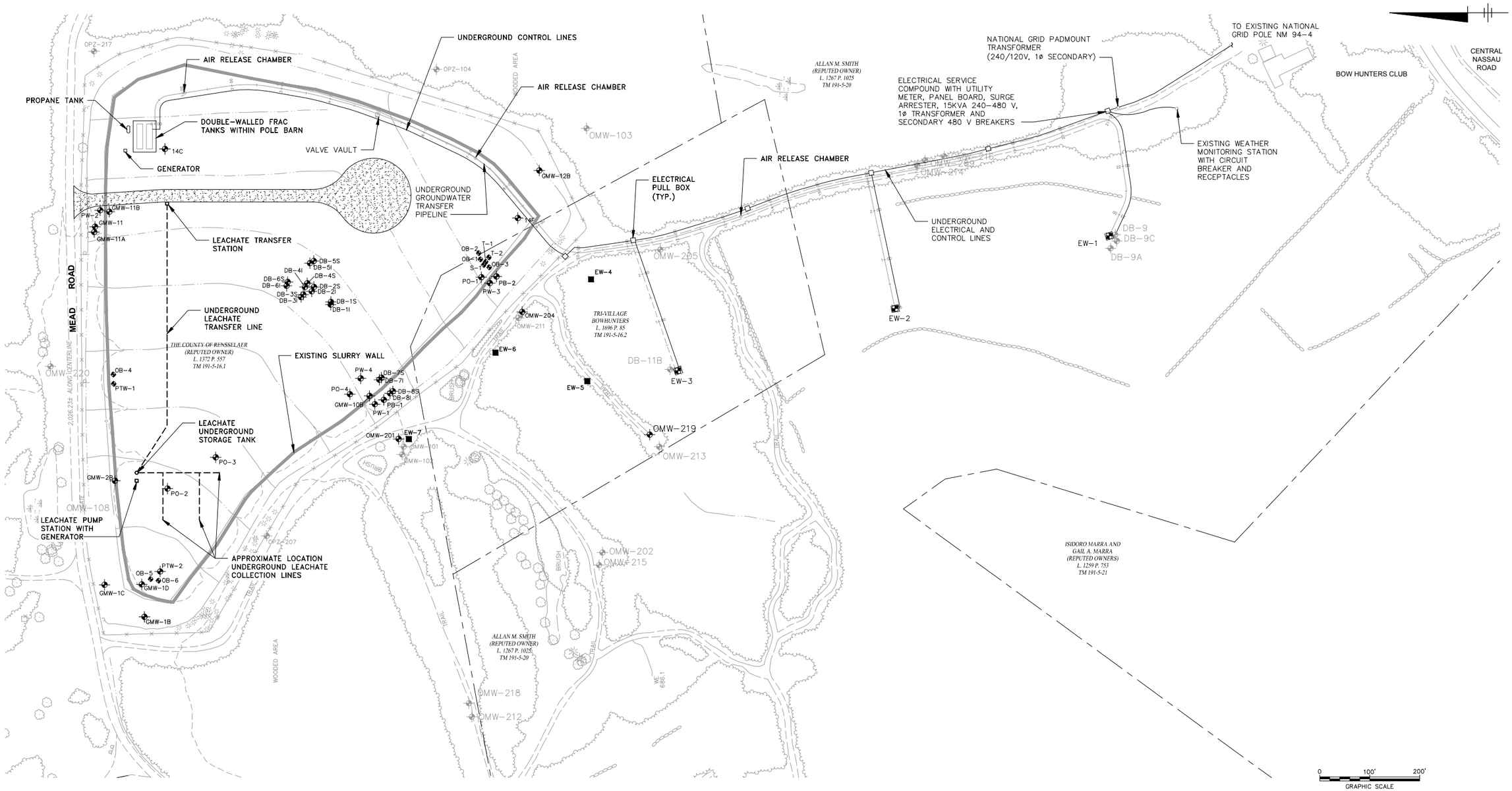
DEWEY LOEFFEL LANDFILL SUPERFUND SITE
NASSAU, NEW YORK

SITE LOCATION MAP

ARCADIS

FIGURE
1

04/116/2012 SYRACUSE, NY-ENV/CAD-141, DJHOWES
B0031174/0000/00001/CDR/31174N01.CDR



LEGEND

- FENCE
- PROPERTY LINES
- EXISTING ROADWAY
- STONE WALL
- 640 CONTOUR LINE
- SWALE
- EXISTING ROAD
- TREE LINE
- EXISTING EXTRACTION WELL
- PROPOSED EXTRACTION WELL
- OR EXISTING MONITORING WELL

DEWEY LOEFFEL LANDFILL SUPERFUND SITE
NASSAU, NEW YORK

SITE PLAN

ARCADIS

FIGURE 2

CITY:SYRACUSE-NY DIV/GROUP:ENVCAD DB:G.STEINBERGER LD:G.STEINBERGER PIC:P.FARR PM/TM: D.SAUDA LYR:ON=*;OFF=*REF*
G:\GE\ENVCAD\SYRACUSE\ACTIVE\B0031174\0000000001\DWG\LANDFILL\31174G02.dwg LAYOUT: 2 SAVED: 4/30/2012 12:50 PM ACADVER: 18.1S (LMS TECH)
XREFS: IMAGES: PROJECTNAME: ----
31174X01
31174X00

ARCADIS

Appendices

ARCADIS

Appendix A

HASP Addendum Form and
Addendum Log Table A-1

ARCADIS

Addendum Form

This form should be completed for new tasks associated with the project. The Project 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 H&S Meeting 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

ARCADIS

Addendum Log Table A-1

Addendums are to be added to every copy of the HASP, and logged on Table A-1 to verify that all copies of the HASP are current:

Table A-1 Addendum Log Table

Addendum Number	Date of Addendum	Reason for Addendum	Person Completing Addendum
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Make additional copies of this form as necessary.

ARCADIS

Appendix B

JSAs

Job Safety Analysis

General

JSA ID	7287	**Status**	(3) Completed
Job Name	Environmental-ATV or utility vehicle operation	**Created Date**	4/11/2012
Task Description	ATV or Utility Vehicle Operation	**Completed Date**	07/10/2012
Template	False	**Auto Closed**	False

Client / Project

Client	GE CORP ENV PROG
Project Number	B00311740001
Project Name	GE/2012 DEWEY LOEFFEL LANDFILL
PIC	FARR, PATRICK
Project Manager	SAUDA, DONALD

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Chisholm, Nicole	5/2/2012	4/11/2012	Hendrickson, Kelly	☑
HASP Reviewer	Groff, David	4/25/2012	4/12/2012	Cullen, Lucas	☑

Job Steps

Job Step No.	Job Step Description		Potential Hazard	Critical Action	H&S Reference
1	ATV/utility vehicle inspection and maintenance	1	Burns to hands and forearm from hot surfaces on engine during maintenance.	Allow vehicle to cool down before performing refueling or maintenance.	
		2	Cuts and scrapes to hands and forearm during engine or tire maintenance.	Wear protective gloves when servicing vehicle, ensure glove is of type that allows dexterity when handling small parts.	
		3	Contact stress to knees and hands during maintenance requiring kneeling.	Use padding to protect knees during maintenance that requires kneeling, protect hands placed on hard surfaces for prolonged periods.	
		4	Exposure to fuel during repair or refueling.	Do not hurry during refueling to reduce potential for mistakes or spills. Assume fuel lines contain fuel if disconnecting, protect eyes from potential splash hazard during a repair to the fuel system. Promptly wash exposed skin or flush eyes if fuel enters eyes.	
		5	Fire from refueling.	Allow engine to cool prior to refueling.	
2	Vehicle loading and unloading	1	Crush hazards from falling or rolling vehicle.	Use TRACK, plan activity. Use appropriate number of workers to manually place or remove vehicle from truck or trailer. Use spotter and drive slowly if driving vehicle on or off of trailer, unnecessary workers stand clear in case vehicle falls of ramp. Watch feet when working to place or remove a vehicle form truck/trailer to prevent being rolled over.	
		2	Pinch hazards to hands during securement.	Wear protective gloves. Keep hands clear from binding devices and straps used to secure vehicle. Inspect for pinch hands clear hands/fingers from pinch areas during tailgate or gate closing activity.	
		3	Push/pull hazards during vehicle placement in trailer or truck.	Avoid excessive exertion or twisting of body when manually placing vehicle on truck/trailer. Use buddy system. Stretch before performing activity.	
		4	Lifting hazards uprighting ramps and gates.	Use proper lifting techniques even for light items that may be bulky, like ramps. Use buddy system for large tailgates or tailgates/trailer gates elevated off of ground.	

		5	Vehicle damage from improper securement.	Inspect securing devices prior to driving vehicles carrying an ATV or utility vehicle. Ensure no slack is present in the securing devices and devices are in good condition.	
3	Vehicle operation	1	Wreck and injury caused by excessive speed or sharp turns.	Always operate vehicle at a safe operating speed, factors to determine safe speed should include terrain, condition of the terrain, driver experience, weather, and vehicle type (rollover potential). Avoid sharp turns; drive at speed that allows for route planning.	
		2	Wreck or injury form crossing water.	Avoid crossing creeks and water bodies where depth of water is not known. Investigate any area in water to be crossed prior to driving across.	
		3	Wreck or injury from horseplay.	Vehicle to only be operated in manner specified by manufacturer, avoid conditions that promote wheelies, sliding, or harsh braking, stay clear of other workers in area.	
		4	Injury during extraction of a stuck vehicle.	Avoid awkward body positions or excessive exertion in attempting to extract a stuck vehicle, call for help. Only use approved tow straps rated for load in towing vehicles out of stuck conditions, NOT tie down straps. Stand clear of any strap or cable used to extract a stuck vehicle to prevent injury form backlash if breakage occurs.	
		5	Injury during operation on uneven terrain.	Always operate vehicle at a safe operating speed on uneven terrain including steep slopes or hillsides on the landfill and surrounding areas.	

PPE **Personal Protective Equipment**

Type	Personal Protective Equipment	Description	Required
Dermal Protection	long sleeve shirt/pants		Required
Eye Protection	safety glasses		Required
Foot Protection	steel-toe boots		Required
Head Protection	Helmet		Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required

Review Comments

Reviewer		Comments
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Approve 4/12/2012	
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Revised 7/10/2012	

Note:

All personnel operating ATVs/utility vehicles will be trained by an experienced operator prior to use. A buddy system will be utilized whenever an ATV/utility vehicle is used. However, only one employee at a time will use the ATV/utility vehicle and a verbal trip plan will be put in place with the second employee so that there is an expected time of return.

Job Safety Analysis

General

JSA ID	7226	**Status**	(3) Completed
Job Name	Environmental-Drum sampling/handling	**Created Date**	4/3/2012
Task Description	Drum Handling	**Completed Date**	04/12/2012
Template	False	**Auto Closed**	False

Client / Project

Client	GE CORP ENV PROG
Project Number	B00311740001
Project Name	GE/2012 DEWEY LOEFFEL LANDFILL
PIC	FARR, PATRICK
Project Manager	SAUDA, DONALD

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Chisholm, Nicole	4/18/2012	4/4/2012	Hendrickson, Kelly	☑
HASP Reviewer	Groff, David	4/18/2012	4/12/2012	Cullen, Lucas	☑
Quality Reviewer	Ulm, David	4/12/2012	4/12/2012	Glenn, Sidney	☑

Job Steps

Job Step No.	Job Step Description		Potential Hazard	Critical Action	H&S Reference
1	Inspect drums for signs of bulging, leaking, crystals, temperature, and odor	1	Exposure to chemicals stored in drum or container.	Read drum labels and MSDS for information about chemical contents; if labels are not attached, call PM or H&S; wear modified level D PPE.	
		2	Contents of the drum can cause fire/explosion hazard.	Monitoring drums for % LEL and VOCs with air meter; if above the action levels in HASP or MSDS then Stop Work, move away from the area, and reassess the situation; call PM and H&S for support.	
2	Remove lids or bungs from drums	1	Hand Injuries from sharp edges, pinch points, and use of hand tools.	Wear leather work gloves; keep fingers clear of drum ring during removal; if a large number of drums are to sampled, use a speed or drum wrench.	Employee H&S Field book, Section III Subpart II, page 104, and Section III Subpart L, page 38.
		2	Rapid drum depressurization may result in flying parts or volatile COC release.	Do not handle or open bulging drums, contact H&S for assistance; bleed built up pressure by carefully loosening bung plug prior to removing ring; keep face and arms away from bung opening when loosening; lift lid just enough to insert sample tube of air monitoring device to monitor air inside drum.	
		3	Use of mechanical tools to remove bolts from drum lids causes excessive noise.	Wear ear plugs with a noise reduction rating (NRR) of at least 27 to protect against hearing damage.	
		4	Splashing can occur if filling drum, or collecting samples.	Pour liquids into drum slowly to minimize splashing; wear safety glasses and face shield to protect eyes and nitrile gloves to protect skin.	
		5	When working with COCs that have fire/explosive properties, sparking or heat could cause fire/explosion.	Work slowly and methodically to minimize the chance of a tool slipping and causing a spark; use brass or non-spark hand tools if such a hazard exists or is suspected.	
3	Sample contents from drums	1	Skin contact with COCs.	Pour liquids slowly to minimize splashing; wear nitrile gloves to protect skin; wear safety glasses and face shield to protect eyes and face; wear Tyvek suit if required by HASP to protect skin.	
		2	Exposure to chemical vapors/fumes.	Conduct air monitoring as outlined in HASP; select appropriate respiratory protection based on air monitoring results.	

3	Sample contents from drums	3	Lacerations from sharp edges and broken sample containers.	Discard any broken sample ware or glass; Don't over tighten sample containers; wear Level 2 cut resistant gloves with nitrile gloves to protect hands when working with sample containers.	
		4	Chemical burns or skin irritation from contact with sample preservatives.	Wear nitrile gloves with Level 2 cut resistant gloves to protect hands.	
4	Replace drum lids	1	Hand injuries from sharp edges, pinch points, and use of hand tools.	See step 2 above.	
5	Moving and storing drums	1	Drum storage areas can be accessed by the general public, or may not be secure.	Secure drums from access by the general public; Store drums away from areas of pedestrian or vehicular traffic.	
		2	Sprains/strain from lifting/pulling/pushing drums.	Full drums can weigh as much as 800 lbs, therefore, use mechanical methods whenever possible; use a team lift approach when using a drum cart – one person tips the drum back slightly while the other puts the forks under the drum, one person then pulls back on cart while the other slowly pushes drum back toward dolly.	
		3	Body parts can be pinched between lift device or drum and the ground.	Do not place hands, feet or body where it can be caught between objects or structures; plan lifts; wear heavy leather gloves to protect hands.	
		4	When moving, the drum can tip or the dolly could become unstable from uneven ground surface.	Plan travel route prior to moving drum; With drum secure on dolly; utilize a spotter for traffic, pedestrians, and trip hazards.	

PPE — Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Dermal Protection	long sleeve shirt/pants		Required
Eye Protection	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	chemical resistant gloves (specify type)	nitrile	Required
	work gloves (specify type)	leather	Required
Head Protection	hard hat		Required
Hearing Protection	ear plugs		Required
Miscellaneous PPE	traffic vest--Class II or III		Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
	Other	drum cart/dolly	Required
Personal	eye wash (specify type)	portable	Required

Review Comments

Reviewer		Comments
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Revise 4/4/2012	
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Approve 4/12/2012	
Employee: **Role** **Review Type** **Completed Date**	Ulm, David Quality Reviewer NA 4/12/2012	

Job Safety Analysis

General

JSA ID	7227	**Status**	(3) Completed
Job Name	General Industry-Fence installation	**Created Date**	4/3/2012
Task Description	Fence Maintenance	**Completed Date**	04/12/2012
Template	False	**Auto Closed**	False

Client / Project

Client	GE CORP ENV PROG
Project Number	B00311740001
Project Name	GE/2012 DEWEY LOEFFEL LANDFILL
PIC	FARR, PATRICK
Project Manager	SAUDA, DONALD

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Chisholm, Nicole	4/18/2012	4/4/2012	Hendrickson, Kelly	☑
HASP Reviewer	Groff, David	4/18/2012	4/12/2012	Cullen, Lucas	☑

Job Steps

Job Step No.	Job Step Description		Potential Hazard	Critical Action	H&S Reference
1	Inspection activities	1	Tripping can occur from uneven walking/working surfaces.	Identify and control any trip hazards. Setup work area with least interference to public and surrounding activities.	Employee H&S Field book, Section III Subpart MN, page 109.
		2	Underground utilities can be hit when doing intrusive work.	Follow Utility Clearance HS Standard prior to installing any new fence poles.	
		3	Staff can be hit by vehicular traffic, and pedestrians can enter work area.	Wear Class II traffic vest when working proximal to vehicular traffic. Use traffic cones to keep pedestrians away.	
2	Fence post installation	1	Injury can occur when using hand and power tools.	Always inspect hand tools prior to starting task. Wear leather work gloves. Use GFCIs for any power tools. Do not use in wet work areas.	
		2	Rotating parts on gas powered augers can cause bodily injury, and this equipment can be unstable to operate.	A two person operated machine is preferred for better stability. Keep all unnecessary staff clear of augering. Do not wear loose clothing or jewelry.	
		3	Fuel spills can occur with refueling equipment.	Use approved gas cans for all refueling of equipment. Allow ample time for motor to cool before refueling.	
		4	Sharp edges can cause cuts, and equipment has pinch point hazards.	Always secure the equipment when transporting them in vehicles with ratchet straps. Use leather work gloves while handling and team lift when moving equipment.	
		5	Mixing and pouring concrete can generate dust.	Wear safety glasses or goggles and respiratory protection.	
3	Chain link fence installation	1	Fence handling can cause lacerations from sharp edges or injury from pinch points and puncture hazards.	Wear leather work gloves to protect hands.	
		2	Muscle strain can occur from heavy lifting.	Team lift chain link sections of fencing or use powered equipment to move them.	
		3	Injury can occur when using hand and power tools.	Always inspect hand tools prior to starting task. Wear leather work gloves. Use GFCIs for any power tools. Do not use in wet work areas.	
		4	Muscle strain can occur when tightening fencing.	Use the proper tool (fencing puller) to tighten fencing and avoid muscle strain.	

3	Chain link fence installation	5	Trip over equipment or uneven working surfaces or get clothing caught in the chain link fencing.	Do not lay out piping for post on ground where it can create a trip hazard for workers and pedestrians. Keep site in order, and do not wear loose clothing. Keep shoe laces tied tightly.	
4	Cut and remove excess fence material. Do not leave it rolled up at the end of the fence line.	1	Excess fencing material may come unrolled and blow into adjacent traffic.	Excess fencing material should be removed at the last post.	

PPE — Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Eye Protection	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	work gloves (specify type)	leather	Required
Head Protection	hard hat		Required
Hearing Protection	ear plugs	If working with powered equipment	Required
Miscellaneous PPE	traffic vest--Class II or III		Required

Supplies

Type	Supply	Description	Required
Communication Devices	other	mobile phone or two-way radio	Recommended
Miscellaneous	first aid kit		Required
	Other	sunscreen	Recommended

Review Comments

Reviewer		Comments
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Revise 4/4/2012	
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Approve 4/12/2012	

Job Safety Analysis

General

JSA ID	7243	**Status**	(3) Completed
Job Name	Environmental-Groundwater Sampling and free product recovery	**Created Date**	4/4/2012
Task Description	Groundwater Sampling	**Completed Date**	04/12/2012
Template	False	**Auto Closed**	False

Client / Project

Client	GE CORP ENV PROG
Project Number	B00311740001
Project Name	GE/2012 DEWEY LOEFFEL LANDFILL
PIC	FARR, PATRICK
Project Manager	SAUDA, DONALD

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Chisholm, Nicole	4/25/2012	4/4/2012	Hendrickson, Kelly	☑
HASP Reviewer	Groff, David	4/18/2012	4/12/2012	Cullen, Lucas	☑

Job Steps

Job Step No.	Job Step Description		Potential Hazard	Critical Action	H&S Reference
1	Stage at pre-determined sampling location and set up work zone and sampling equipment	1	Personnel could be hit by vehicular traffic.	Set up cones and establish work area; position vehicle so that field crew is protected from site traffic; use a spotter for vehicle backing; wear reflective vest to increase visibility to drivers.	
		2	Sampling equipment, tools and monitoring well covers can cause tripping hazard.	Keep equipment picked up and use TRACK to assess changes.	
2	Open wells to equilibrate and gauge wells	1	When squatting down, personnel can be difficult to see by vehicular traffic.	Use a spotter (buddy system) to watch for hazards or use tall cones to identify work area; wear reflective vest to increase visibility to drivers.	
		2	Pinch points on well vault can pinch or lacerate fingers.	Use correct tools to open well vault/cap; wear leather gloves when removing well vault lids.	
		3	Lifting sampling equipment can cause muscle sprain/strain.	Unload as close to work area as safely possible; lift with legs, not back; use two person lift for items weighing >40 lbs. or awkward objects.	
		4	Pressure can build up inside well causing cap to release under pressure.	If well is equipped with pressure relief valve, open valve prior to opening well; keep head away from well when removing cap; wear hard hat to protect from head injuries.	
3	Begin purging well and collecting parameter measurements	1	Electrical shock can occur when connecting/disconnecting pump from the battery.	Equipment must be turned off when connecting/disconnecting; use GFCIs when using powered tools and pumps and don't use in the rain or run electrical cords through wet areas; wear leather gloves to protect hands.	
		2	Purge water can spill or leak from equipment.	Inspect hoses and equipment prior to use and remove from service if defective; if a leak develops, stop work immediately, stop leak, and block drainage grates with sorbent pads; call PM to notify them of any reportable spill.	
		3	Water spilling on the ground can cause muddy/slippery conditions.	Exercise caution when walking on plastic sheeting; wear steel toe safety footwear with ample tread and slip resistant sole.	
		4	Lacerations can occur when cutting materials such as plastic tubing.	When cutting tubing, use tubing cutter; don't use open fixed blades; wear level 2 cut resistant gloves to protect hands.	
		5	Purge water can splash into eyes.	Pour water slowly into buckets/drums to minimize splashing; wear safety glasses to protect eyes.	

4	Collect groundwater or free product sample	1	Working with bailer rope can cause rope burns on hands.	Slowly raise and lower the rope or string for the bailer; wear leather gloves or level 2 cut resistant gloves.	
		2	Sample containers could break or leak preservative.	Discard any broken sample ware or glass; do not over-tighten sample containers. Wear chemical protective gloves with level 2 cut resistant gloves.	
5	Recovery of free product from well	1	Exposure to free product.	Review HASP to identify COCs and wear a minimum of modified level D PPE; additional PPE may be necessary based on the type of product (faceshield, Tyvek suit, or respirator).	
6	Staging of well purge water and/or free product	1	Sprains/strain from moving purge water or drums.	If using buckets, do not fill buckets up to the top, only half fill bucket so emptying is easier; see drum handling JSA for movement of drums.	Drum handling JSA.

PPE — Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Dermal Protection	chemical protective suit (specify type)	Tyvek suit or apron	Required
	long sleeve shirt/pants		Required
Eye Protection	faceshield	when splash hazard exists	Required
	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	chemical resistant gloves (specify type)	nitrile	Required
	work gloves (specify type)	leather and/or cut resistant type 2	Required
Head Protection	hard hat		Required
Miscellaneous PPE	traffic vest--Class II or III		Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
Personal	eye wash (specify type)		Required
Traffic Control	traffic cones	if working in proximity to vehicles	Required

Review Comments

Reviewer		Comments
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Approve 4/12/2012	

Job Safety Analysis

General

JSA ID	7234	**Status**	(3) Completed
Job Name	Construction-Heavy equipment operation	**Created Date**	4/4/2012
Task Description	Heavy Equipment Operations	**Completed Date**	04/12/2012
Template	False	**Auto Closed**	False

Client / Project

Client	GE CORP ENV PROG
Project Number	B00311740001
Project Name	GE/2012 DEWEY LOEFFEL LANDFILL
PIC	FARR, PATRICK
Project Manager	SAUDA, DONALD

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Chisholm, Nicole	4/18/2012	4/4/2012	Hendrickson, Kelly	☑
HASP Reviewer	Groff, David	4/18/2012	4/12/2012	Cullen, Lucas	☑
Quality Reviewer	Ulm, David	4/12/2012	4/12/2012	Glenn, Sidney	☑

Job Steps

Job Step No.	Job Step Description		Potential Hazard	Critical Action	H&S Reference
1	Loading and unloading equipment from transport vehicles	1	Struck by or impact hazards from moving equipment.	Stand clear of equipment loading or unloading from transport vehicles; use spotters during vehicle backing and loading; wear reflective vest to increase visibility to equipment operators.	Employee H&S Field book, Section IV Subpart E, page 119.
		2	Equipment damage from improper removal or placement on vehicle.	Verify that ramps used are rated for weight and are installed and secure prior to moving equipment across, verify that trailers being loaded or unloaded are secured against movement.	
		3	Overhead utility contact for equipment with booms or extensions.	Plan position of transport vehicle to maintain safe distance (>20 ft) from all overhead lines and structures; use spotters since operator focus may be on vehicle alignment with ramps or other ground level distractions.	
		4	Ascending/descending equipment cab.	Do not hurry through task, wear steel toe footwear with good tread and ankle support, maintain 3 points of contact while accessing equipment, no jumping off trailers or truck beds.	
2	Pre-operation inspection	1	Pinch hazards to hands.	Identify likely pinch points and keep hands in field of vision and watch for and keep hands clear of obvious hazards like door or cover closures; do not hurry during the removal or placement of covers or equipment components.	
		2	Head injury from striking equipment covers or components.	Be aware of surroundings and avoid standing or rising up suddenly, especially if door cover is overhead; wear a hard hat to protect the head form injury.	
		3	Exposure to engine fluids or lubricants.	Take care to avoid splashing of fluids and lubricants; verify that MSDS is available for fluids and lubricants; wear nitrile coated level 2 cut resistant gloves; promptly wash exposed skin, and contact WorkCare immediately for any situation where diesel is injected under the skin.	
		4	Awkward body positions and twisting.	Plan inspection activity and do not hurry through task, stretch before crawling or squatting; don't overreach.	
		5	Entanglement in equipment components.	Do not circumvent protective guards or shields, verify that equipment is not operational (LOTO if necessary) before accessing engine compartment.	

3	Equipment operation	1	Strike or impact hazards with other workers, equipment or structures.	Keep eyes moving and watch for unanticipated worker movement; keep workers 15 ft from any extendable area of the equipment, maintain 360 degrees of awareness and maintain communication with other workers; personnel are required to know the emergency STOP hand signals; verify that all back up alarms are functional.	Employee H&S Field book, Section III Subpart MM, page 109.
		2	Utility contact (subsurface or above ground).	Follow utility clearance procedure prior to any intrusive work with equipment; immediately stop work if any unusual or unanticipated condition encountered and assess using TRACK.	
		3	Rollovers on slopes or from excessive loading.	Follow equipment manufacturer instructions for use on slopes and load capacities, wear seatbelt at all times, deploy outriggers (if equipped).	
		4	Noise from engine or work activity.	Verify that mufflers are in good condition; keep equipment maintained; wear hearing protection if noise level exceeds OSHA requirements.	
		5	Slips and falls from accessing or egressing from equipment.	Maintain 3 points of contact when accessing or egressing from equipment, keep ladder or steps on equipment clean and dry to extent possible, verify equipment doors, if present, are in good working order.	
		6	Exposure to tools and metal edges and damaged metal resulting in cuts lacerations to hands during maintenance.	Identify sharp surfaces and mitigate or stay clear to extent practical, wear leather gloves that allow for good dexterity to protect hands from lacerations.	
		7	Pinch/crush hazards to hands from doors or covers.	Watch for and keep hands clear of door or cover closures; do not hurry during the removal or placement of covers or equipment components; wear leather gloves that protect hands and allow for good dexterity.	
		8	Contact stress to knees and hands.	Do not place weight on hands or knees for extended periods of time; use padding or knee pads if kneeling on hard surfaces for an extended period of time.	
4	Maintenance	1	Awkward body positions and twisting.	Plan inspection activity and do not hurry through task; stretch before crawling or squatting; don’t overreach.	
		2	Sprains/strain from excessive force required for turning bolts.	Use automated methods to loosen tight bolts; do not use excessive force or torque when using hand tools; Don’t use "cheater bars."	
		3	Contact with engine fluids or lubricants.	Take care to avoid splashing of fluids and lubricants; verify that MSDS is available for fluids and lubricants; wear nitrile coated level 2 cut resistant gloves; promptly wash exposed skin, and contact WorkCare immediately for any situation where diesel is injected under the skin.	
		4	Flying debris during decontamination or cleaning activities.	Review and follow power washing/decontamination JSA.	
		5	Entanglement in equipment components.	Do not circumvent protective guards or shields, verify that equipment is not operational (LOTO if necessary) when accessing engine compartment.	
		6	Exposure of hands and arms to hot engine components.	Allow the engine to cool before conducting maintenance; wear gloves and long sleeve shirt and pant to protect skin from burns.	
		7	Struck by moving equipment or boom extensions.	Keep at least 15 ft from any extendable area of the equipment; if entering within 15 ft, establish and maintain contact with equipment operator; do not enter area until the equipment has been disengaged; wear reflective vest to increase visibility to operator.	

5	Working in proximity to heavy equipment	1	Equipment damage from moving equipment.	Keep other equipment not required for work outside of heavy equipment work area; flag or mark equipment work area with high visibility markings, cones, etc.	
		2	Noise hazards from equipment operation.	Increase distance from operating equipment if work activity permits; wear hearing protection to protect from noise damage.	

PPE — Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Dermal Protection	long sleeve shirt/pants		Required
Eye Protection	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	work gloves (specify type)	leather	Required
Hearing Protection	ear plugs	if working in high noise areas	Required
Miscellaneous PPE	traffic vest--Class II or III		Required

Supplies

Type	Supply	Description	Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
Personal	eye wash (specify type)	bottle	Required
Traffic Control	traffic cones		Required

Review Comments

Reviewer		Comments
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Revise 4/4/2012	
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Approve 4/12/2012	
Employee: **Role** **Review Type** **Completed Date**	Ulm, David Quality Reviewer NA 4/12/2012	

Job Safety Analysis

General

JSA ID	7233	**Status**	(3) Completed
Job Name	General Industry-Site clearing (tree/brush/vegetation) removal	**Created Date**	4/4/2012
Task Description	Mowing and String Trimming	**Completed Date**	07/10/2012
Template	False	**Auto Closed**	False

Client / Project

Client	GE CORP ENV PROG
Project Number	B00311740001
Project Name	GE/2012 DEWEY LOEFFEL LANDFILL
PIC	FARR, PATRICK
Project Manager	SAUDA, DONALD

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Chisholm, Nicole	4/18/2012	4/4/2012	Hendrickson, Kelly	☑
HASP Reviewer	Groff, David	4/18/2012	4/12/2012	Cullen, Lucas	☑
Quality Reviewer	Cobb, Michael	4/20/2012	4/20/2012	Mowder, Carol	☑

Job Steps

Job Step No.	Job Step Description		Potential Hazard	Critical Action	H&S Reference
1	Prepare equipment for clearing activities	1	Improperly maintained tools and equipment increase risk for injury to workers using tools/equipment.	Maintain tools and equipment according to manufacturer recommendations; verify that cutting blades are sharp; operators shall be trained by a competent person prior to use of the equipment.	Employee H&S Field book, Section III Subpart N, page 44.
		2	Cuts and burns to hands, fingers, forearms, from tool/equipment blades/wires/hot points.	Do not hurry to complete the task; don't touch hot points (e.g., muffler) which will be hot during and after use; wear leather gloves to protect hands.	
		3	Slips/trips/falls egressing from large tractors.	Maintain 3 points of contact when accessing/egressing equipment; never access/egress moving equipment; remove mud on surfaces to prevent slips; wear seatbelt (if equipped); wear steel toe footwear with anti-slip tread.	
		4	Exposure to fuel during fueling activities.	Stand up wind when practical to limit exposure to fuel vapors; promptly wash exposed skin or clothing; have a fire extinguisher available; wear chemical resistant (nitrile) gloves during refueling activities.	
		5	Changing site conditions.	Assess the work area for changing conditions (e.g., animals, pedestrians); refer to the ARCADIS Field H&S Handbook to identify poisonous vegetation prior to using string trimmer.	
2	Clearing brush and mowing	1	Struck by vegetation during clearing activities.	Stand at least 100 feet from clearing activities.	
		2	Slips/trips/falls on even surface.	Plan route and don't walk over downed trees and into vegetation where ground surface cannot be seen; carry tools so that they don't obstruct vision of the ground; wear steel toe footwear with good tread and ankle support.	
		3	Contact with poisonous or physically damaging plants.	Identify and don't come into contact with poisonous plants; wear long pants and long sleeve shirt to protect skin.	

		4	Contact with poisonous or biting insects.	Watch for and avoid hazardous insects, keep doors of equipment closed (if applicable); wear long sleeve shirts and long pants to protect skin.	
		5	Struck by falling trees or large brush.	Keep clear of planned fall direction and wear hardhat during clearing activities to protect against head injuries.	
3	Clearing brush with hand tools and string trimmers	1	Cuts to arms, legs, hands from cutting tools, string trimmer.	When using manual tools cut away from the body; maintain a distance of 100' between workers using string trimmers; don't: reach towards the string (or blade), reach overhead, use in low visibility situations, or use one-handed; wear leather gloves to protect hands and chaps if a chainsaw is used to clear trees.	
		2	Sprain/strain from repetitive motion or excessive push/pulling during clearing.	Use job or task rotation or frequent rest breaks; don't use excessive force when pulling or pushing vegetation.	
		3	Scrapes, cuts to skin from flying vegetation.	Wear leather gloves, safety glasses, face shield, pants and long sleeve shirt; wear briar chaps in thorny vegetation.	
		4	Noise from string trimmer.	Keep unnecessary workers 100' from clearing activity; wear hearing protection with a noise reduction rating (NRR) >27 to protect hearing.	
4	Clearing brush with mowers/brush hogs	1	Struck by flying debris from mowing activity.	Keep unnecessary workers at least 100 feet from clearing activity.	
		2	Foot hazards from slipping into cutting blades using walk behind mowers.	Do not remove and promptly repair guards; plan mowing to reduce situations that increase risk of foot slippage; wear steel toe foot wear with good tread.	
		3	Noise from mowing vehicle.	Keep unnecessary workers 100' from clearing activity; wear hearing protection with a NRR >27 to protect hearing.	

PPE — Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Dermal Protection	long sleeve shirt/pants		Required
Eye Protection	faceshield	when using string trimmer	Required
	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	work gloves (specify type)	leather	Required
Head Protection	hard hat		Required
Hearing Protection	ear plugs		Required
Miscellaneous PPE	traffic vest--Class II or III		Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
Personal	insect repellant		Recommended
	sunscreen		Recommended
	water/fluid replacement		Required

Review Comments

Reviewer		Comments
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Approve 4/12/2012	
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Revised 7/10/2012	

Job Safety Analysis

General

JSA ID	7288	**Status**	(3) Completed
Job Name	Environmental-Other	**Created Date**	4/11/2012
Task Description	Power Washing/Decontamination	**Completed Date**	04/12/2012
Template	False	**Auto Closed**	False

Client / Project

Client	GE CORP ENV PROG
Project Number	B00311740001
Project Name	GE/2012 DEWEY LOEFFEL LANDFILL
PIC	FARR, PATRICK
Project Manager	SAUDA, DONALD

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Chisholm, Nicole	5/2/2012	4/11/2012	Hendrickson, Kelly	☑
HASP Reviewer	Groff, David	4/25/2012	4/12/2012	Cullen, Lucas	☑

Job Steps

Job Step No.	Job Step Description		Potential Hazard	Critical Action	H&S Reference
1	Prepare decontamination area/setup decon	1	Slips/trips/falls.	Remove trip hazards when possible. Mark hazards when they cannot be removed. Create awareness of hazard during safety meeting. Keep work area clear of clutter. Check the decon area for uneven surfaces.	
		2	Lifting/back strain.	Use proper lifting techniques. Keep back straight and bend with your knees. Use buddy system for objects weighing greater than 50 lbs.	
		3	Vehicle traffic.	Choose a location with minimal traffic is possible. Set up traffic safety devices such as cones, caution tape, etc. Around designated decon area.	
		4	Pinch points/lacerations.	Wear cut resistant type ii gloves. Keep hands clear of pinch points; disconnect hoses prior to moving pressure washer.	
		5	Biological hazards-insects.	Inspect designated area for insects prior to setting up decon area. Use insect repellant as needed.	
2	Decontamination of field equipment	1	Spills/leakage of decontamination fluids.	Lay down plastic sheeting to prevent exposure to ground. Ensure decon area is on a level surface to prevent decon fluids from running over sheeting.	
		2	Slips/trips/falls from plastic sheeting.	Use caution when walking on wet, plastic sheeting. Keep decon area free of clutter.	
		3	Lifting/bending/back strain.	Use proper bending and lifting techniques. Keep back straight and lift with your legs. Use buddy system for objects weighing greater than 50 lbs.	
		4	Exposure to decontamination fluids.	Wear safety goggles and nitrile gloves to prevent contact with eyes and skin. Keep unauthorized personnel away from work area.	
		5	Pinch points.	Maintain hand awareness. Use gloves (nitrile and work gloves) when handling equipment with pinch points.	
3	Pressure washing equipment	1	High pressure lines.	Keep hands, feet and body parts clear of pressure nozzle. During pressure operations, delineate work with caution tape or other type of barrier. Keep all unnecessary personnel clear of the area of pressure washing operations. Do not direct the spray toward any person. Keep spray nozzle pointed in a safe direction, preferably toward the ground, when not spraying.	

3	Pressure washing equipment	2	Flying debris.	Wear faceshield and safety goggles when using pressure washer, keep shield clean to maintain good visibility.	
		3	Noise.	During usage noise will increase, use hand signal if needed to communicate with personnel. Wear hearing protection.	
		4	Damage to tank/equipment.	Use correct nozzle when spraying, do not get to close to surface where damage could be caused.	
		5	Hot surfaces/burns.	Do not touch exhaust manifold with hands or equipment.	
		6	Burns/bruises/abrasions.	Use caution while working with high pressure washing equipment. Avoid hot surfaces and water jet blast of pressure washer.	
4	Collection of decontamination fluids	1	Lifting/bending/back strain.	Use proper bending and lifting techniques. Keep back straight and lift with your legs. Use buddy system for objects weighing greater than 50 lbs.	
		2	Exposure to decontamination fluids.	Wear appropriate PPE to prevent contact with eyes and skin. Keep unauthorized personnel away from work area.	
5	Site cleanup	1	Lifting/bending/back strain.	Use proper bending and lifting techniques. Keep back straight and lift with your legs. Use buddy system for objects weighing greater than 50 lbs.	
		2	Hot surfaces/burns/fires.	Do not place any materials or equipment on pressure washer after usage, the exhaust manifold becomes very hot. Ensure ample time is given for engine to cool down before storage.	

PPE — Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Dermal Protection	long sleeve shirt/pants		Required
Eye Protection	faceshield		Required
	safety goggles		Required
Foot Protection	steel-toe boots		Required
Hand Protection	chemical resistant gloves (specify type)	nitrile	Required
Head Protection	hard hat		Required
Hearing Protection	ear plugs		Required
Miscellaneous PPE	traffic vest--Class II or III		Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Decontamination	Decon supplies (specify type)		Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
Personal	eye wash (specify type)	bottle	Required
	insect repellant		Recommended
	sunscreen		Recommended
	water/fluid replacement		Recommended
Traffic Control	barricades		Required

Review Comments

Reviewer		Comments
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Approve 4/12/2012	

Job Safety Analysis

General

JSA ID	7242	**Status**	(3) Completed
Job Name	General Industry-Surveying - land	**Created Date**	4/4/2012
Task Description	Site Survey and Site Inspection	**Completed Date**	04/12/2012
Template	False	**Auto Closed**	False

Client / Project

Client	GE CORP ENV PROG
Project Number	B00311740001
Project Name	GE/2012 DEWEY LOEFFEL LANDFILL
PIC	FARR, PATRICK
Project Manager	SAUDA, DONALD

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Chisholm, Nicole	4/25/2012	4/4/2012	Hendrickson, Kelly	☑
HASP Reviewer	Groff, David	4/18/2012	4/12/2012	Cullen, Lucas	☑

Job Steps

Job Step No.	Job Step Description		Potential Hazard	Critical Action	H&S Reference
1	Mobilize to and from the job site with survey equipment and supplies	1	Vehicular accident.	Follow safe driving procedure and use the Smith System Driving principles.	Employee H&S Field book, Section III Subpart U, page 70.
		2	Sprains/strains.	Plan lifting activity, use mechanical methods if available; use buddy system if lifting objects >40 pounds or cause awkward twisting of body; lift with legs, not back.	
2	Site reconnaissance and walk-around	1	Slips/trips/falls from walking on uneven ground surface.	Survey the site upon arrival; note any site conditions that may pose a potential hazard; wear steel toe safety footwear with good tread and ankle support.	Employee H&S Field book, Section III Subpart LL, page 109.
		2	Struck by site vehicular traffic.	Be aware of vehicles in the area; do not enter areas where heavy equipment is in use; wear a reflective vest to increase visibility to drivers.	
		3	Sprains/strain during manhole cover removal.	Use buddy system if lifting objects >40 pounds; lift with legs, not back; use “J” Hook or pry bar.	
3	Equipment set-up, calibration and survey of target area	1	Slips/trips/falls from walking on uneven ground surface.	Identify uneven ground, debris, and trip hazards; if possible clear area of trip hazards; use buddy system to spot for uneven ground while surveying; wear steel toe safety footwear with good tread and ankle support.	
4	Placement of stakes	1	Hands/fingers/arms struck by hammer/mallet; splinters and lacerations if stake splints during hammering.	Inspect stakes for damage and do not use split or cracked stakes; wear leather gloves and safety glasses to protect hands and eyes from splinters.	
5	Placement of monuments	1	Sprain/strain from digging holes or mixing concrete.	Use right tool for the job; keep back straight and take frequent breaks.	
		2	Exposure to concrete can cause skin irritation.	Do not use bare hands to mix, place, or finish concrete; promptly wash exposed skin; wear impermeable gloves during mixing and concrete placement.	
		3	Inhalation of concrete dust during mixing.	Keep face away from concrete when poured out of bag; promptly wet concrete to be mixed; at a minimum wear a dust mask.	

PPE — Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Dermal Protection	long sleeve shirt/pants		Required
Eye Protection	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	work gloves (specify type)	leather	Required
Head Protection	hard hat		Required
Miscellaneous PPE	traffic vest--Class II or III		Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
	flashlight		Required
Personal	insect repellant		Recommended
	sunscreen		Recommended
	water/fluid replacement		Recommended

Review Comments

Reviewer		Comments
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Approve 4/12/2012	

Job Safety Analysis

General

JSA ID	7244	**Status**	(3) Completed
Job Name	Environmental-Drilling, soil sampling, well installation	**Created Date**	4/4/2012
Task Description	Soil Boring and Monitor Well Installation	**Completed Date**	07/10/2012
Template	False	**Auto Closed**	False

Client / Project

Client	GE CORP ENV PROG
Project Number	B00311740001
Project Name	GE/2012 DEWEY LOEFFEL LANDFILL
PIC	FARR, PATRICK
Project Manager	SAUDA, DONALD

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Chisholm, Nicole	4/25/2012	4/4/2012	Hendrickson, Kelly	☑
HASP Reviewer	Groff, David	4/18/2012	4/12/2012	Cullen, Lucas	☑
Quality Reviewer	Williams, Jennifer	5/9/2012	5/9/2012	Handy, Sara	☑

Job Steps

Job Step No.	Job Step Description		Potential Hazard	Critical Action	H&S Reference
1	Set up necessary traffic and public access controls	1	Struck by vehicle due to improper traffic controls.	Use a buddy system for placing site control cones and/or signage. Position vehicle so that you are protected from moving traffic. Wear Class II traffic vest.	
2	Utility clearance	1	Potential to encounter underground or aboveground utilities while drilling.	Complete utility clearance in accordance with the ARCADIS H&S procedure.	Employee H&S Field book, Section III Subpart MN, page 109.
3	General drill rig operation	1	Excessive noise is generated by rig operation.	When the engine is used at high RPMs or soil samples are being collected, use hearing protection.	
		2	During drill rig operation, surfaces will become hot and cause burns if touched, and COCs in the soils more readily vaporize generating airborne contaminates.	Due to friction and lack of a drilling fluid, heat will be produced during this method. Mainly drill augers. Be careful handling split spoons. Wear proper work gloves. When soils and parts become heated, the COC could volatilize. Air monitoring should always be performed in accordance with the HASP.	
		3	Moving parts of the drilling rig can pull you in causing injury. Pinch points on the rig and auger connections can cause pinching or crushing of body parts.	Stay at least 5 feet away from moving parts of the drill rig. Know where the kill switch is, and have the drillers test it to verify that it is working. Do not wear loose clothing, and tie long hair back. Avoid wearing jewelry while drilling. Cone off the work area to keep general public away from the drilling rig.	
		4	Dust and debris can cause eye injury and soil cuttings and/or water could contain COCs.	Wear safety glasses and stay as far away from actual drilling operation as practicable. Wear appropriate gloves to protect from COCs.	
		5	Drilling equipment laying on the ground (i.e. augers, split spoons, decon equipment, coolers, etc), create a tripping hazard. Water from decon buckets generate mud and cause a slipping hazard.	Keep equipment and trash picked up, and store away from the primary work area.	

		6	The raised derrick can strike overhead utilities, tree limbs or other elevated items.	Never move the rig with the derrick up. Ensure there is proper clearance to raise the derrick, and that you are far enough away from overhead power lines. See the Utility Location H&S policy and procedure for guidance.	
4	Mud rotary drilling	1	The raised derrick can strike overhead utilities, tree limbs or other elevated items.	Never move the rig with the derrick up. Ensure there is proper clearance to raise the derrick, and that you are far enough away from overhead power lines. See the Utility Location H&S policy and procedure for guidance.	
		2	This technology uses fluid, which collects with sediments in large basin. Fluid can splash out and cause slipping/mud hazard. Liquid mixture can splash into your eyes.	Wear rubber boots if needed, and keep clear of muddy/wet area as much as practicable. If area becomes excessively muddy, consider mud spikes or covering the area with a material that improves traction. Wear safety glasses.	
5	Hollow stem auger drilling	1	All hazards in step 3 apply. Additionally, the raised derrick can strike overhead utilities, tree limbs or other elevated items.	Never move the rig with the derrick up. Ensure there is proper clearance to raise the derrick, and that you are far enough away from overhead power lines. See the Utility Location H&S policy and procedure for guidance.	
6	Air rotary drilling	1	This drilling method works with high air pressure and can generate flying debris that can strike your body or get debris in your eyes.	When the drill rig is being driven into media, it will produce flying debris. The flaps behind the drill rig should stay closed whenever possible to reduce the risk of flying debris. Safety glasses and hard hat should always be worn when the drill rig is operating. When penetrating asphalt protect surrounding cars that may be present to avoid debris damage to paint or windshields.	
		2	The raised derrick can strike overhead utilities, tree limbs or other elevated items.	Never move the rig with the derrick up. Ensure there is proper clearance to raise the derrick, and that you are far enough away from overhead power lines. See the Utility Location H&S policy and procedure for guidance.	
		3	When drilling through bedrock prior to groundwater dust can be produced from pulverization. Inhalation of dusts/powder can occur.	Supplemental water should be used to manage dust creation and/or dust masks if necessary.	
7	Rotosonic drilling	1	Fire hydrants are often used for water source. Hydrants deliver water at high pressure. Pressurized water can cause flying parts/debris and excessive slipping hazards.	Water usage from fire hydrants should be cleared with local municipalities prior to use. Only persons that know how to use the hydrant should be performing this task. Ensure all connections are tight, and hose line is not run over to cut by traffic. Any leaks from the hydrant should be reported immediately.	
		2	This method requires a lot of clearance The drill head can turn 90 degrees to attach to the next drill flight or casing. This usually requires a large support truck to park directly behind the rig. As the drill head raises the new casing flight is angled down at the same time until it can be turned completely vertical.	Ensure sufficient overhead clearance.	
		3	Heavy lifting of cores can cause muscle strain.	Always use 2 people to move core containers. Use caution moving core samples to layout area. Plan layout area to ensure adequate aisle space between core runs for logging. Keep back straight and use job rotation.	

		4	The rotosonic drill head can move very quickly up and down while working on a borehole. Moving parts can strike someone or catch body parts.	The operator and helper must communicate and stay clear of the path of the drill head. The drill utilizes two large hydraulic clamps to continuously hold casings while load/unloading previous casings. Do not wear loose clothing.	
8	Reverse rotary drilling	1	This method will use fresh water to pump out drill cuttings through the center of the casing. Water/sediment mixture is generated and could cause contact with impacted soils or groundwater.	Ensure the pit construction can hold the amount of cuttings that are anticipated. Air monitoring should also be used of pit area.	
		2	Fire hydrants are often used for water source. Hydrants deliver water at high pressure. Pressurized water can cause flying parts/debris and excessive slipping hazards.	Water usage from fire hydrants should be cleared with local municipalities prior to use. Only persons that know how to use the hydrant should be performing this task. Ensure all connections are tight, and hose line is not run over to cut by traffic. Any leaks from the hydrant should be reported immediately.	
		3	Settling pit construction can cause tripping hazard from excavated soils, and plastic sheeting can cause slipping.	Cone off the area to keep the general public/visitors away from the settling pit. Ensure proper sloping of excavation.	
		4	The raised derrick can strike overhead utilities, tree limbs or other elevated items.	Never move the rig with the derrick up. Ensure there is proper clearance to raise the derrick, and that you are far enough away from overhead power lines. See the Utility Location H&S policy and procedure for guidance.	
9	Direct push drilling	1	The drill rods will be handled by workers most of the time rather than the rig doing it, therefore pinch points can cause lacerations and crushing of fingers/body parts.	Keep a minimum of 5 feet away from drill rig operation and moving parts.	
		2	The direct push rigs are usually meant to fit in spaces where larger rigs cannot; tight spaces can pin workers.	Do not put yourself between the rig and a fixed object. Use Spotters or a tape measure to ensure clearances in tight areas. Pre-plan equipment movement from one location to the next.	
		3	Some direct push equipment is controlled by wireless devices; these controls can fail and equipment can strike workers or cause damage to property.	The drill rig should be used in a large open area to test wireless controls prior to moving to boring locations. The operator of the rig will test the kill switch with wireless remote prior to use. Operator will stay in range of rig while moving so that wireless signal will not be too weak and cause errors to the controls.	
		4	Sampling sleeves must be cut to obtain access to soil, cutting can cause lacerations.	Preferably let the driller cut the sleeves open. Many drillers have holders for the sleeve to allow for stability when cutting. If we cut the sleeves, use a hook blade, change blade regularly, and cut away from the body.	
10	Rock coring	1	Flying debris can hit workers or cause debris to get in eyes.	Rock chips or overburden may become airborne from drilling method. Wear safety glasses and hard hat and remain at a safe distance from back of drill rig.	
		2	Heavy lifting of cores can cause muscle strain.	Always use 2 people to move core containers. Use caution moving core samples to layout area. Plan layout area to ensure adequate aisle space between core runs for logging. Keep back straight and use job rotation.	

11	Sample collection and processing	1	Injuries can result from pinch points on sampling equipment, and from breakage of sample containers.	Care should be taken when opening sampling equipment. Look at empty containers before picking them up, and do not over-tighten container caps. Use dividers to store containers in the cooler so they do not break.	
		2	Lifting heavy coolers can cause back injuries.	Use two people to move heavy coolers. Use proper lifting techniques.	
12	Monitoring well installation	1	Same hazards as in Step 3 with general drill rig operation.	See step 3.	
		2	Monitoring well construction materials can clutter the work area causing tripping hazards.	Well construction materials should be picked up during the well installation process.	
		3	Heavy lifting can cause muscle strains, and cutting open bags can cause lacerations.	Well construction materials are usually 50 lbs or greater. Team lift or use drill rig to hoist bags. Always use work gloves while cutting open bags.	
		4	Well pack material (i.e. sand, grout, bentonite) can become airborne and get in your eyes.	Wear safety glasses for protection from airborne sand and dust.	
		5	Cutting the top of the well to size can cause jagged/sharp edges on the top of the well casing.	Wear gloves when working with the top of the well casing, and file any sharp jagged edges that resulted from cutting to size.	
13	Soil cutting and purge water management	1	Moving full drums can cause back injury, or pinching/crushing injury.	Preferably have the drilling contractor move full drums with their equipment. If this is not practicable, use lift assist devices such as drum dollies, lift gates, etc. Employ proper lifting techniques, and perform TRACK to identify pinch/crush points. Wear leather work gloves, and clear all walking and work areas of debris prior to moving a drum.	Drum Handling JSA.

PPE	Personal Protective Equipment		
Type	**Personal Protective Equipment**	**Description**	**Required**
Eye Protection	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	chemical resistant gloves (specify type)	nitrile	Required
	work gloves (specify type)	leather	Required
Head Protection	hard hat		Required
Hearing Protection	ear plugs		Required
Miscellaneous PPE	traffic vest--Class II or III		Required
Respiratory Protection	dust mask		Recommended

Supplies			
Type	**Supply**	**Description**	**Required**
Communication Devices	mobile phone		Required
Decontamination	Decon supplies (specify type)		Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
Personal	eye wash (specify type)	bottle	Required
Traffic Control	traffic cones		Required

Review Comments

Reviewer		Comments
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Approve 4/12/2012	
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Revised 7/10/2012	

Job Safety Analysis

General

JSA ID	7231	**Status**	(3) Completed
Job Name	Environmental-Soil sampling/well installation - manual	**Created Date**	4/4/2012
Task Description	Soil Sampling	**Completed Date**	04/13/2012
Template	False	**Auto Closed**	False

Client / Project

Client	GE CORP ENV PROG
Project Number	B00311740001
Project Name	GE/2012 DEWEY LOEFFEL LANDFILL
PIC	FARR, PATRICK
Project Manager	SAUDA, DONALD

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Chisholm, Nicole	4/26/2012	4/13/2012	Hendrickson, Kelly	☑
HASP Reviewer	Groff, David	4/27/2012	4/13/2012	Cullen, Lucas	☑

Job Steps

Job Step No.	Job Step Description		Potential Hazard	Critical Action	H&S Reference
1	Sampling set-up	1	Muscle strains can occur from lifting heavy equipment in and out of vehicle.	Park as close as possible to the sampling locations. Use 2-person lift for items >40 lbs; bend and lift with legs/arms, not back. Position body with feet spread to maintain balance and front-facing target area when moving equipment to minimize twisting/turning of torso.	
		2	Slips/trips/falls could occur from uneven walking and wet working surfaces.	Plan route to the location where work will be performed and do not hurry through task. Wear steel-toed safety work boots with ample tread and ankle support to prevent slipping and ankle injuries. Do not carry objects that obstruct view of ground ahead.	
2	Collect soil sample	1	Staff can come into contact with impacted soils.	Inspect the area do not directly handle impacted soils. Wear nitrile gloves and safety glasses to protect your skin and eyes from impacted soils.	Employee H&S Field book, Section III Subpart R, page 64.
		2	Sharp edges and broken glassware can cause lacerations.	Discard any broken sample containers or glass. Do not over-tighten sample containers.	
		3	Injuries can result from pinch points on sampling equipment, and from breakage of sample containers.	Care should be taken when opening sampling equipment. Look at empty containers before picking them up, and do not over-tighten container caps. Use dividers to store containers in the cooler so they do not break.	
		4	Sample cross-contamination, mislabeling.	Keep samples stored in proper containers, on ice, and away from work area. Pack coolers to minimize sample jar movement. Label samples immediately upon sample collection.	
		5	Sprain/strain	Use 2-person lift for items, like sample coolers, >40 lbs. Bend with the legs/arms, not back. Position body with feet spread to maintain balance and front-facing target area while moving samples to minimize twisting/turning of torso.	
		6	Exposure to contaminants, cross-contamination.	Label sample containers immediately after sampling and keep already used sample containers away from empty ones to avoid cross-contamination. Use PID to screen air in working zones. Wear nitrile gloves and change gloves between sample collections.	

PPE — Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Dermal Protection	long sleeve shirt/pants		Required
Eye Protection	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	chemical resistant gloves (specify type)	nitrile	Required
	work gloves (specify type)	leather or equivalent (per SSO)	Required
Miscellaneous PPE	traffic vest--Class II or III		Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Decontamination	Decon supplies (specify type)		Recommended
Miscellaneous	first aid kit		Required
Personal	eye wash (specify type)	bottle	Required
	sunscreen		Recommended
Traffic Control	traffic cones		Required

Review Comments

Reviewer		Comments
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Revise 4/4/2012	
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Revise 4/12/2012	
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Approve 4/13/2012	

Job Safety Analysis

General

JSA ID	7228	**Status**	(3) Completed
Job Name	Environmental-Remediation system O&M	**Created Date**	4/3/2012
Task Description	Groundwater Treatment System O&M	**Completed Date**	04/13/2012
Template	False	**Auto Closed**	False

Client / Project

Client	GE CORP ENV PROG
Project Number	B00311740001
Project Name	GE/2012 DEWEY LOEFFEL LANDFILL
PIC	FARR, PATRICK
Project Manager	SAUDA, DONALD

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Chisholm, Nicole	4/26/2012	4/13/2012	Hendrickson, Kelly	☑
HASP Reviewer	Groff, David	4/27/2012	4/13/2012	Cullen, Lucas	☑

Job Steps

Job Step No.	Job Step Description		Potential Hazard	Critical Action	H&S Reference
1	General inspection	1	Slips trips and falls on wet surfaces, equipment, piping, or supplies.	Mark all hoses and piping in walkways with high visibility colored materials or paint; use signage if necessary, cover to prevent trip hazards; wear steel toe boots with ankle support, good tread and anti-slip sole.	Employee H&S Field book, Section III Subpart Z, page 83.
		2	Noise from system operation.	Increase distance from noise sources when practical; wear hearing protection with a noise reduction rating (NRR) of at least 27 to protect from hearing damage.	
		3	Impaired visibility when going into structures on bright days or structures without illumination.	Use auxiliary lighting when inspecting inside structures on bright days.	
		4	Burns to skin from contact with system components.	Allow system components to cool down before accessing; wear leather work gloves to protect skin from burns.	
		5	Contact with product from improper system operation.	Review O&M plan prior to inspection/service; use LO/TO for any component removed where product could be released; bleed off any component under pressure; wear safety glasses and long sleeve shirt and pants to protect skin.	
		6	Insect hazards (i.e., wasps, spiders, ticks) in system structures.	Watch for and avoid. Don't reach into poorly lit and damp places on the system; wear leather gloves and long sleeve shirt and pants to protect skin.	
2	System sample collection	1	Contact with sample preservatives.	Always assume acid residue is on outside of sample bottles; keep bottles away from face to avoid breathing vapor; wear nitrile gloves and safety glasses to protect skin and eyes; have baking soda or other acid neutralizer and eye wash available if acid gets on skin or clothing, or in eyes.	
		2	Cuts to hands from damaged sample bottles.	Inspect bottles prior to use and do not use if bottle or lid appears damaged; do not over tighten lids; wear level 2 cut resistant gloves.	
		3	Awkward body positions.	Plan sampling activity; use job rotation if filling large containers from a slow flowing port or valve.	
		4	Exposure to impacted media or free product.	If sample port has potential to be under pressure, bleed pressure off prior to sample collection; wear nitrile gloves and safety glasses to protect skin and eyes; wear face shield and Tyvek suit or apron if splash hazards from pressure or other cause exists.	

3	Pipe, meter, port, valve, gauge, cleaning or replacement	1	Working at height on tanks or edge of vaults.	Follow ARCADIS fall protection SOP, inspect guardrails, stairs, ladders and don't use if damaged or defective; if guardrails are not present and working over 6 ft, wear personal fall arrest device.	Employee H&S Field book, Section III Subpart Y, page 81.
		2	Removal of vessel lids or covers causing overexertion or awkward twisting.	Use mechanical methods when available; use buddy system to lift lids weighting >40 pounds or cause awkward bending or twisting to open.	
		3	Exposure to carbon dusts when dried.	Maintain good housekeeping at all times and clean up spilled carbon when still wet; if dust may form, use respirator with HEPA filter.	
		4	Confined space hazards if tank, vault entry is required.	If possible, avoid confined space entry by doing activities remotely; follow ARCADIS Confined Space procedures if entry is necessary.	
		5	Struck by hazards from hoisting carbon bags or equipment.	Keep personnel clear of lift area; use tag lines if lifting over knee height, do not walk under suspended loads; wear hard hat to protect from head injuries.	
		6	Sprains/strain from lifting carbon bags or equipment.	Use mechanical methods if available; use buddy system to lift objects >40 pounds, may require awkward bending or twisting; or bulky or awkward objects.	
		7	Struck by vehicle or vehicle damage.	Pre-inspect travel route; use a spotter during vehicle backing; wear a traffic safety vest to improve visibility to driver.	
4	Carbon or media change out	1	Lacerations/vibration from hand tools.	Inspect tool prior to use and remove from service if defective; wear padded work gloves with level 2 cut resistance.	Employee H&S Field book, Section III Subpart AA, page 84.
		2	Sprains/strain.	Plan lifting activity, use mechanical methods if available; use buddy system if lifting objects >40 pounds or cause awkward twisting of body; lift with legs, not back.	
		3	Electrical hazards.	Don't do electrical work if not authorized; follow ARCADIS electrical procedures and OMM manual requirements; wear gloves and footwear that is electrical safety rated.	
5	Bag filter change out	1	Entanglement hazards in blower components (hazardous energy).	Use LOTO to inactivate equipment; do not remove protective guards unless necessary to service blower; wear tight fitted clothing and ensure shirt tails are tucked in.	
		2	Pinch points, cuts, scrapes to hands and fingers.	Identify and keep hands and fingers away from pinch hazards; wear level 2 cut resistant gloves to protect hands.	
6	Blower maintenance and servicing	1	Entanglement hazards in blower components (hazardous energy).	Use LOTO to inactivate equipment; do not remove protective guards unless necessary to service blower; wear tight fitted clothing and ensure shirt tails are tucked in.	
		2	Pinch points, cuts, scrapes to hands and fingers.	Identify and keep hands and fingers away from pinch points; wear level 2 cut resistant gloves to protect hands.	
		3	Contact stress to knee/legs from kneeling on hard surfaces.	Use knee pads/padding if kneeling/sitting on hard surfaces.	
		4	Sprains/strain from lifting blower components.	Plan lifting activity, use mechanical methods if available; use buddy system if lifting objects >40 pounds or cause awkward twisting of body; lift with legs, not back.	
		5	Tool slip hazards from grease or oil on surfaces.	Clean up excessive grease and oily areas on surfaces requiring maintenance or adjustment.	
7	Product transfer	1	Fire/explosion from static charges.	Ground transfer system per the requirements of the OMM manual.	
		2	Slips/trips/falls.	Don't run hose or piping across aisle ways, secure from movement or cover, watch for and avoid walking over hoses and piping; wear steel toe boots with ankle support, good tread and anti-slip sole; promptly clean up all spills no matter how small.	

7	Product transfer	3	Skin or eye contact, or inhalation to free product.	Use air monitoring as required by HASP or OMM Manual; stay upwind of vapors; wear safety glasses and long sleeve shirt and pants to protect eyes and skin.	
		4	Sprains/strains lifting buckets/containers of product.	Plan lifting activity, use mechanical methods if available; use buddy system if lifting objects >40 pounds or cause awkward twisting of body; lift with legs, not back; if buckets used to collect product, replace bucket prior to the bucket becoming full to reduce weight needing to be lifted.	
8	Checks of electrical systems	1	Electrocution from contact with energized system components.	Follow ARCADIS electrical procedure; wear electrical rated gloves and footwear and inspect PPE prior to work activity.	
		2	Pinch points, cuts, and scrapes to hands from opening electrical panels.	Identify potential pinch points and keep hands and fingers away; wear electrical rated level 2 cut resistant gloves.	
		3	Burns from arc flash.	Follow ARCADIS electrical procedure; wear electrical rated gloves and footwear and inspect PPE prior to work activity; wear long sleeve pants and shirt meeting the safety requirements for the panel to be inspected.	
9	Tank inspection	1	Skin or eye contact, or inhalation to free product.	Keep face away from tank openings and use air monitoring watch for condensate liquid dripping from lids or caps; wear safety glasses and Tyvek suit or apron to protect eyes and skin.	Employee H&S Field book, Section III Subpart BB, page 86.
		2	Oxygen deficiency and confined space hazards.	Follow ARCADIS confined space procedures. DO NOT stick head inside of a tank under any condition.	
		3	Explosive atmospheres from chemical vapors.	Use air monitoring to ensure safe levels are maintained; if entry required or for detailed inspection, purge tank of vapors following API 1604 procedures - note that air monitoring may be affected by purging methods and may give erroneous results.	
		4	Falls from heights for elevated tanks.	Follow ARCADIS fall protection SOP, inspect guardrails, stairs, ladders and don't use if damaged or defective; if guardrails are not present and working over 6 ft, wear personal fall arrest device.	
		5	Slip and falls on wet surfaces.	Clean up wet areas where practical and maintain good housekeeping; wear steel toe footwear with good tread, anti-slip soles and ankle support.	
		6	Pinch points, cuts, scrapes to hands from tank lids, doors, covers.	Identify and keep hands and fingers away from pinch points; wear level 2 cut resistant gloves to protect hands	
10	Removal of water from secondary containment	1	Slips and falls on wet or icy surfaces.	Clean up wet areas where practical and maintain good housekeeping; use snow/ice removal methods to clear walking paths; wear steel toe footwear with good tread, anti-slip soles and ankle support.	
		2	Slips/trips/falls from hoses or piping.	Don't run hose or piping across aisle ways, secure from movement or cover, watch for and avoid walking over hoses and piping; wear steel toe boots with ankle support, good tread and anti-slip sole; promptly clean up all spills no matter how small.	
		3	Falls from vehicle mounted tanks.	Use 3 points of contact when mounting equipment; plan the route onto tank; inspect the tank for anti-slip tape, paint or other material, if absent, obtain and place on vehicle in access locations.	
11	Drum handling and management	1	Sprain/strain from lifting/pulling/pushing drums.	Full drums can weigh as much as 800 lbs, therefore, use mechanical methods whenever possible; use a team lift approach when using a drum cart – one person tips the drum back slightly while the other puts the forks under the drum, one person then pulls back on cart while the other slowly pushes drum back toward dolly.	

11	Drum handling and management	2	Body parts can be pinched between lift device or drum and the ground.	Do not place hands, feet or body where it can be caught between objects or structures; plan lifts; wear heavy leather gloves to protect hands.	
		3	When moving, the drum can tip or the dolly could become unstable from uneven ground surface.	Plan travel route prior to moving drum; With drum secure on dolly; utilize a spotter for traffic, pedestrians, and trip hazards.	

PPE — Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Dermal Protection	chemical protective suit (specify type)	if splash hazard exists	Required
	long sleeve shirt/pants		Required
Eye Protection	faceshield	if splash hazard exists	Required
	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	chemical resistant gloves (specify type)	nitrile	Required
Head Protection	hard hat		Required
Hearing Protection	ear plugs	if exposed to loud noise	Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
	flashlight		Required
Personal	eye wash (specify type)		Required

Review Comments

Reviewer		Comments
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Revise 4/4/2012	
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Revise 4/12/2012	
Employee: **Role** **Review Type** **Completed Date**	Groff, David HASP Reviewer Approve 4/13/2012	

ARCADIS

Appendix C

HASP Forms

ARCADIS

Document Control Number:TGM - _____

TGM + *project number plus date as follows: xxxxxxxx.xxxx.xxxxx - dd/mm/year*

TAILGATE HEALTH & SAFETY MEETING FORM

This form documents the tailgate meeting conducted in accordance with the Project HASP. Personnel who perform work operations on-site during the day are required to attend this meeting and to acknowledge their attendance, at least daily.

Project Name:			**Project Location:**
Date:	**Time:**	**Conducted by:**	**Signature/Title:**
Client:		**Client Contact:**	**Subcontractor companies:**

TRACKing the Tailgate Meeting

Think through the Tasks (list the tasks for the day):

1 _____ 3 _____ 5 _____

2 _____ 4 _____ 6 _____

Other Hazardous Activities - Check the box if there are any other ARCADIS, Client or other party activities that may pose hazards to ARCADIS operations ☐ If there are none, write "None" here: _____

If yes, describe them here: _____

How will they be controlled? _____

Prework Authorization - check activities to be conducted that require permit issuance or completion of a checklist or similar before work begins:

	Doc #		Doc #		Doc #
☐ Not applicable		☐ Working at Height		☐ Confined Space	
☐ Energy Isolation (LOTO)		☐ Excavation/Trenching		☐ Hot Work	
☐ Mechanical Lifting Ops		☐ Overhead & Buried Utilities		☐ Other permit	

Discuss following questions (for some review previous day's post activities)**. Check if yes :**

☐ Topics from Corp H&S to cover?		
☐ Incidents from day before to review?	☐ Lessons learned from the day before?	☐ Any Stop Work Interventions yesterday?
☐ Any corrective actions from yesterday?	☐ Will any work deviate from plan?	☐ If deviations, notify PM & client
☐ JSAs or procedures are available?	☐ Field teams to "dirty" JSAs, as needed?	☐ All equipment checked & OK?
☐ Staff has appropriate PPE?	☐ Staff knows Emergency Plan (EAP)?	☐ Staff knows gathering points?

Comments: _____

Recognize the hazards (check all those that are discussed) (Examples are provided) and **A**ssess the Risks (Low, Medium, High - circle risk level) - Provide an overall assessment of hazards to be encountered today and briefly list them under the hazard category.

☐ Gravity (i.e., ladder, scaffold, trips) (L M H)	☐ Motion (i.e., traffic, moving water) (L M H)	☐ Mechanical (i.e., augers, motors) (L M H)
☐ Electrical (i.e., utilities, lightning) (L M H)	☐ Pressure (i.e., gas cylinders, wells) (L M H)	☐ Environment (i.e., heat, cold, ice) (L M H)
☐ Chemical (i.e., fuel, acid, paint) (L M H)	☐ Biological (i.e., ticks, poison ivy) (L M H)	☐ Radiation (i.e., alpha, sun, laser) (L M H)
☐ Sound (i.e., machinery, generators) (L M H)	☐ Personal (i.e. alone, night, not fit) (L M H)	☐ Driving (i.e. car, ATV, boat, dozer) (L M H)

Continue TRACK Process on Page 2

TAILGATE HEALTH & SAFETY MEETING FORM - Pg. 2

Control the hazards (Check all and discuss those methods to control the hazards that will be implemented for the day): Review the HASP, applicable JSAs, and other control processes. Discuss and document any additional control processes.

☒	**STOP WORK AUTHORITY** (Must be addressed in every Tailgate meeting - (*See statements below*)				
☐	Elimination	☐	Substitution	☐	Isolation
☐	Engineering controls	☐	Administrative controls	☐	Monitoring
☐	General PPE Usage	☐	Hearing Conservation	☐	Respiratory Protection
☐	Personal Hygiene	☐	Exposure Guidelines	☐	Decon Procedures
☐	Emergency Action Plan (EAP)	☐	Fall Protection	☐	Work Zones/Site Control
☐	JSA to be developed/used ***(specify)***	☐	TIP conducted ***(specify job/JSA)***	☐	Traffic Control
☐		☐		☐	Other ***(specify)***
☐		☐		☐	

Signature and Certification Section - Site Staff and Visitors

Name/Company/Signature	Initial & Sign in Time	Initial & Sign out Time	I have read and understand the HASP

Important Information and Numbers

All site staff should arrive fit for work. If not, they should report to the supervisor any restrictions or concerns.

In the event of an injury, employees will call WorkCare at 1.800.455.6155 and then notify the field supervisor who will, in turn, notify Corp H&S at 1.720.344.3844.

In the event of a motor vehicle accident, employees will notify the field supervisor who will then notify Corp H&S at 1.720.344.3844 and then Corp Legal at 1.720.344.3756.

In the event of a utility strike or other damage to property of a client or 3rd party, employees will immediately notify the field supervisor, who will then immediately notify Corp Legal at 1.678.373.9556 and Corp H&S at 1.720.344.3500

Visitor Name/Co - not involved in work

	In	Out
	In	Out
	In	Out
	In	Out

I will STOP the job any time anyone is concerned or uncertain about health & safety or if anyone identifies a hazard or additional mitigation not recorded in the site, project, job or task hazard assessment.

I will be alert to any changes in personnel, conditions at the work site or hazards not covered by the original hazard assessments.

If it is necessary to **STOP THE JOB,** I will perform **TRACK**; and then amend the hazard assessments or the HASP as needed.

I will not assist a subcontractor or other party with their work unless it is absolutely necessary and then only after I have done TRACK and I have thoroughly controlled the hazard.

Post Daily Activities Review - Review at end of day or before next day's work (Check those applicable and explain:)

- ☐ Lessons learned and best practices learned today: _____
- ☐ Incidents that occurred today: _____
- ☐ Any Stop Work interventions today? _____
- ☐ Corrective/Preventive Actions needed for future work: _____
- ☐ Any other H&S issues: _____

Keep H&S 1st in all things

WorkCare - 1.800.455.6155

Real Time Exposure Monitoring Data Collection Form

Document all air monitoring conducted on the Site below. Keep this form with the project file.

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 3):

_____

_____

Employee Signature Form

I certify that I have read, understand, and will abide by the safety requirements outlined in this HASP.

Printed Name	Signature	Date

Subcontractor Acknowledgement: Receipt of HASP Signature Form

ARCADIS claims no responsibility for the use of this HASP by others although subcontractors working at the site may use this HASP as a guidance document. In any event, ARCADIS does not guarantee the health and/or safety of any person entering this site. Strict adherence to the health and safety guidelines provided herein will reduce, but not eliminate, the potential for injury at this site. To this end, health and safety becomes the inherent responsibility of personnel working at the site.

Printed Name	Company	Signature	Date

Visitor Acknowledgement and Acceptance of HASP Signature Form

By signing below, I waive, release and discharge the owner of the site and ARCADIS 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.

Name	Company	Reason for Visit	Date/Time On Site	Date/Time Off Site

Hazardous Materials Transportation Form

	Vehicle (place X in box)	Type (pick-up, car, box truck, etc.)
Personal		
Rental		
ARCADIS owned/leased		
Government owned		
Trailer		

Materials Transported	Quantity	Storage/Transport Container

List Trained Drivers:

_____

_____

Hazardous Materials Shipment Form

Material Description and Proper Shipping Name (per DOT or IATA)	Shipment Quantity	DOT Hazard Classification	Shipment Method (air/ground)

List Shipper (i.e., who we are offering the shipment to):

_____

_____

List Trained Employee(s):

_____

_____

ARCADIS

Appendix D

PPE Equipment List

ARCADIS

PPE CHECKLIST

R = Equipment required to be present at the site. **O =** Optional equipment. Subcontractors must have the same equipment listed here as a minimum. Levels C and B equipment are defined as optional because while it is anticipated that Level D PPE will be sufficient for all site activities, in the event that upgrade to Levels C or B are necessary, the equipment listed below must be present at the site.

Description (Put Specific Material or Type in Box)	Level Of Protection		
	D	C	B
Body			
Coveralls			
Chemical Protective Suit			O
Splash Apron			
Rain Suit	O	O	O
Traffic Safety Vest (reflective)	R	O	O
Head			
Hard Hat (if does not create other hazard)	R	O	O
Head Warmer (depends on temperature and weather conditions)	O	O	O
Eyes & Face			
Safety Glasses (incorporate sun protection as necessary)	R	O	O
Goggles (based on hazard)	O		
Face Shield	R	O	O
Ears			
Ear Plugs	R	O	O
Ear Muffs	O	O	O
Hands and Arms			
Outer Chemical Resistant Gloves - nitrile	R	O	O
Inner Chemical Resistant Gloves – nitrile	R	O	O
Insulated Gloves			
Work Gloves – leather	R	O	O
Foot			
Safety Boots (steel toe and shank)	R	O	O
Rubber, Chemical Resistant Boots			
Rubber Boots			
Disposable Boot Covers			
Respiratory Protection			
1/2 Mask APR			
Full Face APR		O	
Dust Protection	R		
Powered APR			O
SCBA			
Air Line			

ARCADIS

Appendix E

MSDSs

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Acetone **CAS Number:** 67-64-1
Chemical Formula: C_3H_6O
Structural Chemical Formula: CH_3COCH_3
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).

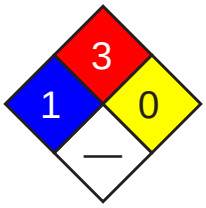
DFG (Germany) MAK
TWA: 500 ppm; PEAK: 1000 ppm.

ACGIH TLV
TWA: 500 ppm; STEL: 750 ppm.

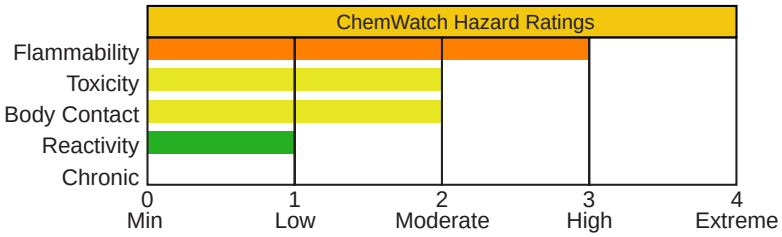
IDLH Level
2500 ppm (10% LEL).

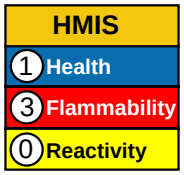
EU OEL
TWA: 500 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless, highly volatile liquid; sweet odor. Irritating. Other Acute Effects: muscle weakness, mentaI 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.

See DOT ERG

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.

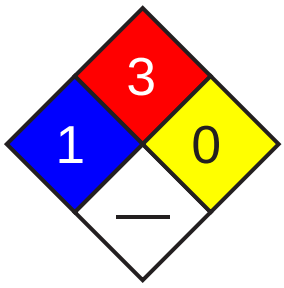
After first aid, get appropriate in-plant, paramedic, or community medical support.

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 know antidotes and treatment should involve the usual methods of decontamination followed by supportive care.

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.

See DOT ERG



Fire Diamond

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 (CO_2).
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.

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.
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
Odor Threshold: 47.5 to 1613.9 mg/m^3
Vapor Pressure (kPa): 24 at 20 °C
Vapor Density (Air=1): 2.0
Formula Weight: 58.08
Specific Gravity (H_2O=1, at 4 °C): 0.79 at 20 °C
Evaporation Rate: 11 (BuAc=1) VFast
pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 56.2 °C (133 °F) at 760 mm Hg
Freezing/Melting Point: -95.35 °C (-139.63 °F)
Volatile Component (% Vol): 100
Water Solubility: Miscible

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) LD_{50}: 5800 mg/kg
Inhalation (human) TC_{Lo}: 500 ppm
Inhalation (man) TC_{Lo}: 12000 ppm/4 hr
Inhalation (man) TC_{Lo}: 10 mg/m^3/6 hr
Inhalation (rat) LC_{50}: 50100 mg/m^3/8 hr
Dermal (rabbit) LD_{50}: 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: LD_{100} Asellus aquaticus 3 ml/l (within 3 days of exposure) /Conditions of bioassay not specified; LC_{50} 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; LD_{100} Gammarus fossarum 10 ml/l (within 48 hr) /Conditions of bioassay not specified; LC_{50} Poecilia reticulata (guppy) 7,032 ppm/14 days /Conditions of bioassay not specified; LC_{50} Ring-necked pheasant oral greater than 40,000 ppm, in diet, age 10 days, (no mortality to 40,000 ppm); LC_{50} 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; LC_{50} 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: 3.97×10^{-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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Benzene **CAS Number:** 71-43-2
Chemical Formula: C_6H_6
Structural Chemical Formula: C_6H_6
EINECS Number: 200-753-7
ACX Number: X1001488-9
Synonyms: Benzene; BENZENE; (6)ANNULENE; BENZEEN; BENZEN; BENZIN; BENZINE; BENZOL; BENZOL 90; BENZOLE; BENZOLENE; BENZOLO; BICARBURET OF HYDROGEN; CARBON OIL; COAL NAPHTHA; CYCLOHEXATRIENE; EPA PESTICIDE CHEMICAL CODE 008801; FENZEN; MINERAL NAPHTHA; MOTOR BENZOL; NITRATION BENZENE; PHENE; PHENYL HYDRIDE; POLYSTREAM; PYROBENZOL; PYROBENZOLE
General Use: Manufacture of chemicals including styrene, dyes, and many other organic chemicals. Has been used in artificial leather, linoleum, oil cloth, airplane dopes, lacquers; as solvent for waxes, resins, oils etc.
May also be a minor component of gasoline, petrol.
Exposure should be minimized by use in closed systems.
Handling procedures and control measures should be evaluated for exposure before commencement of use in plant operations.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
benzene	71-43-2	99.9

OSHA PEL
TWA: 1 ppm; STEL: 5 ppm.

NIOSH REL
TWA: 0.1 ppm; STEL: 1 ppm.

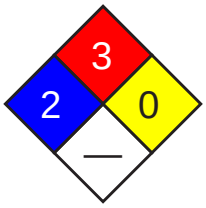
DFG (Germany) MAK
Skin.

ACGIH TLV
TWA: 0.5 ppm; STEL: 2.5 ppm; skin.

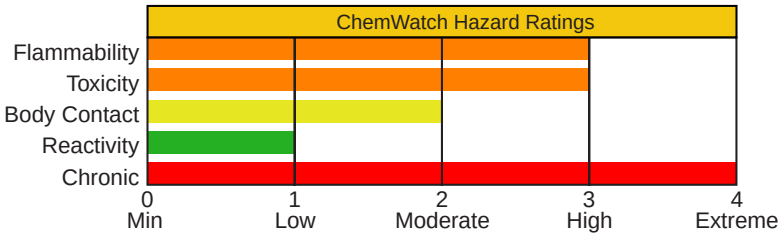
IDLH Level
500 ppm.

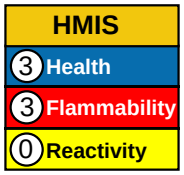
EU OEL
TWA: 1 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; sweet odor. Irritating to eyes/skin/respiratory tract. Toxic. Other Acute Effects: headache, dizziness, drowsiness. Absorbed through skin. Chronic Effects: dermatitis, leukemia, bone marrow damage. Carcinogen. Reproductive effects. Flammable.

Potential Health Effects

Target Organs: blood, central nervous system (CNS), bone marrow, eyes, upper respiratory system, skin
Primary Entry Routes: inhalation, skin contact
Acute Effects
Inhalation: The vapor is discomforting to the upper respiratory tract and lungs and may be harmful if inhaled.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible 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.
Inhalation hazard is increased at higher temperatures.
The symptoms of acute exposure to high vapor concentrations include confusion, dizziness, tightening of the leg muscles and pressure over the forehead followed by a period of excitement. If exposure continues the casualty quickly becomes stupefied and lapses into a coma with narcosis.
Effects of inhalation may include nausea, vomiting headache, dizziness, drowsiness, weakness, sometimes preceded by brief periods of exhilaration, or euphoria, irritability, malaise, confusion, ataxia, staggering, weak and rapid pulse, chest pain and tightness with breathlessness, pallor, cyanosis of the lips and fingertips and tinnitus. Severe exposures may produce blurred vision, shallow, rapid breathing, delirium, cardiac arrhythmias, unconsciousness, deep anesthesia, paralysis and coma characterized by motor restlessness, tremors and hyperreflexia (occasionally preceded by convulsions). Polyneuritis and persistent nausea, anorexia, muscular weakness, headache, drowsiness, insomnia and agitation may also occur. Two-three weeks after the exposure, nervous irritability, breathlessness and unsteady gait may still persist; cardiac distress and an unusual dicoloration of the skin may be evident for up to four weeks.
Hemotoxicity is not normally a feature of acute exposures although anemia, thrombocytopenia, petechial hemorrhage, and spontaneous internal bleeding have been reported. Fatal exposures may result from asphyxia, central nervous system depression, cardiac and respiratory failure and circulatory collapse; sudden ventricular fibrillation may also be fatal.
Death may be sudden or may be delayed for 24 hours. Central nervous system, respiratory or hemorrhagic complications may occur up to five days after the exposure and may be lethal; pathological findings include respiratory inflammation with edema, and lung hemorrhage, renal congestion, cerebral edema and extensive petechial hemorrhage in the brain, pleurae, pericardium, urinary tract, mucous membrane and skin.
Exposure to toxic levels has also produced chromosome damage.

Eye: The liquid is highly discomforting to the eyes, may be harmful following absorption 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 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 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.
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.

Ingestion: 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 - Class 1, Known to be a carcinogen; IARC - Group 1, Carcinogenic to humans; OSHA - Listed as a carcinogen; NIOSH - Listed as carcinogen; ACGIH - Class A2, Suspected human carcinogen; EPA - Class A, Human carcinogen; MAK - Class A1, Capable of inducing malignant tumors as shown by experience with humans.

Chronic Effects: Liquid is an irritant and may cause burning and blistering of skin on prolonged exposure.
Chronic exposure may cause headache, fatigue, loss of appetite and lassitude with incipient blood effects including anemia and blood changes.
Benzene is a myelotoxicant known to suppress bone-marrow cell proliferation and to induce hematologic disorders in humans and animals.
Signs of benzene-induced aplastic anemia include suppression off leukocytes (leukopenia), red cells (anemia), platelets (thromocytopenia) or all three cell types (pancytopenia). Classic symptoms include weakness, purpura, and hemorrhage. The most significant toxic effect is insidious and often irreversible injury to the blood forming tissue. Leukemia may develop.

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.

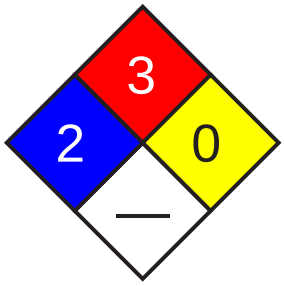
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:
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.
Consider complete blood count. Evaluate history of exposure.

Section 5 - Fire-Fighting Measures

Flash Point: -11 °C Closed Cup
Autoignition Temperature: 562 °C
LEL: 1.3% 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.

See DOT ERG



Fire Diamond

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 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 full body protective clothing with breathing apparatus. 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 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.
Equipment should be thoroughly decontaminated after use.

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: Pollutant - contain spillage. 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. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.

Storage Requirements: Store in original containers in approved flame-proof area.
No smoking, bare lights, heat or ignition sources.
DO NOT store in pits, depressions, basements or areas where vapors may be trapped. Keep containers securely sealed.
Store away from incompatible materials in a cool, dry well ventilated area.
Protect containers against physical damage and check regularly for leaks.
Observe manufacturer's storing and handling recommendations.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. 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.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Nitrile gloves; Neoprene gloves.
Safety footwear.
Do NOT use this product to clean the skin.

Respiratory Protection:
Exposure Range >1 to 10 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range >10 to 100 ppm: Air Purifying, Negative Pressure, Full Face
Exposure Range >100 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
Cartridge Color: black
Note: must change cartridge at beginning of each shift

Other: Overalls. Eyewash unit. Barrier cream. Skin cleansing cream.

Glove Selection Index:
PE/EVAL/PE ..... Best selection
PVA ..... Best selection
TEFLON ..... Best selection

VITON ..... Best selection
VITON/NEOPRENE ..... Best selection
NITRILE+PVC ..... Poor to dangerous choice for other than short-term immersion
BUTYL ..... 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
NATURAL RUBBER ..... Poor to dangerous choice for other than short-term immersion
BUTYL/NEOPRENE ..... Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, highly flammable liquid; floats on water. Characteristic aromatic odor. Highly volatile. Mixes with alcohol, chloroform, ether, carbon disulfide, carbon tetrachloride, glacial acetic acid, acetone and oils.

Physical State: Liquid
Odor Threshold: 4.68 ppm
Vapor Pressure (kPa): 9.95 at 20 °C
Vapor Density (Air=1): 2.77
Formula Weight: 78.12
Specific Gravity (H_2O=1, at 4 °C): 0.879 at 20 °C
Evaporation Rate: Fast

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 80.1 °C (176 °F)
Freezing/Melting Point: 5.5 °C (41.9 °F)
Volatile Component (% Vol): 100
Water Solubility: 0.18 g/100 g of 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
Oral (man) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 930 mg/kg
Inhalation (rat) LC_{50}: 10000 ppm/7h
Inhalation (human) LC_{Lo}: 2000 ppm/5m
Inhalation (man) TC_{Lo}: 150 ppm/1y - I
Inhalation (human) TC_{Lo}: 100 ppm
Reproductive effector in rats

Irritation
Skin (rabbit): 20 mg/24 hr - mod
Eye (rabbit): 2 mg/24 hr - SEVERE

See *RTECS* CY 1400000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it will be subject to rapid volatilization near the surface and that which does not evaporate will be highly to very highly mobile in the soil and may leach to groundwater. It may be subject to biodegradation based on reported biodegradation of 24% and 47% of the initial 20 ppm in a base-rich para-brownish soil in 1 and 10 weeks, respectively. It may be subject to biodegradation in shallow, aerobic groundwaters, but probably not under anaerobic conditions. If released to water, it will be subject to rapid volatilization; the half-life for evaporation in a wind-wave tank with a moderate wind speed of 7.09 m/sec was 5.23 hours; the estimated half-life for volatilization from a model river one meter deep flowing 1 m/sec with a wind velocity of 3 m/sec is estimated to be 2.7 hours at 20 °C. It will not be expected to significantly adsorb to sediment, bioconcentrate in aquatic organisms or hydrolyze. It may be subject to biodegradation based on a reported biodegradation half-life of 16 days in an aerobic river die-away test. In a marine ecosystem biodegradation occurred in 2 days after an acclimation period of 2 days and 2 weeks in the summer and spring, respectively, whereas no degradation occurred in winter. According to one experiment, it has a half-life of 17 days due to photodegradation which could contribute to removal in situations of cold water, poor nutrients, or other conditions less conductive to microbial degradation. If released to the atmosphere, it will exist predominantly in the vapor phase. Gas-phase will not be subject to direct photolysis but it will react with photochemically produced hydroxyl radicals with a half-life of 13.4 days calculated using an experimental rate constant for the reaction. The reaction time in polluted atmospheres which contain nitrogen oxides or sulfur dioxide is accelerated with the half-life being reported as 4-6 hours. Products of photooxidation include phenol, nitrophenols, nitrobenzene, formic acid, and peroxyacetyl nitrate. It is fairly soluble in water and is removed from the atmosphere in rain.

Ecotoxicity: LC_{50} Clawed toad (3-4 wk after hatching) 190 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Morone saxatilis (bass) 5.8 to 10.9 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Poecilia reticulata (guppy) 63 ppm/14 days /Conditions of bioassay not specified; LC_{50} Salmo trutta (brown trout yearlings) 12 mg/l/1 hr (static bioassay); LD_{50} Lepomis macrochirus (bluegill sunfish) 20 mg/l/24 to 48 hr /Conditions of bioassay not specified; LC_{100} Tetrahymena pyriformis (ciliate) 12.8 mmole/l/24 hr /Conditions of bioassay not specified; LC_{50} Cancer magister (crab larvae) stage 1, 108 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Crangon franciscorum (shrimp) 20 ppm/96 hr /Conditions of bioassay not specified

Henry's Law Constant: 5.3×10^{-3}

BCF: eels 3.5

Biochemical Oxygen Demand (BOD): 1.2 lb/lb, 10 days

Octanol/Water Partition Coefficient: log K_{ow} = 2.13

Soil Sorption Partition Coefficient: K_{oc} = woodburn silt loam 31 to 143

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: Benzene
ID: UN1114
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:** 40

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U019 Toxic Waste, Ignitable Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a), per CAA Section 112 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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Chlorobenzene **CAS Number:** 108-90-7
Chemical Formula: C_6H_5Cl
Structural Chemical Formula: C_6H_5Cl
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

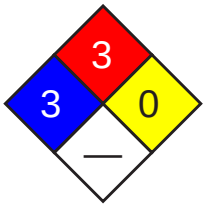
DFG (Germany) MAK
TWA: 10 ppm; PEAK: 20 ppm.

ACGIH TLV
TWA: 10 ppm.

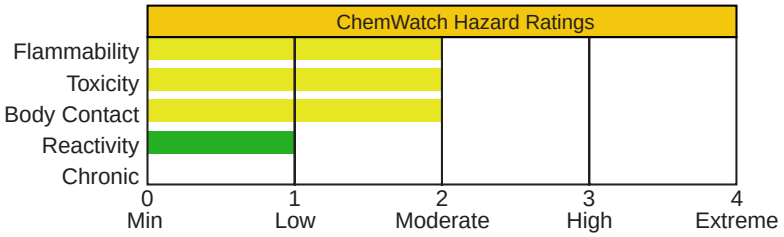
IDLH Level
1000 ppm.

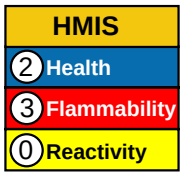
EU OEL
TWA: 23 mg/m^3 (5 ppm); STEL: 70 mg/m^3 (15 ppm).

Section 3 - Hazards Identification



Fire Diamond





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 methemoglinemia, 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 gastocnemius 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.

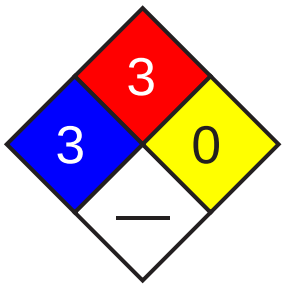
After first aid, get appropriate in-plant, paramedic, or community medical support.

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-chlorophenylmercaturic acid, chlorophenols, chlorocatechols and mandelic acid) Periodic medical

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

See DOT ERG



Fire Diamond

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.

Section 6 - Accidental Release Measures

See DOT ERG

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/m^3: Air Purifying, Negative Pressure, Half Mask
Exposure Range >750 to <1000 mg/m^3: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Exposure Range 1000 to unlimited mg/m^3: 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/m^3
Vapor Pressure (kPa): 1.2 at 20 °C
Vapor Density (Air=1): 3.9
Formula Weight: 112.56
Specific Gravity (H_2O=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) LD_{50}: >2290 mg/kg
Oral (rat) LD_{50}: 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: LC_{50} Poecilia reticulata (guppy) 19 ppm/14 days /Conditions of bioassay not specified; LC_{50} 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; LD_{50} 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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Chloroform
CHL4090

Section 1 - Chemical Product and Company Identification 61

Material Name: Chloroform
CAS Number: 67-66-3
Chemical Formula: $CHCl_3$
Structural Chemical Formula: $CHCl_3$
EINECS Number: 200-663-8
ACX Number: X1000035-4
Synonyms: Chloroform; CHLOROFORM; CHLOROFORME; CLOROFORMIO; FORMYL TRICHLORIDE; FREON 20; METHANE TRICHLORIDE; METHANE,TRICHLORO-; METHENYL CHLORIDE; METHENYL TRICHLORIDE; METHYL TRICHLORIDE; R 20; R 20 (REFRIGERANT); TCM; TRICHLOORMETHAAN; TRICHLORMETHAN; TRICHLOROFORM; TRICHLOROMETHANE; TRICLOROMETANO
General Use: As a solvent for fats, oils, rubber, alkaloids, waxes, gutta-percha and resins; as a cleaning agent; in fire extinguishers to lower the freezing temperature of carbon tetrachloride; in the rubber industry; as a solvent in organic chemistry.
Medical use as anesthetic discontinued because ot toxicity.
Major use in modern industry is in the production of fluorocarbon-22, a refrigerant.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
chloroform	67-66-3	>98

OSHA PEL
Ceiling: 50 ppm, 240 mg/m^3.

ACGIH TLV
TWA: 10 ppm.

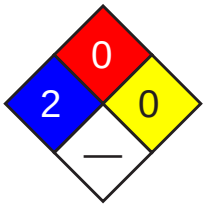
EU OEL
TWA: 10 mg/m^3.

NIOSH REL
STEL: 2 ppm (9.78 mg/m^3) (60-minute).

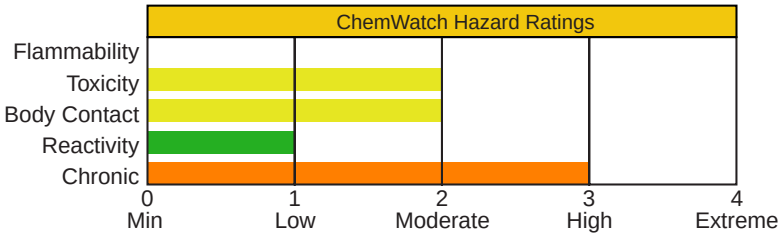
IDLH Level
500 ppm.

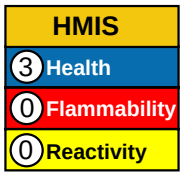
DFG (Germany) MAK
TWA: 0.5 ppm; PEAK: 1 ppm; skin.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless, volatile liquid; ethereal odor. Irritating to eyes/skin/respiratory tract. Toxic. Other Acute Effects: dizziness, liver/kidney damage. Chronic Effects: CNS effects, possible cancer hazard, possible birth defects based on animal data.

Potential Health Effects

Target Organs: liver, kidneys, heart, eyes, skin
Primary Entry Routes: inhalation, ingestion, skin contact/absorption
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.

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).
1000-2000 ppm may cause dizziness, headache, fatigue, salivation and nausea. 4000 ppm may cause vomiting, serious disorientation and a fainting feeling. 14000-16000 ppm may cause anesthesia and rapid loss of consciousness. More than 20000 ppm may cause respiratory failure, cardiac arrhythmias and death. Fatty changes and centrilobular necrosis of the liver and fatty degenerative changes of the kidney and heart may occur.
If death does not occur immediately from respiratory arrest or ventricular fibrillation, it may occur later from liver and kidney damage.
Toxic effects are increased by consumption of alcohol.

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 material may produce moderate eye irritation leading to 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 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 material is highly 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.
Other symptoms include burning of the mouth, throat, esophagus and stomach, diarrhea, abdominal and substernal pain, cold, clammy skin, cyanosis of the extremities and face, muscle cramps, mydriasis, hypotension, peripheral vasodilation, irregular respiration, respiratory failure, unconsciousness and liver damage.

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.

Chronic Effects: Repeated exposure to 77-237 ppm has caused lassitude, dullness, urinary frequency, and gastrointestinal disturbances. Other symptoms include dry mouth, thirst, malaise, anorexia, headache, depression, confusion, weakness, blurred vision, paresthesias, loss of sense of balance, memory loss, tremors, anemia, kidney damage, and fatty degeneration of the liver.
Repeated ingestion may cause liver and kidney damage.
Chloroform is not strongly teratogenic but is embryotoxic. Several epidemiological and ecological studies indicate that there is an association between cancer of the large intestine, rectum, and/or urinary bladder and the constituents of chlorinated water.

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: 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.
Avoid giving milk or oils.
Avoid giving alcohol.

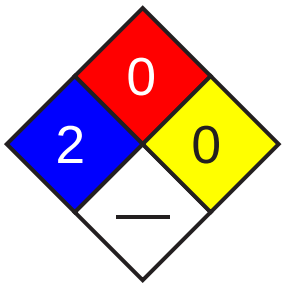
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically. Do not administer sympathomimetic drugs as they may cause ventricular arrhythmias.

Section 5 - Fire-Fighting Measures

Flash Point: Nonflammable
LEL: Not applicable
UEL: Not applicable
Extinguishing Media: There is no restriction on the type of extinguisher which may be used. Use fire fighting procedures suitable for surrounding area.
General Fire Hazards/Hazardous Combustion Products: Nonflammable liquid
Decomposes on heating and produces acrid and toxic fumes of phosgene, carbon dioxide (CO_2), carbon monoxide (CO), chlorine and hydrogen chloride.
Heating may cause expansion or decomposition leading to violent rupture of containers.
Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

See DOT ERG



Fire Diamond

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.
Product is not combustible. No special firefighting procedures required.
Use fire fighting procedures suitable for surrounding area.
If safe to do so, remove containers from path of fire.
Cool fire-exposed containers with water spray from a protected location.

Section 6 - Accidental Release Measures

Small Spills: Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Increase ventilation.
Wipe up and absorb small quantities with vermiculite or other absorbent material.
Place in suitable containers for disposal.
Allow small quantities to evaporate.

See DOT ERG

Large Spills: Contact fire department and tell them location and nature of hazard.
Clear area of personnel and move upwind.
Wear breathing apparatus plus protective gloves. Stop leak if safe to do so.
Absorb or cover spill with sand, earth, inert material or vermiculite.
Collect and seal in labeled drums for disposal.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid breathing vapors and contact with skin and eyes. Avoid contact with strong alkalis.
Avoid sources of heat.
When handling, DO NOT eat, drink or smoke.
Use in a well-ventilated area.
Keep containers securely sealed when not in use.
Prevent concentration in hollows and sumps. DO NOT enter confined spaces until atmosphere has been checked.
Always wash hands with soap and water after handling. Work clothes should be laundered separately.
Recommended Storage Methods: Check that containers are clearly labeled.
Store in metal drums or safety cans.
Glass container.
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: Wear chemical protective gloves, eg. PVC. Wear safety footwear.
Respiratory Protection:
Exposure Range >50 to <500 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face
Exposure Range 500 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Note: poor warning properties

Other: Impervious protective clothingRubber apron.
Ensure there is ready access to a safety shower.

Glove Selection Index:

PE/EVAL/PE ..... Best selection
PVA ..... Best selection
TEFLON ..... Best selection
VITON ..... Satisfactory; may degrade after 4 hours continuous immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, colorless, very volatile liquid with characteristic heavy, "sweetish" ethereal odor and sweet taste. Viscosity is 0.56 mPa sec at 20 °C. Mixes with alcohol, benzene, ether, petroleum ether, carbon tetrachloride, carbon disulfide, and oils.

Physical State: Liquid
Odor Threshold: 250 to 1000 mg/m^3
Vapor Pressure (kPa): 21.2 at 20 °C
Vapor Density (Air=1): 4.13
Formula Weight: 119.37
Specific Gravity (H_2O=1, at 4 °C): 1.489 at 20 °C
pH: Not applicable
pH (1% Solution): Not applicable
Boiling Point: 61.67 °C (143 °F)
Freezing/Melting Point: -63.33 °C (-81.994 °F)
Volatile Component (% Vol): 100
Water Solubility: < 1 mg/mL at 19 °C

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 acetone, strong alkali, nitrogen tetroxide, fluorine, metals (Al, K, Li, Mg, Na, NaK alloy), potassium tert-butoxide, methanol, sodium methoxide, disilane, amd triisopropylphosphine.
Also reacts violently with (acetone + a base), (perchloric acid + phosphorous pentoxide), (KOH + methanol) and (NaOH + methanol).
Attacks, softens and may dissolve rubber, many plastics, paints and coatings.

Section 11 - Toxicological Information

Toxicity

Oral (rat) LD_{50}: 800 mg/kg
Oral (human) LD_{Lo}: 140 mg/kg
Unknown route (human) LD_{Lo}: 546 mg/kg
Inhalation (human) LC_{Lo}: 25000 ppm/5 m
Inhalation (rat) LC_{Lo}: 8000 ppm/4 h
Inhalation (human) TC_{Lo}: 10 mg/m^3/1 y
Inhalation (human) TC_{Lo}: 5000 mg/m^3/7 m

Irritation

Skin (rabbit): 10 mg/24 hr (open) - mild
Skin (rabbit): 500 mg/24 hr - mild
Eye (rabbit): 148 mg
Eye (rabbit): 20 mg/24 hr - moderate

See *RTECS* FS 9100000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Releases to water and land will be primarily lost by evaporation and will end up in the atmosphere. Release to the atmosphere may be transported long distances and will photodegrade with a half-life of a few months. Spills and other releases on land will also leach into the groundwater where it will reside for long periods of time. Will not be expected to bioconcentrate into the food chain but contamination of food is likely due to its use as an extractant and its presence in drinking water.

Ecotoxicity: LC_{50} Micropterus salmoides (largemouth bass) 51 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Daphnia magna (cladoceran) 28,900 ug/l/48 hr in a static bioassay; LC_{50} Salmo gairdneri (rainbow trout) 2030 ug/l soft water, 1240 ug/l hard water (40% teratogenesis), 27 day flow-through tests (20 min after fertilization to 8 days after hatching)

Henry's Law Constant: 3.67 x10^{-3}
BCF: fish < 1
Biochemical Oxygen Demand (BOD): none
Octanol/Water Partition Coefficient: log K_{ow} = 1.97
Soil Sorption Partition Coefficient: K_{oc} = soils 34

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible.
Allow absorbed spillage to evaporate in an open top container, away from habitation.
Bury residue in an authorized landfill.
Return containers to drum reconditioner or recycler.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Chloroform
ID: UN1888
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:** 40

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U044 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: Listed
RQ: 10 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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

1,1-Dichloroethane
ETH8150

Section 1 - Chemical Product and Company Identification 61

Material Name: 1,1-Dichloroethane **CAS Number:** 75-34-3
Chemical Formula: $C_2H_4Cl_2$
Structural Chemical Formula: Cl_2CHCH_3
EINECS Number: 200-863-5
ACX Number: X1002609-2
Synonyms: AETHYLIDENCHLORID; ASYMMETRICAL DICHLOROETHANE; CHLORINATED HYDROCHLORIC ETHER; CHLORURE D'ETHYLIDENE; CLORURO DI ETILIDENE; 1,1-DICHLOORETHAAN; 1,1-DICHLORAETHAN; 1,1-DICHLORETHANE; 1,1-DICHLOROETHANE; ALPHA ALPHA DICHLOROETHANE; DICHLOROETHANE,1,1-; 1,1-DICLOROETANO; ETHANE,1,1-DICHLORO-; ETHYLIDENE CHLORIDE; 1,1-ETHYLIDENE DICHLORIDE; ETHYLIDENE DICHLORIDE
General Use: Extraction solvent, fumigant.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
1,1-dichloroethane	75-34-3	>99

OSHA PEL
TWA: 100 ppm; 400 mg/m^3.

ACGIH TLV
TWA: 100 ppm.

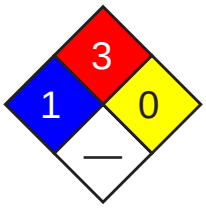
EU OEL
TWA: 100 ppm.

NIOSH REL
TWA: 100 ppm (400 mg/m^3) (Chloroethanes).

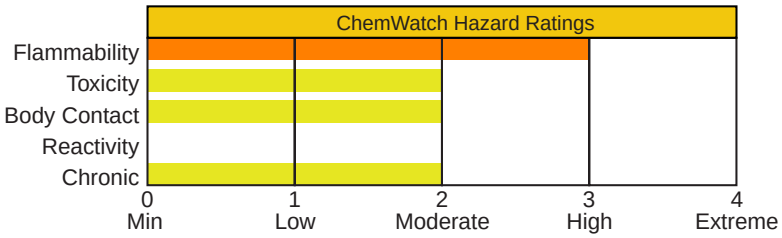
IDLH Level
3000 ppm.

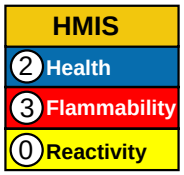
DFG (Germany) MAK
TWA: 100 ppm; PEAK: 200 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; chloroform odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: dizziness, coughing, staggering, disturbed vision, irregular heartbeat, unconsciousness, coma, pulmonary edema. Chronic Effects: rash, neurological effects. Flammable.

Potential Health Effects

Target Organs: skin, central nervous system (CNS), liver, kidneys
Primary Entry Routes: inhalation, skin contact
Acute Effects
Inhalation: The vapor is discomforting to the upper respiratory tract and lungs.
1,1-dichloroethane is reported to produce salivation, sneezing and coughing in exposed workers. In the few cases of reported intoxication the anticipated anesthetic effects have been observed with associated dizziness, nausea and vomiting. In severe or fatal cases hepatic and renal injury has been described.
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).

Eye: The liquid 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 liquid is discomforting to the skin and is capable of causing skin reactions which may lead to dermatitis from repeated exposures over long periods or if exposure is prolonged.
The liquid may cause more severe response, even a burn, if exposure is prolonged.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.
The liquid is discomforting to the gastrointestinal tract and 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 - Class A4, Not classifiable as a human carcinogen; EPA - Class C, Possible human carcinogen; MAK - Not listed.

Chronic Effects: Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.
Excessive exposure may cause kidney injury; liver injury is not likely.
Birth defects are unlikely. Even exposures having an adverse effect on the mother should have no effects on the fetus.

Section 4 - First Aid Measures

See DOT ERG

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.
Avoid giving milk or oils.
Avoid giving alcohol.

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

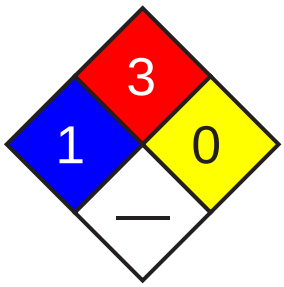
Note to Physicians: Treat symptomatically. For ingestion, consider gastric lavage.
Do not administer sympathomimetic drugs as they may cause ventricular arrhythmias.

Section 5 - Fire-Fighting Measures

See DOT ERG

Flash Point: 13.889 °C Open Cup
Autoignition Temperature: 458 °C
LEL: 5.6% 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.



Fire Diamond

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, phosgene and carbon dioxide (CO_2).

Fire Incompatibility: Avoid reaction with strong oxidizing agents, alkalis, amines, aluminum and its alloys.

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.
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.
DO NOT use aluminum 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.
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; or as required, 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.
Respiratory Protection:
Exposure Range >100 to <3000 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask

Exposure Range 3000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Note: poor warning properties

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

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless, neutral, volatile mobile liquid with a chloroform odor and a sweet taste similar to saccharin. Mixes with alcohol, ether, acetone and benzene.

Physical State: Liquid
Odor Threshold: 445.5 to 810 mg/m^3
Vapor Pressure (kPa): 24.34 at 20 °C
Vapor Density (Air=1): 3.42
Formula Weight: 98.96
Specific Gravity (H_2O=1, at 4 °C): 1.174
Evaporation Rate: 11.6 (BuAc=1)

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 57.3 °C (135 °F)
Freezing/Melting Point: -96.9 °C (-142.42 °F)
Volatile Component (% Vol): 100
Water Solubility: 0.5 g/100 ml water 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 storage with strong oxidizing agents, alkalis, amines, aluminum and its alloys.

Section 11 - Toxicological Information

Toxicity
Oral (rat) LD_{50}: 725 mg/kg
Inhalation (rat) LC_{Lo}: 16000 ppm/4 hr
Equivocal tumorigenic agent by RTECS criteria.

Irritation
Nil reported

See *RTECS* KI 0175000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released on land, it will rapidly volatilize, although it may also leach into groundwater where its fate is unknown. Bioconcentration in aquatic organisms will not be important. If released in water it will be removed by volatilization with a half-life of 6-9 days, 5-8 days, and 24-32 hr, respectively in a typical pond, lake, or river. In the atmosphere, it will degrade (half-life 62 days) by reaction with photochemically produced hydroxyl radicals, and it will be scavenged by rain.

Ecotoxicity: LC_{50} Lepomis macrochirus (bluegill) 550 ppm/96 hr, static bioassay in fresh water at 23 °C; mild aeration applied after 24 hr (no specific isomer; LC_{50} Poecilia reticulata (guppies) 202 ppm/7 days. /Conditions of bioassay not specified; TL_m Lagodon rhomboides (pinperch) 160 mg/l/24 hr. /Conditions of bioassay not specified; TL_m Artemia salina (brine shrimp) 320 mg/l/24 hr. /Conditions of bioassay not specified

BCF: estimated at 1.3

Biochemical Oxygen Demand (BOD): 0.05 g/g, 10 days

Octanol/Water Partition Coefficient: log K_{ow} = 1.9

Soil Sorption Partition Coefficient: K_{oc} = estimated at 43

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: 1,1-Dichloroethane
ID: UN2362
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:** 40

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U076 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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Ethylene Dichloride
DIC4250

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Ethylene Dichloride
CAS Number: 107-06-2
Chemical Formula: $C_2H_4Cl_2$
Structural Chemical Formula: ClH_2CCH_2Cl
EINECS Number: 203-458-1
ACX Number: X1000031-6
Synonyms: AETHYLENCHLORID; 1,2-BICHLOROETHANE; BICHLORURE D'ETHYLENE; BORER SOL; BROCIDE; CHLORURE D'ETHYLENE; CLORURO DI ETHENE; 1,2-DCE; DESTRUXOL BORER-SOL; 1,2-DICHLOORETHAAN; 1,2-DICHLOR-AETHAN; DICHLOREMULSION; 1,2-DICHLORETHANE; DI-CHLOR-MULSION; DICHLOR-MULSION; 1,2-DICHLOROETHANE; ALPHA,BETA-DICHLOROETHANE; BETA-DICHLOROETHANE; DICHLORO-1,2-ETHANE; SYM-DICHLOROETHANE; DICHLOROETHYLENE; 1,2-DICLOROETANO; DUTCH LIQUID; DUTCH OIL; EDC; ENT 1,656; ETHANE DICHLORIDE; ETHANE,1,2-DICHLORO-; ETHYLEENDICHLORIDE; ETHYLENE CHLORIDE; 1,2-ETHYLENE DICHLORIDE; ETHYLENE DICHLORIDE; FREON 150; GLYCOL DICHLORIDE; NU-G00511; RY DICHLORO-1,2-ETHANE
Derivation: Prepared from reaction of acetone and hydrochloric acid, or ethylene and chloride gas.
General Use: Used primarily as an intermediate in the manufacture of vinyl chloride; also used as a degreaser, as a scavenger in leaded gasoline, in paint removers, in wetting and penetrating agents, in ore floatation processes, as a fumigant, and as a solvent for fats, oils, waxes and gums.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Ethylene dichloride	107-06-2	ca 100% vol

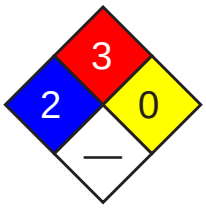
OSHA PEL
TWA: 50 ppm; Ceiling: 100 ppm; 200 ppm, 5-minute maximum peak in any 3 hours.

NIOSH REL
TWA: 1 ppm (4 mg/m^3); STEL: 2 ppm (8 mg/m^3) (Chloroethanes).

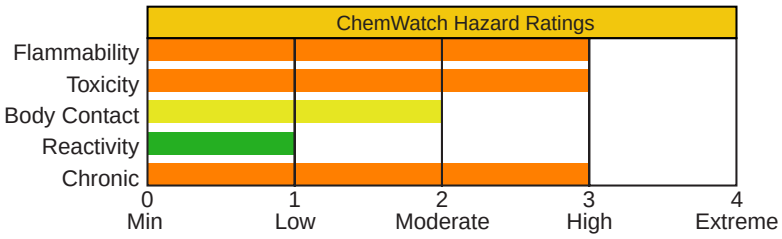
ACGIH TLV
TWA: 10 ppm.

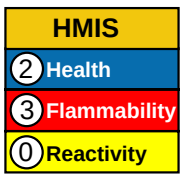
IDLH Level
50 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear, colorless liquid; sweet chloroform-like odor. Irritating to respiratory tract. Other Acute Effects: intoxication, CNS depression, vomiting, dizziness, diarrhea, liver/kidney damage, cardiac arhythmia, coma. death. Possible human carcinogen. Highly flammable. Reacts violently with amines and finely divided alkali metals.

Potential Health Effects

Target Organs: Liver, kidneys, heart, gastrointestinal tract, respiratory tract, skin, CNS, eyes; in animal testing, adrenal glands; cancer sites: forestomach, mammary gland, and circulatory system
Primary Entry Routes: Inhalation, skin and/or eye contact/absorption

Acute Effects Note: Nursing infants of mothers exposed to ethylene dichloride are at risk.

Inhalation: Inhalation may result in respiratory tract irritation, pulmonary edema, dizziness, vomiting, coma and delayed death.

Eye: At high concentrations vapors are irritating. Contact with liquid may cause pain, irritation, lacrimation, and, if not rapidly removed, permanent clouding of the cornea.

Skin: Skin contact with this defatting agent can cause drying and chapping. Prolonged contact with the skin, as when held tightly on skin with clothing, produces severe irritation, moderate edema, and necrosis. Absorption can result in acute systemic effects; only large doses produce serious poisoning.

Ingestion: CNS depression, gastrointestinal upset, mental confusion, dizziness, nausea, and vomiting may result from ingestion and may pose an aspiration hazard. Deaths have occurred from ingestion of 8-200 mL.

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 A4, Not classifiable as a 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: Liver and kidney disease, cardiovascular and CNS disorders; conditions requiring the use of insulin or anti-coagulants may be aggravated by exposure to ethylene dichloride.

Chronic Effects: Long term exposure can result in hepatotoxicity (liver damage), nephrotoxiciy (kidney damage), weight loss, low blood pressure, jaundice, oliguria (reduced urine excretion), anemia, CNS depression, insomnia, nausea, vomiting, pulmonary congestion, and adrenal gland damage. Animal studies suggest that immunologic suppression may occur. Repeated skin contact may produce dermatitis with rough, red, dry, cracking skin.

Section 4 - First Aid Measures

See DOT ERG

Inhalation: Remove exposed person to fresh air, monitor for respiratory distress, 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 advised otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water. *Do not* induce vomiting. Consult physician immediately.

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

Note to Physicians: Implement medical surveillance procedures for workers with potential for exposure. Monitor prothrombin time, serum glucose, electrolytes, liver function, and renal function in severe cases, and arterial blood gases and chest x-ray if respiratory tract irritation is present. Treat overexposure symptomatically and supportively.

Section 5 - Fire-Fighting Measures

See DOT ERG

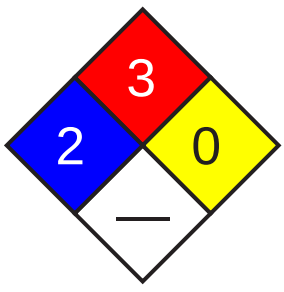
Flash Point: 56 °F (13 °C) CC; 64°F (18 °C) OC

Autoignition Temperature: 775 °F (413 °C)

LEL: 6.2% v/v

UEL: 15.9% v/v

Flammability Classification: OSHA Class IB Flammable Liquid



Fire Diamond

Extinguishing Media: To extinguish fires involving this flammable liquid, use carbon dioxide, dry chemical, alcohol-resistant foam, water spray or fog. Water may be an ineffective extinguishing medium, but a water spray can be used to cool fire-exposed containers, and flush spills away from ignition sources.

General Fire Hazards/Hazardous Combustion Products: Include carbon oxides, acetylene, vinyl chloride, hydrogen chloride, and phosgene gas. In still air or confined spaces the heavier-than-air vapors of ethylene dichloride may travel along low-lying surfaces to distant ignition sources and flashback. Forms dense soot on burning. Vapors may form explosive mixtures with air.

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways. Remove containers from fire hazard area if feasible. Otherwise, cool fire-exposed containers until well after the fire is extinguished. Structural protective clothing is permeable, remain clear of smoke, water fallout, and water runoff. 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.

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, isolate area and deny entry. Remove sources of ignition, and provide maximum explosion-proof ventilation. Stay upwind and have cleanup personnel protect against inhalation and contact. Use appropriate foam to blanket release and suppress vapors.

See DOT ERG

Small Spills: Absorb ethylene dichloride with vermiculite, earth, sand or similar material.

Large Spills: For large spills, dike far ahead of liquid spill for later disposal. Do not release into sewers or waterways. Ground all tools. Use nonsparking equipment.

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

Section 7 - Handling and Storage

Handling Precautions: Avoid inhalation of vapors, contact with skin and eyes. Use only with ventilation sufficient to maintain airborne concentrations at nonhazardous levels (see Sec. 2). Wear protective gloves, goggles, and clothing (see Sec. 2). Keep away from heat and ignition sources. Ground and bond containers during transfers to prevent static sparks.

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 well-ventilated area, away from heat, ignition sources and incompatibles (see Sec. 10). Ethylene dichloride is normally packaged under nitrogen gas.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where possible, transfer ethylene dichloride from drums or other storage containers to process containers in a closed system. Minimize ignition sources in surrounding low-lying areas where ethylene chloride vapors may collect. Elec trically ground and bond all containers and equipment. Install Class I, Group D electrical equipment. Provide gen eral or local explosion-proof 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: Advise employees of potential health hazards associated with occupational exposure to ethylene dichloride. Consider preplacement and periodic medical exams with emphasis on the skin, eyes, respiratory tract, CNS, cardiovascular sys tem, and liver and kidney function.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets of Barricade™, Viton™, Teflon™, or Responder™ (Breakthrough Time (BT) >8 hr), if possible, or alternatively, polyvinyl alcohol, 4H™ (PE/EVAL) (BT >4 hr) to prevent prolonged or repeated skin contact. Butyl rubber, natural rubber, polyethylene, Neoprene, nitrile rubber, and polyvinyl chloride (BT < 1 hr) will rapidly degrade in the presence of ethylene dichloride, and are not recommended for protective cloth ing. Wear splash-proof chemical goggles and faceshield, 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 con tact 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 con tamination, and presence of sufficient oxygen. At concentrations above the NIOSH RELs, use any SCBA with full facepiece operated in pressure-demand or other positive-pressure mode, or any supplied-air respirator with full facepiece operated in pres sure-demand or other positive pressure mode in combination with 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. 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: Clear, colorless with a sweet chloroform- like odor characteristic of chlorinated hydrocarbons.

Physical State: Liquid

Odor Threshold: 24 to 440 mg/m^3

Vapor Pressure (kPa): 87 mm Hg at 77 °F (25 °C)

Formula Weight: 98.96

Specific Gravity (H_2O=1, at 4 °C): 1.26 at 69 °F (20 °C)

Refractive Index: 1.445 at 69 °F (20 °C)

Boiling Point: 182.3 °F (83.5 °C)

Freezing/Melting Point: -31.9 °F (-35.5 °C)

Viscosity: 0.84 cP at 68 °F (20 °C)
Surface Tension: 32.2 dynes/cm
Ionization Potential (eV): 11.05 eV
Water Solubility: 8.7 g/L at 68 °F (20 °C)
Other Solubilities: Alcohol, chloroform, ether, acetone, carbon tetrachloride

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Ethylene dichloride is stable at room temperature in closed containers under normal storage and handling conditions. However, over time, it slowly decomposes, becomes acidic and darkens in color. Hazardous polymerization cannot occur. Heat and incompatibles.

Storage Incompatibilities: Violent reactions can result from contact with liquid ammonia; nitrogen tetraoxide; chlorine; dimethylaminopropylamine; finely divided metals including aluminum, potassium, and magnesium; other alkalis, amines, strong oxidizers, strong acids, strong bases, and reducing agents. Ethylene dichloride can corrode steel, iron and other metals.

Hazardous Decomposition Products: Thermal oxidative decomposition of ethylene dichloride produces carbon oxides (CO_x), acetylene, vinyl chloride, hydrogen chloride (HCl), and phosgene gas.

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral, LD_{50}: 670 mg/kg.

Human, LD_{Lo}: 286 mg/kg produced toxic effects including ulceration or bleeding from stomach, nausea or vomiting, and fatty liver degeneration.

Human, TD_{Lo}: 428 mg/kg produced somnolence, cough, nausea or vomiting.

Human, TD_{Lo}: 892 mg/kg produced hypermotility, diarrhea, nausea or vomiting, and liver effects.

Acute Inhalation Effects:

Human, inhalation, TC_{Lo}: 4000 ppm/1 hr produced flaccid paralysis without anesthesia, coma, and nausea or vomiting.

Rat, inhalation, TC_{50}: 1000 ppm/7 hr produced coma, cyanosis, and body temperature decrease.

Acute Skin Effects:

Rabbit, skin, LD_{50}: 2800 mg/kg produced lacrimation, general anesthesia, and ataxia.

Irritation Effects:

Rabbit, ocular, 63 mg, 24 hr, caused severe irritation.

Other Effects:

Multiple Dose Toxicity Effects: Rat, inhalation, 1500 ppm/7 hr/5 days administered intermittently produced respiratory depression, changes in kidney, ureter or bladder tubules, and death.

Guinea pig, inhalation, 100 ppm/226 day, 7 hr/day, caused body weight loss, and increased liver weight.

Mouse, oral, 4.89 mg/kg/14 day, caused a 30% decrease in leukocyte number and suppressed humoral immune response.

Reproductive Effects: Rat, intrauterine, 1.5 ppm, day 7- term, resulted in increased rates of fetal heart defects.

Genetic Effects: Rat, oral, 150 mg/kg, resulted in DNA damage.

Tumorigenicity - Rat, inhalation, 5 ppm/7 hr/78 weeks, administered intermittently, resulted in production of tumors (skin and appendages) and leukemia.

Rat, oral, 47 mg/kg/day/78 weeks, caused increase in hemangiosarcomas of the circulatory system, squamous cell carcinomas of the forestomach, mammary gland adenocarcinomas and fibroadenomas.

See *RTECS* KI0525000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Because of its moderately high vapor pressure, ethylene dichloride will readily evaporate from surface water (estimated half-life several hours to 10 days), as well as soil. It is not known to bioaccumulate. In the atmosphere, ethylene dichloride may be transported over long distances, and will degrade primarily by photo-oxidation (half-life: 1 month). In groundwater, this chemical does not readily degrade. Ethylene dichloride does not readily sorb and is highly mobile in the soil column.

Ecotoxicity: Stonefly (*Pteronarcys*), LC_{50}=100 mg/L/96 hr; rainbow trout (*Salmo gairdneri*), LC_{50}=225 mg/L/96 hr; bluegill (*Lepomis macrochirs*), LC_{50}=1430 mg/L/96 hr; fathead minnow (*Pimephales promelas*), LC_{50}=136 mg/L/96 hr.

Henry's Law Constant: 1.10×10^{-3} atm-m^3/mole

Octanol/Water Partition Coefficient: log K_{ow} = 1.48

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):

Shipping Name and Description: Ethylene dichloride
ID: UN1184
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid, 6.1 - Poison *or* Poison Inhalation Hazard *if inhalation hazard, Zone A or B*
Special Provisions: IB2, T7, TP1
Packaging: **Exceptions:** None **Non-bulk:** 202 **Bulk:** 243
Quantity Limitations: **Passenger aircraft/rail:** 1 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** B **Other:** 40

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U077 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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Vinylidene Chloride
DIC4450

Section 1 - Chemical Product and Company Identification 61

Material Name: Vinylidene Chloride
CAS Number: 75-35-4
Chemical Formula: $C_2H_2Cl_2$
Structural Chemical Formula: $H_2C=CCl_2$
EINECS Number: 200-864-0
ACX Number: X1003497-6
Synonyms: 1,1-DICHLOROETHYLENE; ASYM-DICHLOROETHYLENE; CHLORURE DE VINYLIDENE; 1,1-DCE; 1,1-DICHLOROETHENE; 1,1-DICHLOROETHENE (9CI); AS-DICHLOROETHYLENE; ETHENE,1,1-DICHLORO-; ETHYLENE,1,1-DICHLORO-; SCONATEX; VDC; VINYLIDENE CHLORIDE; VINYLIDENE CHLORIDE (II); VINYLIDENE CHLORIDE (INHIBITED); VINYLIDENE CHLORIDE MONOMER; VINYLIDENE CHLORIDE(II); VINYLIDENE CHLORIDE,INHIBITED; VINYLIDENE CHLORIDE,MONOMER; VINYLIDENE DICHLORIDE; VINYLIDINE CHLORIDE
General Use: Reactive monomer in manufacture of vinylidene polymer plastics and copolymers.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
vinylidene chloride	75-35-4	>98

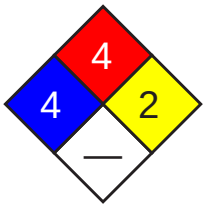
OSHA PEL

NIOSH REL

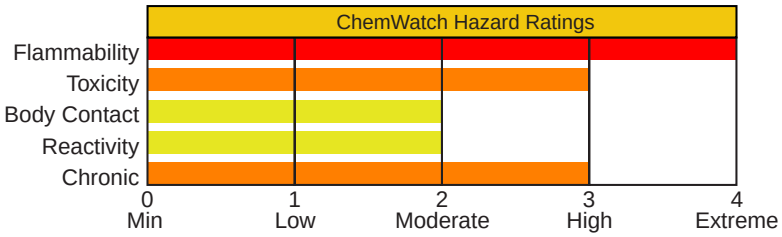
DFG (Germany) MAK
TWA: 2 ppm; PEAK: 4 ppm.

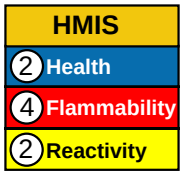
ACGIH TLV
TWA: 5 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; sweet odor. Irritating. Other Acute Effects: narcosis, drunkenness, unconsciousness, conjunctivitis, transient corneal injury, iritis. Chronic Effects: hepatic/renal dysfunction. Flammable.

Potential Health Effects

Target Organs: skin, eyes, central nervous system (CNS), liver, kidneys
Primary Entry Routes: inhalation
Acute Effects

Inhalation: 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).
Vapor concentrations of 400 ppm are said to induce symptoms of drunkenness leading to unconsciousness.
Extensive hemorrhagic centrolobular liver necrosis was seen in rats 6 hours after a 4-hour exposure to 200 ppm.

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 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 may produce skin discomfort following prolonged contact.
Defatting and/or drying of the skin may lead to dermatitis.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.
The liquid is highly discomforting to the gastrointestinal tract and toxic if swallowed.
Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.
A single oral dose of 500 mg/kg elicited extensive liver enzyme changes.
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.

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 C, Possible human carcinogen; MAK - Class B, Justifiably suspected of having carcinogenic potential.

Chronic Effects: The material may accumulate in the human body and progressively cause tissue damage.
Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.
Vinylidene chloride is toxic to the liver and kidneys. After exposure to 48 ppm continuously for 90 days, liver damage was evident in rats and deaths occurred among monkeys and guinea pigs. In this study only rats showed evidence of renal (kidney) tubular injury.
It is proposed that vinylidene chloride may undergo microsomal oxidation to produce oxiranes. These are highly reactive and covalently bind to nucleic acids producing mutations and possibly cancers. The monohalogenated alkenes are thought be more carcinogenic than their dihalogenated counterparts.

Section 4 - First Aid Measures

See DOT ERG

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.
Avoid giving milk or oils.
Avoid giving alcohol.

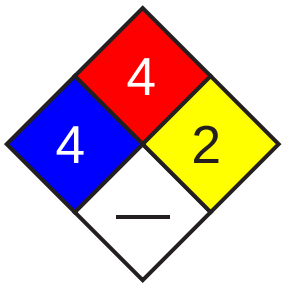
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treatment that is employed in carbon tetrachloride exposures follows:
1.Acute exposures to carbon tetrachloride present, initially, with CNS depression followed by hepatic and renal disfunction.
2.Respiratory depression and cardiac dysrhythmias are an immediate threat to life.
3.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.
4.Ipecac syrup, lavage, activated charcoal or catharsis may all be used in the first 4 hours.
5.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: -16.111 °C Open Cup
Autoignition Temperature: 570 °C
LEL: 7.3% v/v
UEL: 16% 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 any contamination of this material as it is very reactive and any contamination is potentially hazardous. Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.
Polymerization may occur at elevated temperatures.
Polymerization may be accompanied by generation of heat as exotherm.
Process is self accelerating as heating causes more rapid polymerization.
Exotherm may cause boiling with generation of acrid, toxic and flammable vapor.
Polymerization and exotherm may be violent if contamination with strong acids, amines or catalysts occurs.
Polymerization and exotherm of material in bulk may be uncontrollable and result in rupture of storage tanks.
Polymerization may occur if stabilizing inhibitor becomes depleted by aging.
Stabilizing inhibitor requires dissolved oxygen to be present in liquid for effective action.
Specific storage requirements must be met for stability on ageing and transport.
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.

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

See DOT ERG

Section 7 - Handling and Storage

Handling Precautions: Material contains a stabilizer / polymerization inhibitor system that provides workable but not indefinite shelf life.
Storage at higher temperatures and long term storage may result in polymerization with solidification. In larger quantities e.g. 200 l drums this may result in generation of heat (exotherm); which may release highly irritating hot vapor. Do not open hot exotherming drums - cool externally with water to avoid vapor release.
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.
DO NOT use aluminum or galvanized containers.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. 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; 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 Butyl rubber gloves or Nitrile rubber gloves.
Safety footwear.
Respiratory Protection:
Exposure Range >5 to 250 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask
Exposure Range >250 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
Note: poor warning properties
Other: Overalls. Eyewash unit.
Glove Selection Index:
PVA ..... Best selection
VITON ..... Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless highly flammable liquid with pleasant chloroform-like odor. Soluble in organic solvents. Presence of a stabilizing inhibitor prevents / retards peroxide formation.

Physical State: Liquid
Odor Threshold: 2000 to 5500 mg/m^3
Vapor Density (Air=1): >1
Formula Weight: 96.94
Specific Gravity (H_2O=1, at 4 °C): 1.2129
Evaporation Rate: Fast
pH: Not applicable
pH (1% Solution): Not applicable
Boiling Point: 31.7 °C (89 °F) at 760 mm Hg
Freezing/Melting Point: -122.5 °C (-188.5 °F)
Water Solubility: 0.04% by weight

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: May form explosive peroxides on standing or following concentration by distillation.

Review of stocks and testing for peroxide content by given tested procedures at 3-monthly intervals is recommended, together with safe disposal of peroxidic samples.
Peroxide containing residues can often be rendered innocuous by pouring into an excess of sodium carbonate solution.
Presence of a stabilizing inhibitor prevents/retards peroxide formation.
Stable under controlled storage conditions provided material contains adequate stabilizer/polymerization inhibitor.
Bulk storages may have special storage requirements.
In absence of inhibitor and in the presence of air, vinylidene chloride rapidly absorbs oxygen with formation of a violently explosive peroxide.
Peroxides initiate vinylidene chloride polymerization, producing insoluble polymer which absorbs peroxide. This results in separated polymer with concentrate of peroxide. In the dry state and 15% or more peroxide present this is readily detonated by heat or shock.
Hindered phenols are suitable inhibitors to prevent peroxidation.

Storage Incompatibilities: WARNING: Long standing in contact with air and light may result in the formation of potentially explosive peroxides.
Avoid any contamination of this material as it is very reactive and any contamination is potentially hazardous.
Explosion hazard may follow contact with incompatible materials.
Contamination with polymerization catalysts - peroxides, persulfates, oxidizing agents - also strong acids, strong alkalies, will cause polymerization with exotherm - generation of heat. Polymerization of large quantities may be violent - even explosive.
Light or water tend to promote self-polymerization.
Haloalkenes are highly reactive. Some of the more lightly substituted lower members are highly flammable; many members of the group are peroxidizable and polymerizable.
When stored at between -40 and 25 C in the absence of an inhibitor and in the presence of air, vinylidene chloride rapidly absorbs oxygen with the formation of a violently explosive peroxide. This peroxide initiates polymerization to produce an insoluble polymer which adsorbs the peroxide. Separation of the polymer in the dry state must be avoided since if more than 15% of the peroxide is present, the polymer may be detonatable by slight shock or friction.
Hindered phenols have been used to prevent peroxidation. Reaction products with ozone are particularly dangerous.

Section 11 - Toxicological Information

Toxicity
Oral (rat) LD_{50}: 200 mg/kg
Inhalation (human) TC_{Lo}: 25 ppm
Inhalation (rat) LC_{50}: 6350 ppm/4 hr

Irritation
Nil reported

See *RTECS* KV 9275000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Once in the atmosphere it will degrade rapidly by photooxidation with a half-life of 11 hours in relatively clean air or under 2 hours in polluted air. If spilled on land, part will evaporate and part will leach into the groundwater where its fate is unknown, but degradation is expected to be slow based upon microcosm studies. It would not be expected to bioconcentrate into fish.

Ecotoxicity: LC_{50} Cyprinodon variegatus (sheepshead minnow) 249 mg/l/24 hr, 48 hr, 72 hr, 96 hr in a static bioassay using sea water; EC_{50} Skeletonema costatum (alga) > 712,000 ug/l/96 hr, Toxic effects: Inhibition chlorophyll synthesis; reduced cell counts. /Conditions of bioassay not specified; LC_{50} Lepomis macrochirus (bluegill) 74 mg/l at 24 hr & 96 hr, temp at 21-23 °C, water hardness 32-48 mg/l (calcium carbonate), pH 6.7-7.8, dissolved oxygen concentration 7.0-8.8 mg/l (static bioassay); LC_{50} Mysidopsis bahia (mysid shrimp) > 798 mg/l/24 hr, 48 hr, 72 hr; 224 mg/l/96 hr in a static bioassay using seawater; LC_{50} Menidia beryllina (inland silverside) 250 ppm/96 hr in a static bioassay in synthetic seawater at 23 °C with mild aeration

Henry's Law Constant: 2.61×10^{-2}

BCF: not significant

Octanol/Water Partition Coefficient: log K_{ow} = 1.48

Soil Sorption Partition Coefficient: K_{oc} = estimated at 150

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: Vinylidene chloride, stabilized
ID: UN1303
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: I - Great Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: T12, TP2, TP7
Packaging: **Exceptions:** 150 **Non-bulk:** 201 **Bulk:** 243
Quantity Limitations: **Passenger aircraft/rail:** 1 L **Cargo aircraft only:** 30 L
Vessel Stowage: **Location:** E **Other:** 40

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U078 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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

cis-Acetylene Dichloride
DIC4550

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: cis-Acetylene Dichloride **CAS Number:** 156-59-2
Chemical Formula: $C_2H_2Cl_2$
Structural Chemical Formula: CHCl=CHCl
EINECS Number: 205-859-7
ACX Number: X1007815-0
Synonyms: ACETALYNE DICHLORIDE; CIS-ACETYLENE DICHLORIDE; CIS-1,2-DICHLORETHYLENE; 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

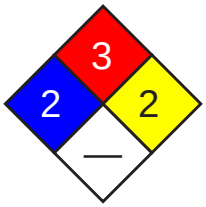
OSHA PEL
TWA: 200 ppm; 790 mg/m^3.

NIOSH REL

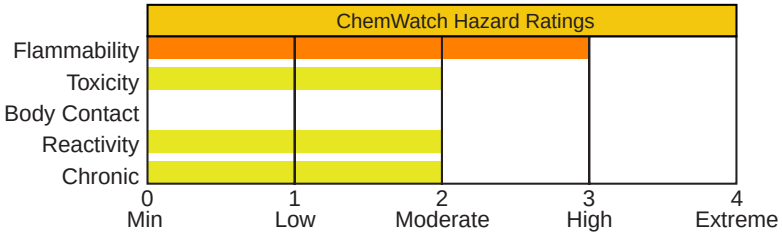
DFG (Germany) MAK
TWA: 200 ppm; PEAK: 400 ppm.

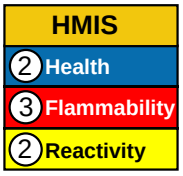
ACGIH TLV
TWA: 200 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!


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 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: • 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.

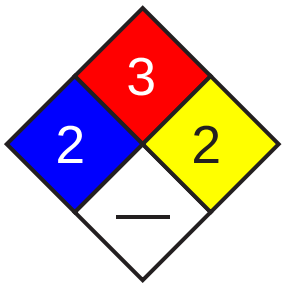
After first aid, get appropriate in-plant, paramedic, or community medical support.

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.

See DOT ERG



Fire Diamond

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.

Section 6 - Accidental Release Measures

See DOT ERG

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
Odor Threshold: 0.085 ppm
Vapor Pressure (kPa): 200 mm Hg at 25 °C
Vapor Density (Air=1): 3.34
Formula Weight: 96.94
Specific Gravity (H_2O=1, at 4 °C): 1.2837 at 20 °C/4 °C
Boiling Point: 60.3 °C (141 °F) at 760 mm Hg
Freezing/Melting Point: -80.5 °C (-112.9 °F)
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 alkalies or their concentrated solutions will form chloracetylene which ignites in air. Haloalkenes are highly reactive.

Section 11 - Toxicological Information

Toxicity

Inhalation (mouse) LC_{Lo}: 65000 mg/m^3/2 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: LC_{50} Lepomis machrochirus (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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Ethylbenzene **CAS Number:** 100-41-4
Chemical Formula: C_8H_{10}
Structural Chemical Formula: $C_6H_5 \cdot C_2H_5$
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.

ACGIH TLV
TWA: 100 ppm; STEL: 125 ppm.

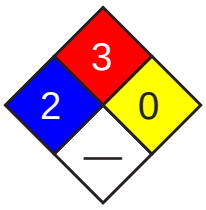
EU OEL
TWA: 100 ppm; STEL: 200 ppm.

NIOSH REL
TWA: 100 ppm (435 mg/m^3); STEL: 125 ppm (545 mg/m^3).

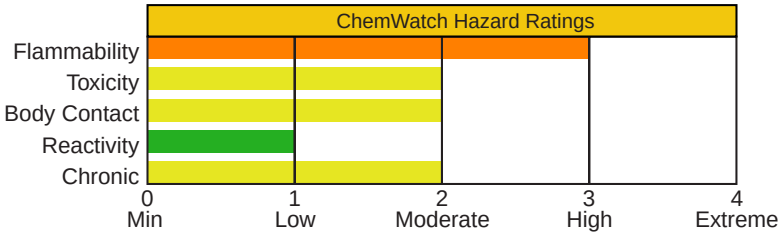
IDLH Level
800 ppm (10% LEL).

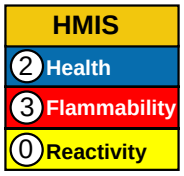
DFG (Germany) MAK
Skin.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!


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/m^3 (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

See DOT ERG

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.

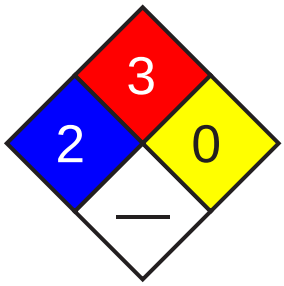
Note to Physicians: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:

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.

See DOT ERG



Fire Diamond

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.

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.
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: 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/m^3
Vapor Pressure (kPa): 1.333 at 25.9 °C
Vapor Density (Air=1): 3.66
Formula Weight: 106.17
Specific Gravity (H_2O=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) LD_{50}: 3500 mg/kg
Inhalation (human) TC_{Lo}: 100 ppm/8h
Inhalation (rat) LC_{Lo}: 4000 ppm/4h
Intraperitoneal (mouse) LD_{50}: 2642 mg/kg~
Dermal (rabbit) LD_{50}: 17800 mg/kg~
Liver changes, utheral 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 exist 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: LC_{50} Cyprinodon variegatus (sheepshead minnow) 275 mg/l 96 hr in a static unmeasured bioassay; LC_{50} 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 ; LC_{50} Palaemonetes pugio (grass shrimp, adult) 14,400 ug/l/24 hr in a static unmeasured bioassay; LC_{50} 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: 8.44×10^{-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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Methylene Chloride
MET5440

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Methylene Chloride **CAS Number:** 75-09-2
Chemical Formula: CH_2Cl_2
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.

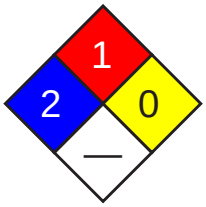
OSHA PEL
TWA: 25 ppm; STEL: 125 ppm.

NIOSH REL

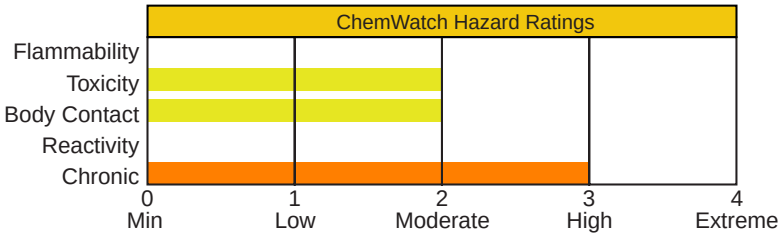
ACGIH TLV
TWA: 50 ppm.

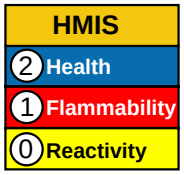
IDLH Level
2300 ppm.

Section 3 - Hazards Identification



Fire Diamond





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

See DOT ERG

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.

Section 5 - Fire-Fighting Measures

See DOT ERG

Flash Point: Methylene chloride does not have a flash point by standard tests. However, it does form flammable mixtures with air.

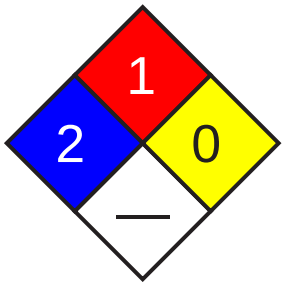
Autoignition Temperature: 1033 °F (556 °C)

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 Diamond

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.

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).

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/m^3

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 (H_2O=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 tetraoxide, 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, LD_{50}: 1600 mg/kg.

Human, oral, LD_{Lo}: 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), LC_{50} = 193 mg/L/96 hr; *Lepomis macrochirus* (bluegill), LC_{50} = 230 mg/L/24 hr; *Poecilia reticulata* (guppies), LC_{50} = 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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Methyl Isobutyl Ketone
MET3360

Section 1 - Chemical Product and Company Identification 61

Material Name: Methyl Isobutyl Ketone **CAS Number:** 108-10-1
Chemical Formula: $C_6H_{12}O$
Structural Chemical Formula: $(CH_3)_2CHCH_2COCH_3$
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.

ACGIH TLV
TWA: 50 ppm; STEL: 75 ppm.

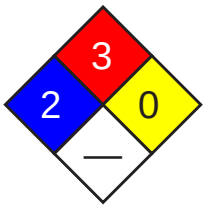
EU OEL
TWA: 20 ppm; STEL: 50 ppm.

NIOSH REL
TWA: 50 ppm (205 mg/m^3); STEL: 75 ppm (300 mg/m^3).

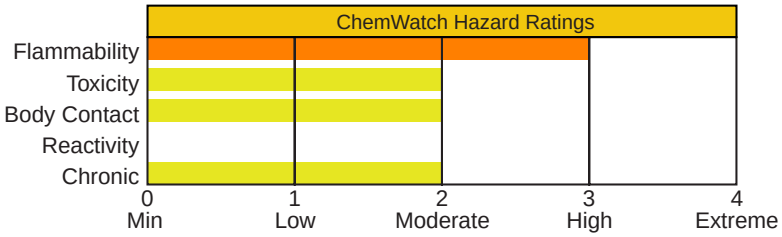
IDLH Level
500 ppm.

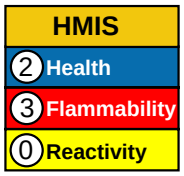
DFG (Germany) MAK
TWA: 20 ppm; PEAK: 40 ppm; skin.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!


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.

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.

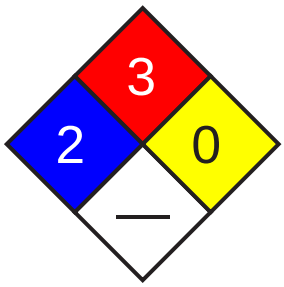
Do NOT induce vomiting. Give a glass of water.

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

Note to Physicians: Treat symptomatically.

Section 5 - Fire-Fighting Measures

See DOT ERG



Fire Diamond

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.

Section 6 - Accidental Release Measures

See DOT ERG

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
Odor Threshold: 0.410 to 192.7 mg/m^3
Vapor Pressure (kPa): 1.33 at 30 °C
Vapor Density (Air=1): 3.5
Formula Weight: 100.16
Specific Gravity (H_2O=1, at 4 °C): 0.80
Evaporation Rate: 1.62 (BuAc=1))
pH: Not applicable
pH (1% Solution): Not applicable
Boiling Point: 116.8 °C (242 °F) at 760 mm Hg
Freezing/Melting Point: -84.7 °C (-120.46 °F)
Volatile Component (% Vol): 100
Water Solubility: 1.91% 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

Toxicity
Oral (rat) LD_{50}: 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 (t1/2 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 (t1/2 15 hours in sunlight) and reaction with hydroxyl radical (t1/2 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: LC_{50} Pimephales promelas (fathead minnow) 505 mg/l 96 hr flow-through bioassay, wt 0.12 g, water hardness 45.5 mg/l $CaCO_3$, temp: 25 +/- 1 °C, pH 7.5, dissolved oxygen greater than 60% of saturation; LD_{50} Angelaius phoeniceus (Redwinged blackbird) oral 100 mg/kg; LC_{50} Carassius auratus (goldfish) 460 mg/l/24 hr /Conditions of bioassay not specified

Henry's Law Constant: estimated at 9.4×10^{-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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Perchloroethylene **CAS Number:** 127-18-4
Chemical Formula: C_2Cl_4
Structural Chemical Formula: $Cl_2C=CCl_2$
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; PERCLENE; PERCLENE D; PERCLOROETILENE; PERCOSOLV; PERCOSOLVE; PERK; PERKLONE; PERSEC; TETLEN; TETRACAP; TETRACHLOORETHEEN; TETRACHLORAETHEN; TETRACHLORETHYLENE; TETRACHLOROETHENE; 1,1,2,2-TETRACHLOROETHYLENE; TETRACHLOROETHYLENE; TETRACLOROETENE; TETRAGUER; TETRALENO; TETRALEX; TETRAVEC; TETROGUER; TETROPIL
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.

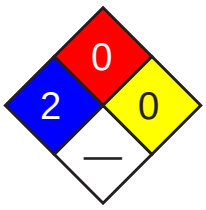
NIOSH REL
Minimize workplace exposure concentrations.

DFG (Germany) MAK
Skin.

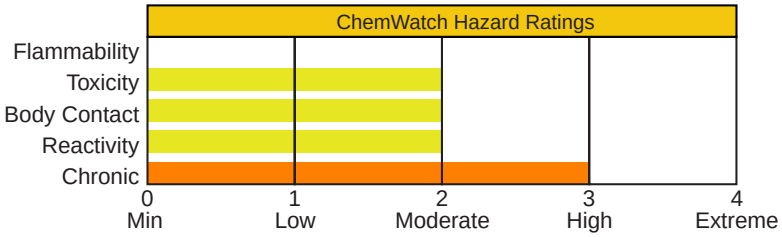
ACGIH TLV
TWA: 25 ppm; STEL: 100 ppm.

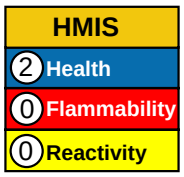
IDLH Level
150 ppm.

Section 3 - Hazards Identification



Fire Diamond





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).

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.

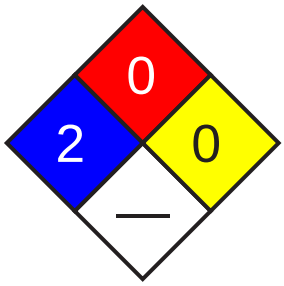
Note to Physicians: Treat symptomatically.
Do not administer sympathomimetic drugs as they may cause ventricular arrhythmias.
For acute or short-term repeated exposures to perchloroethylene:
Tetrachloroethylene/perchlorethylene is well absorbed through the lungs with peak levels more important than duration in determining blood concentration.
Lungs excrete most of the absorbed tetrachloroethylene in an unchanged state; about 3% is converted by the liver to form trichloracetic 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):

Determinant	Index	Sampling Time	Comments
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.



Fire Diamond

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.

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
Odor Threshold: Recognition 4.68 ppm
Vapor Pressure (kPa): 2.11 at 22 °C
Vapor Density (Air=1): 5.83
Formula Weight: 165.82
Specific Gravity (H_2O=1, at 4 °C): 1.63 at 15 °C
Evaporation Rate: 0.09 Ether=1

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 121 °C (250 °F) at 760 mm Hg
Freezing/Melting Point: -19 °C (-2.2 °F)
Volatile Component (% Vol): 100
Water Solubility: 0.02% by weight

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 presenceof 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) LD_{50}: 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/m^3/8 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: LC_{50} Tanytarsus dissimilis (midge) 30, 840 ug/l/48 hr, static bioassay; LC_{50} Poecilia reticulata (guppy) 18 ppm/7 days /Conditions of bioassay not specified; LC_{50} Daphnia magna (water flea) 18 mg/l/48 hr, static bioassay, at 22 °C; LC_{50} Salmo gairdneri (rainbow trout) 5 mg/l/96 hr, static bioassay at 12 °C

Henry's Law Constant: 2.87×10^{-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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Toluene
CAS Number: 108-88-3
Chemical Formula: C_7H_8
Structural Chemical Formula: $C_6H_5CH_3$
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.

ACGIH TLV
TWA: 50 ppm; skin.

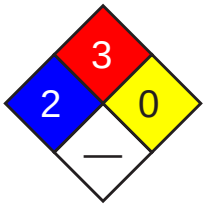
EU OEL
TWA: 192 mg/m^3 (50 ppm); STEL: 384 mg/m^3 (100 ppm).

NIOSH REL
TWA: 100 ppm (375 mg/m^3); STEL: 150 ppm (560 mg/m^3).

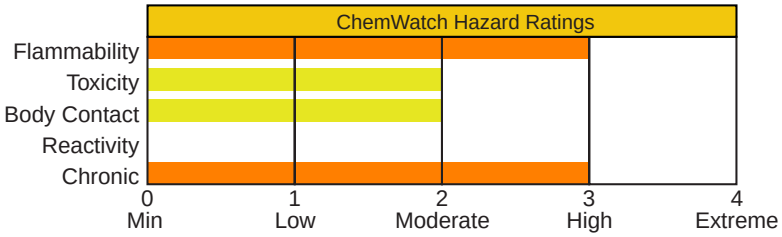
IDLH Level
500 ppm.

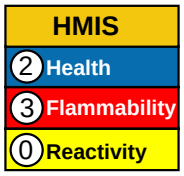
DFG (Germany) MAK
TWA: 50 ppm; PEAK: 200 ppm; skin.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Danger!


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/absorbtion.
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. 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 - 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 pyschometric 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.

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.

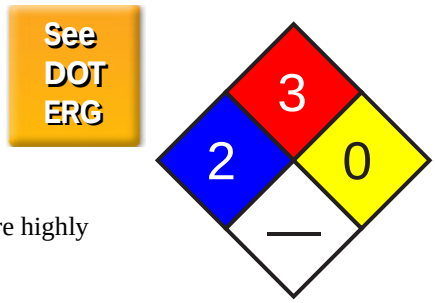
Note to Physicians: Following acute or short-term repeated exposures to toluene:
1. Toluene is absorbed across to alveolar barrier, the blood/air mixture being 11.2/15.6 (at 37 °C) The order of toluene, in expired breath, is of the order of 18 ppm following sustained exposure to 100 ppm.
The tissue/blood 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):

Determinant	Index	Sampling Time	Comments
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 (CO_2).



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
Odor Threshold: 2.14 ppm
Vapor Pressure (kPa): 2.93 at 20 °C
Vapor Density (Air=1): 3.2
Formula Weight: 92.14
Specific Gravity (H_2O=1, at 4 °C): 0.87 at 20 °C
Evaporation Rate: 2.4 (BuAc=1)

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 111 °C (232 °F) at 760 mm Hg
Freezing/Melting Point: -95 °C (-139 °F)
Volatile Component (% Vol): 100
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: Segregate from strong oxidizers.

Section 11 - Toxicological Information

Toxicity

Oral (human) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 636 mg/kg
Inhalation (human) TC_{Lo}: 100 ppm
Inhalation (man) TC_{Lo}: 200 ppm
Inhalation (rat) LC_{50}: > 26700 ppm/1h
Dermal (rabbit) LD_{50}: 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: LC_{50} Aedes aegypti-4th instar (mosquito larvae) 22 mg/l /Conditions of bioassay not specified; LC_{50} Cyprinodon variegatus (sheepshead minnow) 277-485 mg/l 96 hr /Conditions of bioassay not specified; LC_{50} Calandra granaria (grain weevil) 210 mg/l /in air; LC_{50} Cancer magister (crab larvae stage I) 28 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Crangon franciscorum (shrimp) 4.3 ppm 96 hr /Conditions of bioassay not specified; LC_{50} Artemia salina (brine shrimp) 33 mg/l 24 hr /Conditions of bioassay not specified; LC_{50} Morone saxatilis (striped bass) 7.3 mg/l 96 hr /Conditions of bioassay not specified; LC_{50} Pimephales promelas (fathead minnows) 55-72 mg/l (embryos), 25-36 mg/l (1-day posthatch protolarvae), 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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

1,1,1-Trichloroethane
MET2840

Section 1 - Chemical Product and Company Identification 61

Material Name: 1,1,1-Trichloroethane **CAS Number:** 71-55-6
Chemical Formula: $C_2H_3Cl_3$
Structural Chemical Formula: CH_3CCl_3
EINECS Number: 200-756-3
ACX Number: X1000020-3
Synonyms: AEROTHENE MM; AEROTHENE TT; ALGYLEN; ALPHA-T; BALTANA; CF 2; CHLOROETENE; CHLOROETHANE-NU; CHLOROETHENE; CHLOROETHENE NU; CHLOROFORM,METHYL-; CHLOROTENE; CHLOROTHANE NU; CHLOROTHENE; CHLOROTHENE (INHIBITED); CHLOROTHENE NU; CHLOROTHENE SM; CHLOROTHENE VG; CHLOROTHENE(INHIBITED); CHLORTEN; CHLORTHANE-NU; CHLORYLEN; DOWCLENE LS; ETHANA NU; ETHANE,1,1,1-TRICHLORO-; GEMALGENE; GENKLENE; ICI-CF 2; INHIBISOL; METHYL CHLOROFORM; METHYLCHLOROFORM; METHYLTRICHLOROMETHANE; SOLVENT 111; STROBANE; TAFCLEAN; 1,1,1-TCE; TCEA; 1,1,1-TRICHLOORETHAAN; 1,1,1-TRICHLORAETHAN; TRICHLORAN; 1,1,1-TRICHLOROETHANE; ALPHA-TRICHLOROETHANE; TRICHLORO-1,1,1-ETHANE; TRICHLOROETHANE; 1,1,1-TRICHLOROETHANE (STABILIZED); TRICHLOROMETHYLMETHANE; 1,1,1-TRICLOROETANO; TRIELENE; TRI-ETHANE
General Use: Used as a solvent for metal degreasing and vapor degreasing. Used in pesticides, some protective coatings, adhesives and cements, polishes, printing inks. Component of so called "safety" i.e. (nonflammable) solvents. Material is highly volatile and may quickly form concentrated atmosphere in confined or unventilated area. Vapor is heavier than air and may displace and replace air in breathing zone, acting as a simple asphyxiant. This may happen with little warning of overexposure.
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	%
1,1,1-trichloroethane	71-55-6	>94

OSHA PEL
TWA: 350 ppm; 1900 mg/m^3.

ACGIH TLV
TWA: 350 ppm; STEL: 450 ppm.

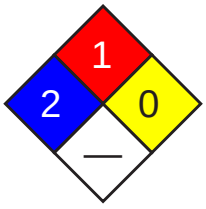
EU OEL
TWA: 100 ppm; STEL: 200 ppm.

NIOSH REL
Ceiling: 350 ppm (1900 mg/m^3) (15-minute) (Chloroethanes).

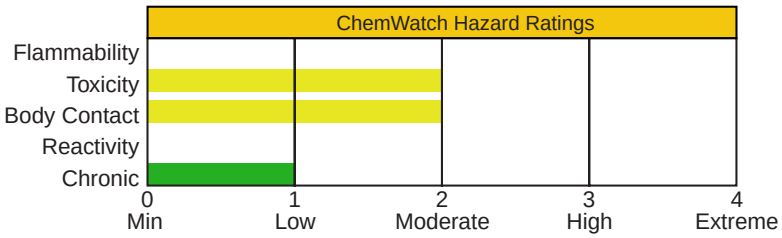
IDLH Level
700 ppm.

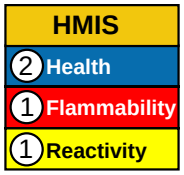
DFG (Germany) MAK
TWA: 200 ppm; PEAK: 200 ppm; skin.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; sweet odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: headache, dizziness, incoordination; mild liver/kidney dysfunction. Vapor will burn with a strong ignition source.

Potential Health Effects

Target Organs: skin, eyes, central nervous system (CNS), cardiovascular system
Primary Entry Routes: inhalation, skin contact
Acute Effects

Inhalation: The vapor is mildly discomforting to the upper respiratory tract.
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.
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.
WARNING: Odor is not considered objectionable at levels likely to result in central nervous system effects (500-1000 ppm).
If the odor is strong, leave the area promptly; ventilate well before returning. Avoid becoming a casualty.
Perception of odor may decline after several hours of exposure (olfactory fatigue).
Sensitive humans may experience anesthetic effects from short exposures at 800-1000 ppm. These effects readily occur at concentrations of 2000 ppm or greater. Numerous deaths due to depression of the nervous system, control of respiration, and/or fatal cardiac arrhythmia have been reported following inhalation. Autopsy has revealed intracerebral hemorrhage and passive congestion of the brain. Use in clinical anaesthesiology confirms the cardiotoxicity of 1,1,1-trichloroethane. Volunteers exposed to 200 ppm or 400 ppm for 4 hours on two occasions (with six day separation between each) exhibited increases in reaction time and average body sway. In a further study male subjects repeatedly exposed at 350 ppm showed impaired reaction time, perceptual speed and manual dexterity.

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 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 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 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 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.
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 - Class A4, Not classifiable as a human carcinogen; 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.
Toxic effects are increased by consumption of alcohol.
In a study conducted on workers exposed to 1,1,1-trichloroethane for periods ranging from several months to 6 years no adverse effects was noted when compared with a matched control group. Exposures for some workers exceeded 200 ppm during the study period.
Chronic exposure may result in liver and kidney damage.

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.

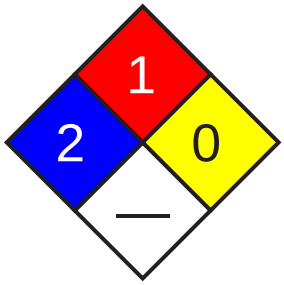
Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).
Wash affected areas thoroughly with water (and soap if available).
Seek medical attention in event of irritation.
Ingestion: Contact a Poison Control Center.
Do NOT induce vomiting. Give a glass of water.
Avoid giving milk or oils.
Avoid giving alcohol.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: For acute or short-term repeated exposure to 1,1,1-trichloroethane:
1.Do not administer sympathomimetic drugs as they may cause ventricular arrhythmias.
2. Institute prompt supportive measures to combat CNS depression.
3.An adequate title volume of 10-15 mL/kg body weight should be maintained.
4.For ingestion consider gastric lavage. A cuffed endotracheal tube, to protect airway, should be used if lavage given.
5. Consider activated charcoal approx 30 -50 gram in water slurry to follow lavage. Material is a GI tract irritant and a cathartic. Consider standard cathartic to hasten elimination.
BIOLOGICAL EXPOSURE INDEX - BEI
These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Trichloroethane in end-exhaled air	40 ppm	Prior to last shift of work-week	
Trichloroacetic acid in urine	10 mg/L	End of work-week	NS,SQ
Total trichloroethanol in urine	30 mg/L	End of shift at end of work-week	NS,SQ
Total trichloroethanol in blood	1 mg/m	End of shift at end of work-week	NS

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: > 93.3 °C
Autoignition Temperature: 500 °C
LEL: 7.5% v/v
UEL: 12.5% v/v
Extinguishing Media: Water spray or fog; foam, dry chemical powder, or BCF (where regulations permit).
Carbon dioxide.



Fire Diamond

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 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.

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.
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).

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 bottle. Inhibited grades may be stored in metal drums.
DO NOT use aluminum or galvanized containers.
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: Use in a well-ventilated area.
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 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: Butyl rubber gloves; Neoprene gloves.
Safety footwear.
Respiratory Protection:
Exposure Range >350 to <700 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask
Exposure Range 700 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Note: poor warning properties
Other: Overalls. Eyewash unit. Barrier cream. Skin cleansing cream.

Glove Selection Index:

PE/EVAL/PE ..... Best selection
PVA ..... Best selection
VITON ..... Best selection
TEFLON ..... Best selection
NITRILE+PVC ..... Poor to dangerous choice for other than short-term immersion
PVDC/PE/PVDC ..... Poor to dangerous choice for other than short-term immersion
BUTYL ..... Poor to dangerous choice for other than short-term immersion
HYPALON ..... Poor to dangerous choice for other than short-term immersion
NITRILE ..... 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
NATURAL RUBBER ..... Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless, highly volatile liquid. Miscible in most organic solvents. Mild chloroform-like odor.

Physical State: Liquid
Odor Threshold: 44 ppm
Vapor Pressure (kPa): 14 at 20 °C
Vapor Density (Air=1): 4.6
Formula Weight: 133.42
Specific Gravity (H_2O=1, at 4 °C): 1.34 at 20 °C
Evaporation Rate: 12.8 (n-(BuAc=1)

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 74 °C (165 °F) at 760 mm Hg
Freezing/Melting Point: -30.4 °C (-22.72 °F)
Volatile Component (% Vol): 100
Decomposition Temperature (°C): 260
Water Solubility: 0.4% by weight

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. 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 and sodium-potassium alloys, magnesium, zinc and aluminum.
Avoid contact with water as the slow formation of hydrochloric acid results.
Attacks natural rubber.
Aerosols containing this material must not be packed in aluminum

Section 11 - Toxicological Information

Toxicity

Oral (human) TD_{Lo}: 670 mg/kg
Oral (rat) LD_{50}: 10300 mg/kg
Inhalation (human) TC_{Lo}: 920 ppm/70 min
Inhalation (man) LC_{Lo}: 27000 mg/m^3/10m
Inhalation (man) TC_{Lo}: 200 ppm/4 hr
Inhalation (man) TC_{Lo}: 350 ppm
Inhalation (rat) LC_{50}: 18000 ppm/4h
Dermal (rabbit) LD_{Lo}: 1000 mg/kg

Irritation

Skin (rabbit): 20 mg/24 hr moderate
Skin (rabbit): 5000 mg/12 d-I mild
Eye (man): 450 ppm/8 hr
Eye (rabbit): 2 mg/24 hr SEVERE
Eye (rabbit): 100 mg mild

See *RTECS* KJ 2975000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Releases to surface water will decrease in concentration almost entirely due to evaporation. Spills on land will decrease in concentration almost entirely due to volatilization and leaching. Releases to air may be transported long distances and partially return to earth in rain. In the troposphere, it will degrade very slowly by photooxidation and also slowly diffuse to the stratosphere where photodegradation will be rapid.
Ecotoxicity: LC_{50} Poecilia reticulata (guppy) 133 ppm/7 day /Conditions of bioassay not specified; EC_{50} Pimephales promelas (fathead minnow) 28.8 mg/l/96 hr (confidence limit 23.0 -36.2 mg/l), flow-through bioassay with measured concentrations, 25.6 °C, dissolved oxygen 6.5 mg/l, hardness 46.4 mg/l $CaCO_3$, alkalinity 42.6 mg/l $CaCO_3$, and pH 7.99

Henry's Law Constant: 8 x10^{-3}
BCF: bluegills 28
Octanol/Water Partition Coefficient: log K_{ow} = 2.49
Soil Sorption Partition Coefficient: K_{oc} = 183

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: 1,1,1-Trichloroethane
ID: UN2831
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 U226 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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Trichloroethylene **CAS Number:** 79-01-6
Chemical Formula: C_2HCl_3
Structural Chemical Formula: $ClCH=CCl_2$
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; TRICHLOORETHEEN; TRICHLOORETHYLEEN,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

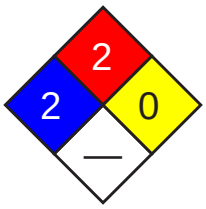
OSHA PEL
TWA: 100 ppm; Ceiling: 200 ppm; 300 ppm, 5-minute maximum peak in any 2 hours.

NIOSH REL

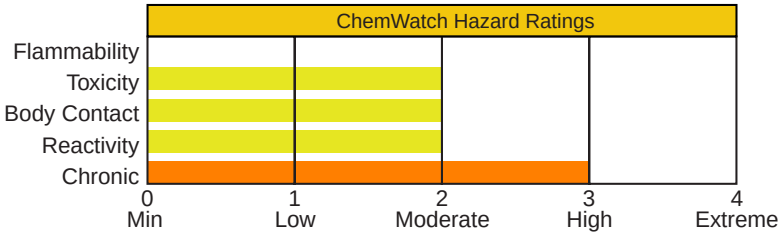
IDLH Level
1000 ppm.

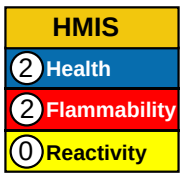
ACGIH TLV
TWA: 50 ppm; STEL: 100 ppm.

Section 3 - Hazards Identification



Fire Diamond





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 where 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.

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.
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 give 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, trichloracetic acid, trichlorethanol 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):

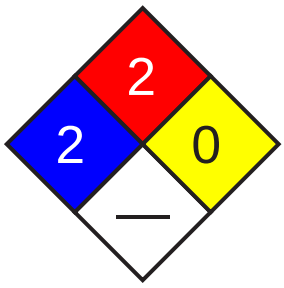
Determinant	Index	Sampling Time	Comments
Trichloroacetic acid in urine	10 mg/gm creatinine	End of work-week	NS
Trichloroacetic acid AND Trichloroethanol in urine	300 mg/mg creatinine	End of shift at end of work-week	NS
Free Trichloroethanol in blood	4 mg/L	End of shift at end of work-week	NS
Trichloroethylene 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.

See DOT ERG



Fire Diamond

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.

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.
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
Odor Threshold: 10 mg/l
Vapor Pressure (kPa): 7.87 at 20 °C
Vapor Density (Air=1): 4.54
Formula Weight: 131.38
Specific Gravity (H_2O=1, at 4 °C): 1.47 at 15 °C
pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 87 °C (189 °F)
Freezing/Melting Point: -73 °C (-99.4 °F)
Volatile Component (% Vol): 100
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) LD_{50}: 5650 mg/kg
Inhalation (man) LC_{Lo}: 2900 ppm
Inhalation (human) TD_{Lo}: 812 mg/kg
Inhalation (human) TC_{Lo}: 6900 mg/m^3/10 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: LC_{50} Sheepshead minnow 20 mg/l/96 hr. /Conditions of bioassay not specified; LC_{50} Mexican axolotl (3-4 wk after hatching) 48 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Clawed toad (3-4 wk after hatching) 45 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Pimephales promelas (fathead minnow) 40.7 mg/l/96 hr (95% confidence limits 31.4-71.8 mg/l) /Flow-through test; EC_{10} 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 ; LC_{50} Grass shrimp 2 mg/l/96 hr. /Conditions of bioassay not specified

Henry's Law Constant: 1×10^{-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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Vinyl Chloride
VIN2980

Section 1 - Chemical Product and Company Identification 61

Material Name: Vinyl Chloride
CAS Number: 75-01-4
Chemical Formula: C_2H_3Cl
Structural Chemical Formula: CH_2=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

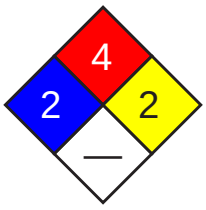
OSHA PEL
TWA: 1 ppm; Ceiling: 5 ppm, 15-minute; 1910.1017.

NIOSH REL

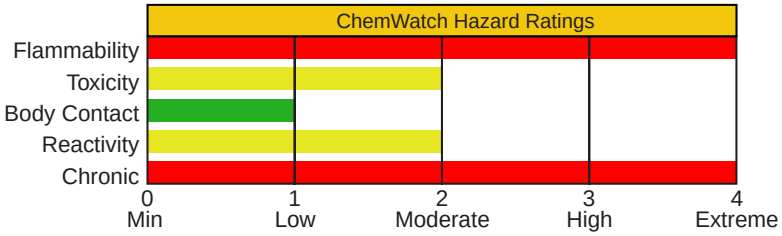
ACGIH TLV
TWA: 1 ppm.

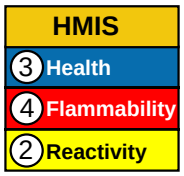
EU OEL
TWA: 7.77 mg/m^3.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Danger!


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 case become chronic. Allergic dermatitis and schleroderma 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.

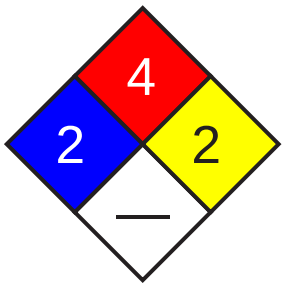
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically. Do not give adrenalin (epinephrine) or related drugs.

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.

See DOT ERG



Fire Diamond

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.

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 were gas may have accumulated.
3. Shut of all sources of possible ignition and increase ventilation.
4. Clear area of personnel.
5. Stop leak only if safe to so do.
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.

See DOT ERG

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 so do.
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 (H_2O=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) LD_{50}: 500mg/kg
Oral (rat) TD_{Lo}: 3463mg/kg/52w
Inhalation (rat) TC_{Lo}: 1ppm/4h/52w
Inhalation (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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Xylene
CAS Number: 1330-20-7
Chemical Formula: C_8H_{10}
Structural Chemical Formula: $C_6H_4(CH_3)_2$
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.

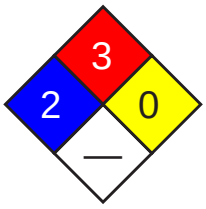
NIOSH REL
TWA: 100 ppm, 435 mg/m^3; STEL: 150 ppm, 655 mg/m^3.

DFG (Germany) MAK
TWA: 100 ppm; PEAK: 200 ppm; skin.

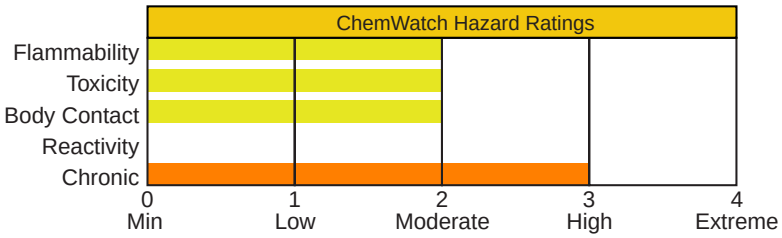
ACGIH TLV
TWA: 100 ppm; STEL: 150 ppm.

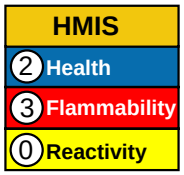
EU OEL
TWA: 50 ppm; STEL: 100 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!


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.

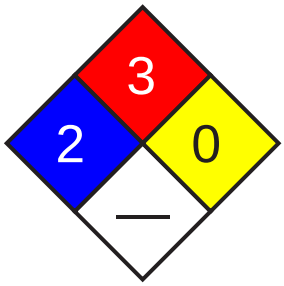
For ingestions exceeding 1-2 mL (xylene)/kg, intubation and lavage with cuffed endotracheal tube is recommended. The use of charcoal and cathartics is equivocal.
2.Pulmonary absorption is rapid with about 60-65% retained at rest.
3.Primary threat to life from ingestion and/or inhalation is respiratory 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):

Determinant	Index	Sampling Time	Comments
Methylhippuric acids in urine	1.5 gm/gm creatinine	End of shift	
	2 mg/min	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 (CO_2).
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.

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.

See DOT ERG

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
Odor Threshold: 5.00 x10^{-5} ppm
Vapor Pressure (kPa): 0.5 at 15 °C
Vapor Density (Air=1): 3.66 at 15 °C
Formula Weight: 106.18
Specific Gravity (H_2O=1, at 4 °C): 0.87 at 15 °C
Evaporation Rate: 0.7 Bu Ac=1

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 137 °C (279 °F) to 140 °C (284 °F)
Freezing/Melting Point: -47 °C (-53 °F)
Volatile Component (% Vol): 100
Water Solubility: Practically 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

Toxicity
Oral (human) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 4300 mg/kg
Inhalation (human) TC_{Lo}: 200 ppm
Inhalation (man) LC_{Lo}: 10000 ppm/6h
Inhalation (rat) LC_{50}: 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: LC_{50} Rainbow trout 13.5 mg/l/96 hr /Conditions of bioassay not specified; LD_{50} 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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111
Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: 2-Chlorophenol **CAS Number:** 95-57-8
Chemical Formula: C_6H_5ClO
Structural Chemical Formula: C_6H_4OHCl
EINECS Number: 202-433-2
ACX Number: X1001812-5
Synonyms: P-CHLORFENOL; 1-CHLORO-2-HYDROXYBENZENE; 2-CHLORO-1-HYDROXYBENZENE; 2-CHLOROPHENOL; O-CHLOROPHENOL; O-CHLORPHENOL; 2-HYDROXYCHLOROBENZENE; PHENOL,2-CHLORO-; PHENOL,O-CHLORO-; PINE-O DISINFECTANT; SEPTI-KLEEN
Derivation: Produced by reacting chlorine monoxide with phenol in carbon tetrachloride or oxidation of *o*-chlorocumene followed by hydration.
General Use: Used as a chemical intermediate in the manufacture of dyes, disinfectants, other chlorophenol compounds, phenolic resins; as a solvent for polyester fibers, soil fumigant, pesticide against ascarid eggs and larvae, in catechol production, and in processes for extracting sulfur and nitrogen from coal.

Section 2 - Composition / Information on Ingredients

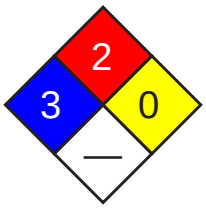
Name	CAS	%
2-Chlorophenol	95-57-8	<100% vol

Trace Impurities: chlorinated 2-phenoxyphenols, diphenyl ethers, and dibenzofurans.

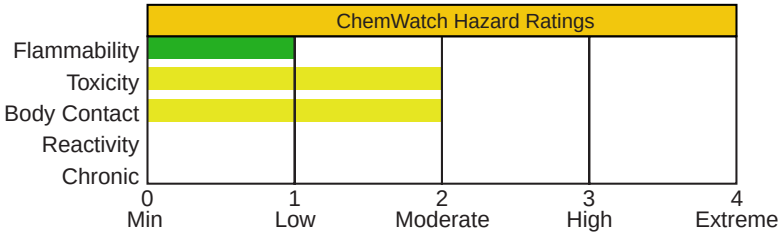
OSHA PEL **NIOSH REL**

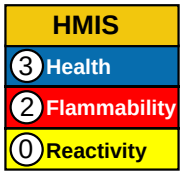
ACGIH TLV

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Danger!


Corrosive

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Light amber liquid; unpleasant, medicinal odor. Corrosive. Other Acute Effects: CNS depressant causing muscular weakness, low BP, convulsions, possible death. Chronic Effects: liver/kidney damage. Combustible.

Potential Health Effects

Target Organs: Eyes, skin, respiratory system, central nervous system (CNS), liver, kidneys.
Primary Entry Routes: Inhalation, eye contact, skin contact/absorption.
Acute Effects

Inhalation: Respiratory tract irritation may occur with delayed pulmonary edema (fluid in lungs); however, central nervous system effects dominate, ranging from weakness, headache, dizziness, and convulsions or collapse resulting in death (generally due to respiratory or cardiac failure).

Eye: May cause irritation.

Skin: Can cause irritation which may be severe (possible burns) on prolonged contact. 2-Chlorophenol can be absorbed through the skin to cause CNS, liver, and kidney toxicity.

Ingestion: Initial increase followed by a decrease in respiration, blood pressure, and urinary output; fever, increased bowel action, motor weakness, digestive disturbances, and damage to the liver, kidneys, pancreas, and spleen.

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: Any chronic condition involving the target organs.

Chronic Effects: Digestive disturbances; nervous disorders with faintness, dizziness, and mental changes; skin eruptions, jaundice, oliguria (decreased urinary output); and uremia (accumulation in the blood of constituents normally eliminated by the kidney, indicative of severe kidney toxicity).

Section 4 - First Aid Measures

See DOT ERG

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 for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

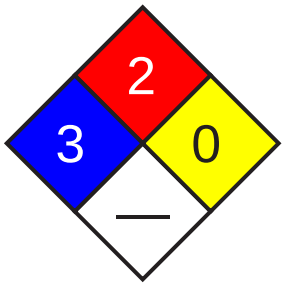
Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water to dilute.

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

Note to Physicians: Support respiratory and cardiovascular function.

Section 5 - Fire-Fighting Measures

See DOT ERG



Fire Diamond

Flash Point: 147 °F (64 °C), Closed Cup

Autoignition Temperature: None reported.

Flammability Classification: Class IIIA Combustible Liquid

Extinguishing Media: For small fires, use dry chemical, carbon dioxide, water spray, or regular foam. For large fires, use water spray, fog, or regular foam.

General Fire Hazards/Hazardous Combustion Products: Carbon oxide(s), hydrogen chloride, phosgene, and chlorine gas. Container may explode in heat of fire.

Fire-Fighting Instructions: If possible without risk, move container from fire area. If impossible, cool containers with water spray until well after fire is out. Fight fire from maximum distance. 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 is not effective against 2-chlorophenol.

Section 6 - Accidental Release Measures

See DOT ERG

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. Neutralize with sodium bicarbonate for later disposal. *Do not* release into sewers or waterways. Damp mop any residue with dilute sodium bicarbonate solution.

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

Section 7 - Handling and Storage

Handling Precautions: Use only with ventilation sufficient to prevent health effects and wear appropriate PPE. *Do not* use near heat and ignition sources.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using 2-chlorophenol, 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 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 2-chlorophenol. 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 exams of exposed workers with emphasis on the skin, liver, kidneys, and CNS.

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 2-chlorophenol 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: Amber-colored with an unpleasant, medicinal odor.

Physical State: Liquid

Odor Threshold: Chemically pure gas 1.8 x10^{-4} mg/m|super 3|no

Vapor Pressure (kPa): 1 mm Hg at 53.8 °F (12.1 °C); 40 mm Hg at 179.6 °F (82 °C); 100 mm Hg at 222.8 °F (106 °C)

Formula Weight: 128.56

Specific Gravity (H_2O=1, at 4 °C): 1.256 at 77 °F (25 °C)

Refractive Index: 1.5565 at 25 °C; 1.5473 at 40 °C

pH: Weakly acidic

Boiling Point: 346.1 °F (174.5 °C)

Freezing/Melting Point: 44.6 °F (7 °C)

Viscosity: 4.11 cP at 77 °F (25 °C)

Surface Tension: 40.3 dyne/cm at 68 °F (20 °C); 42.25 dyne/cm at 54.9 °F (12.7 °C)

Water Solubility: 2.85% at 68 °F (20 °C)

Other Solubilities: Soluble in alcohol, alkalis, and ether.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: 2-Chlorophenol 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 oxidizers.

Storage Incompatibilities: Strong oxidizers.

Hazardous Decomposition Products: Thermal oxidative decomposition of 2-chlorophenol can produce carbon oxide(s), hydrogen chloride, and chlorine gas.

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral, LD_{50}: 670 mg/kg.

Mouse, oral, LD_{50}: 345 mg/kg caused convulsions or effect on seizure threshold and respiratory stimulation.

Other Effects:

Rat, oral: 4550 mg/kg administered on the 70th day prior to mating and from 1 to 21 days of pregnancy resulted in still births and decreased litter size.

Tumorgenicity, mouse, skin: 4800 mg/kg applied intermittently for 12 weeks resulted in skin tumors.

Hamster, lung cell: 800 µmol/L resulted in sex chromosome loss with nondisjunction.

See *RTECS* SK2625000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, 2-chlorophenol is expected to be relatively mobile and leach to groundwater. Biodegradation can account for a large portion of the removal of 2-chlorophenol from soil. In water, photolysis will occur near the surface. Evaporation will also occur with a half-life of 3.3 days from a model river 1 m deep, flowing 1 m/sec. with a wind speed of 3 m/sec. Studies show biodegradation to be significant with complete removal reported in 13 to 36 days in die-away tests using two raw river waters and 15 days in acclimated river water. Bioconcentration is not significant indicated by BCF's (bioconcentration factors) of 214 (bluegill sunfish) and 7.1 (goldfish). In air, 2-chlorophenol may undergo photolysis and reaction with nitrogen oxides (polluted air) with a half-life of 1.96 days. Wet deposition may also occur.

Ecotoxicity: *Pimephales promelas* (fathead minnow), LC_{50} = 11, 630 µg/L/96hr; *Lepomis macrochirus* (bluegill), LC_{50} = 6,590 µg/L/96 hr; *Chlorella pyrenoidosa* (algea), EC_{50} (*complete chlorophyll destruction*) = 500,000 µg/L

Octanol/Water Partition Coefficient: log K_{ow} = 2.15

Section 13 - Disposal Considerations

Disposal: Dissolve in a flammable solvent and burn in a furnace equipped with an afterburner and scrubber. 2-Chlorophenol is a candidate for rotary-kiln or liquid injection incineration. Biodegradation with a *Pseudomonas* strain can achieve 100% reduction in 26 hours. 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: Chlorophenols, liquid
ID: UN2021
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 U048 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 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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: 1,2-Dichlorobenzene **CAS Number:** 95-50-1
Chemical Formula: $C_6H_4Cl_2$
Structural Chemical Formula: $C_6H_4Cl_2$
EINECS Number: 202-425-9
ACX Number: X1001576-4
Synonyms: BENZENE,1,2-DICHLORO-; BENZENE,O-DICHLORO-; CHLOROBEN; CHLORODEN; CLOROBEN; DCB; O-DCB; O-DICHLOR BENZOL; O-DICHLORBENZENE; 1,2-DICHLOROBENZENE; O-DICHLOROBENZENE; ORTHO-DICHLOROBENZENE; DICHLOROBENZENE,ORTHO,LIQUID; O-DICHLOROBENZOL; DILANTIN DB; DILATIN DB; DIZENE; DOWTHERM E; EPA PESTICIDE CHEMICAL CODE 059401; ODB; ODCB; ORTHODICHLOROBENZENE; ORTHODICHLOROBENZOL; ORTHOSOL; SPECIAL TERMITE FLUID; TERMITKIL
General Use: Solvent for oils, resins, waxes, gums, tars, rubbers, asphalts, oxides of nonferrous metals. Has been used as heat transfer media. Component of dyes, metal polishes, degreasers for leather, metals and wool. Used as an insecticide and fumigant; industrial odor control. Solvent carrier in production of toluene diisocyanate.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
1,2-dichlorobenzene	95-50-1	>95
1,4-dichlorobenzene	106-46-7	4-5

OSHA PEL
Ceiling: 50 ppm, 300 mg/m^3.

NIOSH REL
Ceiling: 50 ppm (300 mg/m^3).

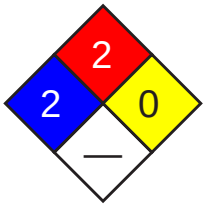
DFG (Germany) MAK
TWA: 10 ppm; PEAK: 20 ppm; skin.

ACGIH TLV
TWA: 25 ppm; STEL: 50 ppm.

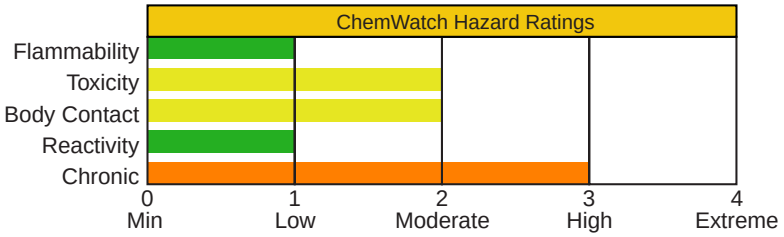
IDLH Level
200 ppm.

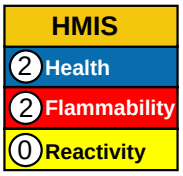
EU OEL
TWA: 20 ppm; STEL: 50 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; aromatic odor. Irritating to eyes/skin/respiratory tract. Toxic. Other Acute Effects: blisters, burning pain in stomach, nausea, vomiting, diarrhea. Chronic Effects: headache, anorexia, weight loss, jaundice, cirrhosis. Combustible.

Potential Health Effects

Target Organs: liver, kidneys, skin, eyes
Primary Entry Routes: inhalation, skin absorption
Acute Effects
Inhalation: The vapor is discomforting to the upper respiratory tract.
The vapor from heated material is highly discomforting and harmful if inhaled.
Inhalation of vapor may result in nausea, headache. Intermittent exposure at 100 ppm in the workplace caused some irritation to both eyes and upper respiratory system.

Rats survived inhalation exposure for 2 hours at 977 ppm but died after 7 hour exposure. Rats surviving a 7 hour exposure at 539 ppm showed liver necrosis and kidney tubule damage. Liver damage was evident in other rats exposed from 50 to 800 ppm and during exposures lasting 0.5 and 1 hour at 390 ppm. Mouse exposed to the saturated vapor (calculated as between 2000 and 3000 ppm) showed prompt narcosis, followed by central respiratory depression and cyanosis - death occurred within 24 hours. 8000 ppm produced sedation in dogs exposed for 1 hour. Rats exposed at a concentration of 450 ppm, 6 hours/day for up to 13 days showed pale, discolored kidneys.

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 be irritating to the eye, with prolonged contact causing inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
Undiluted o-DCB applied to rabbit eye caused pain and slight conjunctival irritation. Irritation cleared within 5 days without residual injury.

Skin: The liquid is highly discomforting to the skin and it is absorbed by the skin and is capable of causing skin reactions which may lead to dermatitis or ulceration if exposure is prolonged.
Toxic effects may result from skin absorption.
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.
o-DCB was irritating when applied to the skin of human subjects for 15-60 minutes. One worker developed a dermatitis following hand contact that was reported as sensitization after a follow-up patch test. Two subjects reported a burning sensation during a 1 hour exposure. A diffuse redness of the treated area progressed to a darker red color with blister formation within 24 hours. A brown pigment formed at the site which was apparent 3 months postexposure.

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, abdominal irritation, pain and vomiting.
Oral doses of 500 mg given over 13 weeks to mice and rats produced necrosis and hepatocellular degeneration and depletion of lymphocytes in both the spleen and thymus and renal tubular degeneration in rats.
Multifocal mineralization of the myocardial fibers of the heart and skeletal muscle was seen in mice. Necrosis of individual hepatocytes was seen in female mice given 250 mg/kg. At 125 mg/kg a few rats exhibited minimal hepatocellular necrosis.

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 inhalation exposure may cause changes to liver and kidney and hematological (blood) disorders.
There is some evidence to suggest a link between leukemia and exposure to dichlorobenzenes.
A 2 year study with rats and mice treated with oral doses of either 60 or 120 mg 5 days/ week produced a lower survival time of male rats receiving the higher dose. An increase in the incidence of tubular regeneration in the male mouse kidney was the only compound-related, non-neoplastic, histologic lesion observed and no evidence of carcinogenicity was seen during the study.
Four cases involving cancer and exposure to o-DCB have been reported.
These involved the development of peripheral leukoblastosis, chronic lymphoid leukemia and myeloblastic leukemia.

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: If in eyes, hold eyes open, flood with water for at least 15 minutes and see a doctor.

Skin Contact: If skin contact occurs, remove contaminated clothing and wash skin thoroughly.

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.
Avoid giving alcohol.

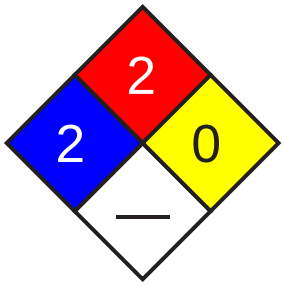
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically. Do not give adrenalin (epinephrine) or related drugs.

o-DCB is absorbed through the lungs, gastrointestinal tract and intact skin. High lipid solubility and low water solubility causes diffusion through most membranes. Metabolites include 3,4-dichlorophenol, 2,3-dichlorophenol and 3,4- and 4,5-dichlorocatechols. The conjugates excreted in the urine are mainly glucuronides.

Section 5 - Fire-Fighting Measures

See DOT ERG



Fire Diamond

Flash Point: 68.333 °C Open Cup
Autoignition Temperature: 648 °C
LEL: 2% v/v
UEL: 9% 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 liquid. Moderate fire hazard when exposed to heat or flame.
May form an explosive mixture with air.
Decomposes on heating and produces toxic fumes of hydrogen chloride, carbon monoxide (CO), carbon dioxide (CO_2) and minor amounts of chlorine.
Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.
Avoid contact with hot aluminum and aluminum alloys.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
Wear full body protective clothing with breathing apparatus. Prevent spillage from entering drains or waterways.
If safe to do so, switch off electrical equipment until vapor fire hazard is removed.
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

See DOT ERG

Small Spills: POLLUTANT -contain spillage. Environmental hazard - contain spillage.
Clean up all spills immediately.
Wear protective clothing, impervious gloves and safety glasses.
Contain and absorb spill with sand, earth, inert material or vermiculite.
Place spilled material in clean, dry, sealable, labeled container.
Large Spills: POLLUTANT -contain spillage. Environmental hazard - contain spillage.
Contact fire department and tell them location and nature of hazard.
Clear area of personnel and move upwind.
Wear full body protective clothing with breathing apparatus. Prevent spillage from entering drains or waterways.
Shut off all possible sources of ignition and increase ventilation.
No smoking or bare lights within area.
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: Avoid generating and breathing mist. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Prevent concentration in hollows and sumps. DO NOT enter confined spaces until atmosphere has been checked.
Avoid contact with incompatible materials.
Avoid smoking, bare lights or ignition sources.
Avoid physical damage to containers.
Keep containers securely sealed when not in use.
Use in a well-ventilated area.
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: Use in a well-ventilated area.
If inhalation risk of overexposure exists, wear NIOSH-approved organic-vapor respirator.
If mist is present, use air supplied breathing apparatus.
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 and Neoprene rubber gloves or PVA gloves.
Safety footwear or Rubber boots.
Respiratory Protection:
Exposure Range >50 to <200 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 200 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: Impervious protective clothing or Rubber apron.
Eyewash unit.
Ensure there is ready access to a safety shower.
Glove Selection Index:
VITON ..... Best selection

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless to pale yellow liquid, pleasant aromatic odor. Soluble in alcohol, aromatics, acetone.
Physical State: Liquid
Odor Threshold: 12 to 300 mg/m^3
Vapor Pressure (kPa): 0.133 at 20 °C
Vapor Density (Air=1): 5.07
Formula Weight: 147.00
Specific Gravity (H_2O=1, at 4 °C): 1.305 at 20 °C
Evaporation Rate: < 1
pH: Not applicable
pH (1% Solution): Not applicable
Boiling Point: 180.5 °C (357 °F) at 760 mm Hg
Freezing/Melting Point: -17 °C (1.4 °F)
Volatile Component (% Vol): 100 approx.
Water Solubility: 0.01% by weight

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 DO NOT use aluminum, galvanized or tin-plated containers.

Section 11 - Toxicological Information

Toxicity
Oral (rat) LD_{50}: 500 mg/kg
Intraperitoneal (rat) LD_{50}: 840 mg/kg
Subcutaneous (rat) LD_{50}: 5000 mg/kg
Inhalation (rat) LD_{Lo}: 821 ppm/7 hr
Oral (mouse) LD_{50}: 4386 mg/kg
Intraperitoneal (mouse) LD_{50}: 1228 mg/kg
Oral (rabbit) LD_{50}: 500 mg/kg
Diffuse and zonal hepatocellular necrosis, lachrymation, general anesthesia, paternal effects, specific developmental anormalities (musculoskeletal system) recorded.

Irritation
Eye (rabbit): 100 mg/30 s rinse-mild

See *RTECS* CZ 4500000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it can be moderately to tightly adsorbed. Leaching from hazardous waste disposal areas has occurred and the detection in various groundwaters indicates that leaching can occur. Volatilization from soil surfaces may be an important transport mechanism. It is possible it will be slowly biodegraded in soil under aerobic conditions. Chemical transformation by hydrolysis, oxidation or direct photolysis are not expected to occur in soil. If released to water, adsorption to sediment will be a major environmental fate process based upon extensive monitoring data in the Great Lakes area and K_{oc} values. Analysis of Lake Ontario sediment cores has indicated the presence and persistence since before 1940. It is volatile from the water column with an estimated half-life of 4.4 hours from a model river one meter deep flowing 1 m/sec with a wind velocity of 3 m/sec at 20 °C; adsorption to sediment will attenuate volatilization. Aerobic biodegradation in water may be possible, however, anaerobic biodegradation is not expected to occur. Experimental BCF values of 66-560 have been reported it has been detected in trout from Lake Ontario. Aquatic hydrolysis, oxidation and direct photolysis are not expected to be important. If released to air, it will exist predominantly in the vapor-phase and will react with photochemically produced hydroxyl radicals at an estimated half-life rate of 24 days in a typical atmosphere. Direct photolysis in the troposphere is not expected to be important. The in rainwater suggests that atmospheric removal via wash-out is possible.
Ecotoxicity: Aquatic toxicity: 13 ppm/*/marine plankton/no growth/ salt water *Time period not specified
Henry's Law Constant: 0.0024
BCF: rainbow trout 270 to 560
Biochemical Oxygen Demand (BOD): theoretical < 0.1 lb/lb, 1/8 days
Octanol/Water Partition Coefficient: log K_{ow} = 3.38
Soil Sorption Partition Coefficient: K_{oc} = 280

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: o-Dichlorobenzene
ID: UN1591
Hazard Class: 6.1 - Poisonous materials
Packing Group: III - Minor Danger
Symbols: + - Override definitions
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 U070 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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: 1,4-Dichlorobenzene
CAS Number: 106-46-7
Chemical Formula: $C_6H_4Cl_2$
Structural Chemical Formula: $C_6H_4Cl_2$
EINECS Number: 203-400-5
ACX Number: X1001577-1
Synonyms: 1,4-Dichlorobenzene; 1,4-DICHLOROBENZENE; BENZENE,1,4-DICHLORO-; BENZENE,P-DICHLORO-; P-CHLOROPHENYL CHLORIDE; PARA CRYSTALS; P-DCB; 1,4-DICHLOORBENZEEN; P-DICHLOORBENZEEN; 1,4-DICHLOR-BENZOL; P-DICHLORBENZOL; DI-CHLORICIDE; P-DICHLOROBENZENE; PARA-DICHLOROBENZENE; DICHLOROBENZENE,PARA,SOLID; P-DICHLOROBENZOL; PARA-DICHLOROBENZOL; DICHLOROCIDE; 1,4-DICLOROBENZENE; P-DICLOROBENZENE; EPA PESTICIDE CHEMICAL CODE 061501; EVOLA; GLOBOL; PARACIDE; PARADI; PARADICHLORBENZOL; PARADICHLOROBENZENE; PARADICHLOROBENZOL; PARADOW; PARAMOTH; PARANUGGETS; PARAZENE; PDB; PDCB; PERSIA-PERAZOL; SANTOCHLOR
General Use: As an insecticidal fumigant, moth repellant for fabric and fur, germicide. Deodorant toilet blocks, urinal disinfectant. As a space odorant. In dyes, intermediates, pharmacy, agriculture (fumigating soil); In the manufacture of 2,5-dichloroaniline.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
1,4-dichlorobenzene	106-46-7	>97

OSHA PEL
TWA: 75 ppm; 450 mg/m^3.

NIOSH REL

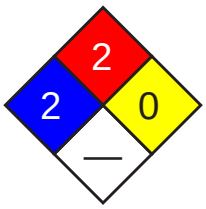
DFG (Germany) MAK
Skin.

ACGIH TLV
TWA: 10 ppm.

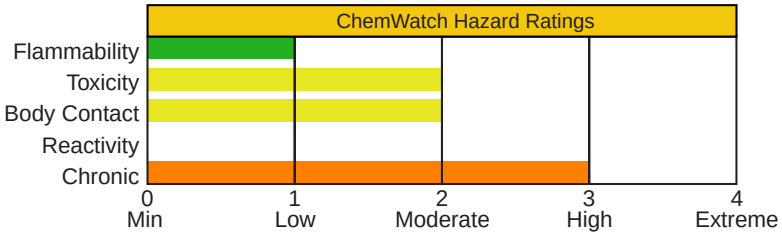
IDLH Level
150 ppm.

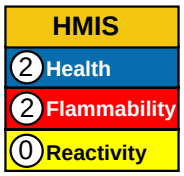
EU OEL
TWA: 20 ppm; STEL: 50 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Volatile, white crystals; mothball-like odor. Severely irritating. Other Acute Effects: hemolytic anemia, jaundice, methemglobinemia. Chronic Effects: lung granulomatosis, liver abnormalities, kidney damage, anemia, cataracts. Possible cancer hazard. Combustible.

Potential Health Effects

Target Organs: liver, respiratory system, eyes, kidneys, skin
Primary Entry Routes: inhalation, skin contact

Acute Effects

Inhalation: The vapor is discomforting to the upper respiratory tract if inhaled and the material may present a hazard from repeated exposures over long periods. 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.

The physiological response to p-DCB is primarily injury to the liver and secondarily to the kidneys. Central nervous system depression will occur at concentrations that are extremely objectionable to the eyes and nose.

Individuals exposed to higher concentrations may show weakness, dizziness and weight loss. Vomiting may occur. Acute hemolytic anemia with methemoglobinemia has been reported.

Prolonged inhalation exposure may cause dizziness, headache nausea, vomiting, central nervous system depression and damage to liver and kidneys.

Rabbits exposed 8 hours/day for a total of 62 exposures in 83 days at 770-800 ppm exhibited tremors, weakness, and death along with edema of the cornea and opacity of the lens.

Eye: The material 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 if exposure is prolonged.

The vapor from heated material is highly discomforting to the eyes.

Vapors from heated material may cause mild corneal damage.

Solid particles in the eye are reported to be very painful. At workplace concentrations ranging from 50-170 ppm periodic medical examination found no evidence of adverse effects in workers with particular reference to ocular lesions including cataracts. Painful irritation of eyes and nose has been recorded at 80-160 ppm.

Skin: The material is moderately discomforting to the skin and it is absorbed by skin.

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.

Skin contact may result in irritation, burning sensation, skin defatting and possible dermatitis. Skin contact resulted in dermatitis when workers handled cakes of the pure chemical. Prolonged occlusive contact will produce a burning sensation.

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

The material is discomforting and toxic if swallowed.

Large doses have caused tremor in exposed animals; insects exhibit symptoms resembling DDT poisoning.

Hepatic porphyria was produced in rats following seven consecutive doses of 770 mg p-DCB/kg. Slight to moderate corneal opacity was noted in rabbits following 3 weeks of daily dosing with 5000 mg/kg. Rats receiving a daily dose of 500 mg/kg for 20 days showed cloudy swelling and necrosis in the central areas of the liver lobules and swelling of the renal tubular epithelium. 100 mg/kg daily doses did not reproduce this finding. Pale and mottled kidneys were seen in rats given oral doses of 70 to 428 mg/kg/day for 28 days. Rats given 1200 mg/kg for 13 weeks showed degeneration and necrosis of hepatocytes, hypoplasia of the bone marrow, lymphoid depletion of the spleen and thymus, and epithelial necrosis of the nasal turbinates and small intestinal mucosa. At doses of 300 mg/kg male rats showed kidney damage characterized by degeneration or necrosis of the renal cortical tubular epithelial cells. Female rats did not show these lesions even at doses of 1500 mg/kg.

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 - Not listed.

Chronic Effects: In individuals exposed chronically to p-DCB, liver effects including jaundice, cirrhosis, and possible death may occur. Chronic exposure may also produce weakness, headache, rhinitis, twitching of the facial muscles. A woman who consumed 4 to 5 moth ball pellets daily for 2.5 years developed unsteady gait, tremors of the hand and general mental sluggishness which disappeared 4 months after exposure ceased. Eight workers manufacturing p-DCB based mothproofing agents for 1 to 7 months developed neural disorders including intensified muscle reflexes, mild clonus of the ankle and tremors of the fingers. They reported loss of appetite and hemopoietic changes.

Rats treated for 2 years with gastric intubation showed kidney lesion and in the male, hyperplasia of the thyroid at dose rates of 150 mg/kg.

Mice treated with 300 mg/kg in a similar 2 year gavage study showed liver changes characterized by hepatocellular degeneration. Thyroid follicular cell hyperplasia was increased in male but not female mice. Nephropathy consisting primarily of degeneration of the cortical tubular epithelium was seen and was more pronounced in males.

Rats, guinea pigs, rabbits, mice and monkeys exposed by inhalation 7 hours/day, 5 days/week for 140 exposures at 800 ppm exhibited tremor, weight loss and liver changes, including swelling and central necrosis in female rats, and swelling of the kidney epithelium.

An increase in liver tumors (e.g. renal tubular cell adenocarcinomas) was seen in male rats treated by gastric intubation doses of 150 mg/kg for 2 years. No evidence of carcinogenicity was seen in female rats. An increase incidence of hepatocellular carcinomas and adenomas was seen in mice treated with gavage doses of 300 mg/kg/day for 2 years. A positive dose-trend for adrenal gland pheochromocytomas in male mice was also reported.

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 ERG

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.
Avoid giving milk or oils.

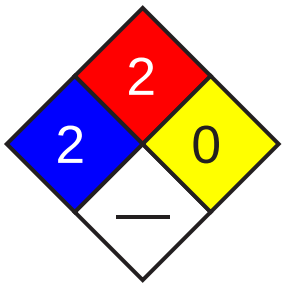
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically.
EYES - Stain for evidence of corneal injury.
SKIN - Treat as for dermatitis.
RESPIRATION - Administer oxygen if available. The use of bronchodilators, expectorants and antitussives may help.
There is no antidote for systemic effects.
Readily absorbed after oral administration to rats and found in all organs with accumulation in adipose tissues. 90% of the dose is excreted within 48 hours. Two metabolites, 2,5-dichlorophenylmethylsulfone and 2,5-dichlorophenylsulfoxide are detected in the blood (though not the compound itself). Slow release from the adipose tissues is probably responsible for the persistence of these metabolites. 2,5-dichlorophenol is detected in plasma, urine, liver, kidneys and fatty tissues - in humans this metabolite is a useful monitor of exposure. An occupational exposure for 1 week to 7.4 ppm p-DCB produced an increase of p-DCB in the urine as a direct measurement.

Section 5 - Fire-Fighting Measures

Flash Point: 65.556 °C Closed Cup
Autoignition Temperature: > 482 °C
LEL: 2.5% v/v
UEL: 16% v/v

See DOT ERG



Fire Diamond

Extinguishing Media: Water spray or fog; foam.
Dry chemical powder.
Alcohol stable foam.
Carbon dioxide.

General Fire Hazards/Hazardous Combustion Products: Combustible. Slight fire hazard when exposed to heat or flame.
Heat 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. May emit poisonous fumes.
Decomposes on heating and produces toxic fumes of hydrogen chloride, chlorine, carbon monoxide (CO), phosgene and carbon dioxide (CO_2).

Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result. Avoid contact with aluminum, powdered metals.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
Wear full body protective clothing with breathing apparatus. Prevent 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.
Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid contact with skin and eyes.
Control personal contact by using protective equipment.
Use dry clean-up procedures and avoid generating dust.

See DOT ERG

Place in a suitable labeled container for waste disposal.
Large Spills: Clear area of personnel and move upwind. Slippery when spilled.
Contact fire department and tell them location and nature of hazard.
Wear full body protective clothing with breathing apparatus. Prevent 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.
Collect recoverable product into labeled containers for recycling.
Collect solid residues and seal in labeled drums for disposal.
Wash area with detergent and 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: 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: Glass container; Metal can. Steel drum.
DO NOT use aluminum or galvanized containers.
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. 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; or as required, 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.
Respiratory Protection:
Exposure Range >75 to <150 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 150 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: Overalls. Eyewash unit.
Glove Selection Index:
NEOPRENE..... Satisfactory; may degrade after 4 hours continuous immersion
NITRILE..... 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: Volatile, white crystals with penetrating, aromatic odor. Sublimes (evaporates) at room temperature. Soluble in alcohol, acetone aromatics.
Physical State: Divided solid
Odor Threshold: 15 to 30 ppm
Vapor Pressure (kPa): 1.33 at 54.8 °C
Vapor Density (Air=1): 5.08
Formula Weight: 147.0
Specific Gravity (H_2O=1, at 4 °C): 1.46
Evaporation Rate: Slow
pH (1% Solution): Not applicable.

Boiling Point: 174 °C (345 °F) at 760 mm Hg
Freezing/Melting Point: 53.1 °C (127.58 °F)
Volatile Component (% Vol): 100
Decomposition Temperature (°C): >55
Water Solubility: 65.3 mg/L 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 storage with oxidizers. DO NOT use aluminum or galvanized containers.

Section 11 - Toxicological Information

Toxicity

Oral (rat) LD_{50}: 2000-3000 mg/kg
Oral (human) LD_{Lo}: 857 mg/kg
Oral (human) TD_{Lo}: 300 mg/kg
Oral (rat) LD_{50}: 500 mg/kg
Dermal (rabbit) LD_{50}: >2000 mg/kg
Intraperitoneal (rat) LD_{50}: 2562 mg/kg
Oral (mouse) LD_{50}: 2950 mg/kg
Intraperitoneal (mouse) LD_{50}: 2000 mg/kg
Oral (rabbit) LD_{50}: 2830 mg/kg
Dermal (rabbit) LD_{50}: >2000 mg/kg
Eye effects, respiratory tract changes, diarrhea, specific developmental effects (cardiovascular system) recorded.

Irritation

Eye (human): 80 ppm

See *RTECS* HT 7525000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it can be moderately to tightly adsorbed. Leaching from hazardous waste disposal areas has occurred and the detection in various groundwaters indicates that leaching can occur. Volatilization from soil surfaces may be an important transport mechanism. It is possible it will be slowly biodegraded in soil under aerobic conditions. Chemical transformation by hydrolysis, oxidation or direct photolysis are not expected to occur in soil. If released to water, volatilization may be the dominant removal process. The volatilization half-life from a model river one meter deep flowing one meter/sec with a wind velocity of 3 m/sec is estimated to be 4.3 hours at 20 °C. Adsorption to sediment will be a major environmental fate process based upon extensive monitoring data in the Great Lakes area and K_{oc} values based upon monitoring samples. Analysis of Lake Ontario sediment cores has indicated presence and persistence since before 1940. Adsorption to sediment will attenuate volatilization. Aerobic biodegradation in water may be possible, however, anaerobic biodegradation is not expected to occur. For the most part, experimental BCF values reported in the literature are less than 1000 which suggests that significant bioconcentration will not occur; however, a BCF of 1800 was determined for guppies in one study. Aquatic hydrolysis, oxidation and direct photolysis are not expected to be important. If released to air it will exist predominantly in the vapor-phase and will react with photochemically produced hydroxyl radicals at an estimated half-life rate of 31 days in typical atmosphere. Direct photolysis in the troposphere is not expected to be important. The detection in rain-water suggests that atmospheric removal via wash-out is possible.

Ecotoxicity: LC_{50} Poecilia reticulata (guppy) 4.0 ppm/14 days /Conditions of bioassay not specified; LC_{50} Lepomis macrochirus (bluegill sunfish) 4.54 mg/l/24 hr; 4.3 mg/l/48 hr; 4.25 mg/l/96 hr /Static bioassay; LC_{50} Sheepshead minnow 7.5-10 mg/l/24 hr; 7.17 mg/l/48 hr; 7.4 mg/l/96 hr /Static bioassay

Henry's Law Constant: 0.0015

BCF: increases with log p

Octanol/Water Partition Coefficient: log K_{ow} = 3.39

Soil Sorption Partition Coefficient: K_{oc} = 273

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: 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 U072 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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: 2,4-Xylenol **CAS Number:** 105-67-9
Chemical Formula: $C_8H_{10}O$
Structural Chemical Formula: $(CH_3)_2C_6H_3OH$
EINECS Number: 203-321-6
ACX Number: X1001858-1
Synonyms: BACTICIN; BENZENE,2,4-DIMETHYL-1-HYDROXY-; BULK LYSOL BRAND DISINFECTANT; 2,4-DIMETHYLPHENOL; 4,6-DIMETHYLPHENOL; 2,4-DMP; DU COR CONCENTRATED FLY INSECTICIDE; EPA PESTICIDE CHEMICAL CODE 086804; GABLE-TITE DAR CREOSOTE (CREOLA); GABLE-TITE LIGHT CREOSOTE (CREOLA); GALLEX; 1-HYDROXY-2,4-DIMETHYLBENZENE; 4-HYDROXY-1,3-DIMETHYLBENZENE; 4-HYDROXY-M-XYLENE; LYSOL BRAND DISINFECTANT; PHENOL,2,4-DIMETHYL-; 2,4-XYLENOL; AS-M-XYLENOL; ASYM-O-XYLENOL; M-4-XYLENOL; M-XYLENOL
General Use: Used for preparation of coal tar disinfectants, solvents, pharmaceuticals, insecticides and fungicides, plasticizers, rubber chemicals, additives to lubricants and petrol, wetting agents, dyestuffs.

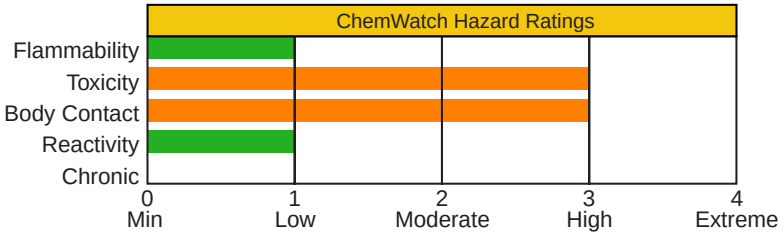
Section 2 - Composition / Information on Ingredients

Name	CAS	%
2,4-xylenol	105-67-9	>99

OSHA PEL **NIOSH REL**

ACGIH TLV

Section 3 - Hazards Identification



ANSI Signal Word

Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

White crystalline solid or liquid; sweet tarry odor. Severely irritating. Toxic by all routes. Other Acute Effects: cardiovascular/CNS effects; thirst, sweating, nausea, diarrhea, cyanosis. Chronic Effects: liver/kidney damage. Will burn.

Potential Health Effects

Target Organs: Skin, eyes, respiratory tract, central nervous system (CNS), cardiovascular system, heart, kidneys
Primary Entry Routes: accidental skin and eye contact and by inhalation of vapors especially at higher temperatures
Acute Effects
Inhalation: The material is harmful and discomforting to the upper respiratory tract.
Pulmonary absorption may lead to systemic toxicity affecting the cardiovascular and central nervous systems.
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. Phenols may exhibit local anesthetic properties and, in general, are central nervous system depressants at high concentrations.

The dihydroxy derivatives act as simple phenols but their effects are largely limited to local irritation. Trihydroxy derivatives may reduce the oxygen content of blood at sufficient exposure levels. Methyl phenols (cresols) typically do not pose significant inhalation hazards due to relatively low vapor pressures and objectionable odors. Substituted phenols produce similar effects to phenol although such effects may only be evident at high levels of exposure. Alkyl substitution tends to increase toxicity.

Eye: The material is highly discomforting to the eyes and may be capable of causing burns.

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 highly discomforting to the skin, is rapidly absorbed and may be capable of causing burns.

Toxic effects may result from skin absorption.

Toxicology is identical in most respects to phenol exposures.

Evidence exists that oral effects are less severe than when the substance is introduced through dermal wounds, body cavities or even unbroken skin.

Irrespective of the route of exposure there is no doubt that the major hazard stems from systemic effects. Although the onset of poisoning is amazingly abrupt, the dangerous phase of intoxication is usually complete within 24 hours.

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, hyperpnea, abdominal pain, hemolysis, convulsions, coma and pulmonary edema followed by pneumonia. Respiratory failure and kidney damage may follow.

Ingestion: The material is toxic if swallowed and may be corrosive and capable of causing burns.

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

Some phenol derivatives may produce mild to severe damage within the gastrointestinal tract. Absorption may result in profuse perspiration, intense thirst, nausea, vomiting, diarrhea, cyanosis (following the formation of methemoglobin), hyperactivity, stupor, falling blood pressure, hyperpnea, abdominal pain, hemolysis, convulsions, coma and pulmonary edema followed by pneumonia. Respiratory failure and kidney damage may follow.

Severe phenol ingestions cause hypotension, coma, ventricular dysrhythmias, seizures and white coagulative chemical burns.

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: Chronic exposure to low doses may result in liver and kidney damage.

Prolonged exposure to some derivatives of phenol may produce dermatitis, anorexia, weight loss, weakness, muscle aches and pain, liver damage, dark urine, skin eruptions, diarrhea, nervous disorders with headache, salivation, fainting, increased skin and scleral pigmentation, vertigo and mental disorders.

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: If this product comes in contact with the eyes:

- 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: 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. 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: 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 excitory 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. Alternatively: 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 glucoronide 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):

Determinant	Index	Sampling Time	Comments
• Total phenol in blood creatinine	250 mg/g	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: > 112 °C Closed Cup

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. Avoid creating dust - may present dust explosion hazard. Dry dust can be electrostatically charged by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport. Build-up of electrostatic charge may be prevented by grounding. Vapor may readily form an explosive mixture with air. Other combustion products include carbon dioxide (CO_2).

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 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 contact with skin and eyes.
- Control personal contact by using protective equipment.
- Use dry clean up procedures and avoid generating dust.
- Place in a suitable labeled container for waste disposal.

Large Spills: Pollutant.
- 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.
- 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).

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. Polyethylene or polypropylene container. Plastic pail. Polylined 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. Full face shield. 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: White crystalline solid or liquid with a sweet tarry odor.

Physical State: colorless crystals or needles
Odor Threshold: 0.0005 to 0.4 mg/m^3
Vapor Pressure (kPa): 0.0621 mm Hg at 20 °C
Vapor Density (Air=1): > 1
Formula Weight: 122.16
Specific Gravity (H_2O=1, at 4 °C): 0.965 at 20 °C/4 °C
Evaporation Rate: not applicable
pH: not applicable
Boiling Point: 211.5 °C (413 °F) at 766 mm Hg
Freezing/Melting Point: 25.4 °C (77.72 °F) to 26 °C (78.8 °F)
Volatile Component (% Vol): not applicable

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.

Section 11 - Toxicological Information

Toxicity
Oral (rat) LD_{50}: 3200 mg/kg
Dermal (rat) LD_{50}: 1040 mg/kg

Tumorigenic.

Irritation
Nil reported

See *RTECS* ZE5600000, for additional data.

Section 12 - Ecological Information

Environmental Fate: When released in water it will degrade principally due to biodegradation with a half-life of hours to days at ambient temperature. In humic waters oxidation by alkyl peroxy radicals may also be important. Adsorption to sediment and particulate matter in the water column will only be moderate and bioconcentration in fish should not be significant. If spilled on soil, it will probably adsorb moderately to the soil and biodegrade in several days. In the atmosphere, it will degrade during daylight hours by reaction with photochemically produced hydroxyl radicals (half-life 8 hr). At night it will probably degrade very rapidly by reaction with nitrate radicals. Washout by rain will also be an effective removal process.
Ecotoxicity: LC_{50}Lemina minor (duckweed) 292,800 ug/l/48 hr /Static, unmeasured bioassay; LC_{50}Pimephales promelas (fathead minnow) 17 mg/l/96 hr /Flow through bioassay; TL_m Carassius carassius (crucian carp) 30 mg/l/24 hr /Conditions of bioassay not specified; LC_{50}Daphnia magna (cladoceran) 2,120 ug/l/48 hr /Static, unmeasured bioassay; TL_m Salvelinus (trout embryo) 28 mg/l/24 hr /Conditions of bioassay not specified
Henry's Law Constant: estimated at 6×10^{-7}
BCF: fish 1.8 to 2.18
Octanol/Water Partition Coefficient: log K_{ow} = 2.30
Soil Sorption Partition Coefficient: K_{oc} = estimated at 425

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: Xylenols
ID: UN2261
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, T7, 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 U101 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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: o-Cresol **CAS Number:** 95-48-7
Chemical Formula: C_7H_8O
Structural Chemical Formula: $CH_3C_6H_4OH$
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.

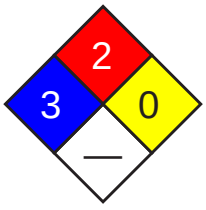
NIOSH REL
TWA: 2.3 ppm (10 mg/m^3).

DFG (Germany) MAK
Skin.

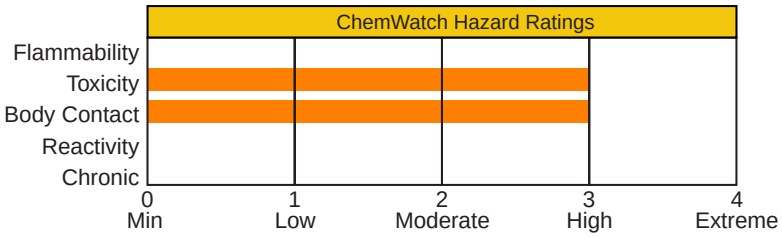
ACGIH TLV
TWA: 5 ppm; skin.

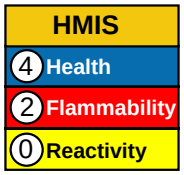
IDLH Level
250 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Danger!


Poison Corrosive Explosive

☆☆☆☆☆ 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 excitory 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 glucoronide 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):

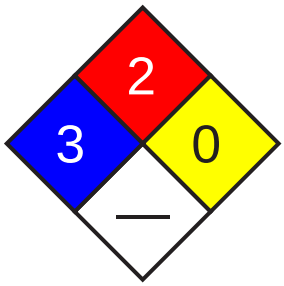
Determinant	Index	Sampling Time	Comments
Total phenol in blood	250 mg/g creatinine	End of shift	B,NS

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 (H_2O=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) LD_{50}: 121 mg/kg
Dermal (rabbit) LD_{50}: 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: 1.6×10^{-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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Cresols
CAS Number: 1319-77-3
Chemical Formula: C_7H_8O
Structural Chemical Formula: $CH_3C_6H_4OH$
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; CRESOLI; 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

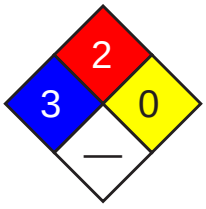
OSHA PEL
TWA: 5 ppm; 22 mg/m^3; skin.

NIOSH REL
TWA: 2.3 ppm, 10 mg/m^3.

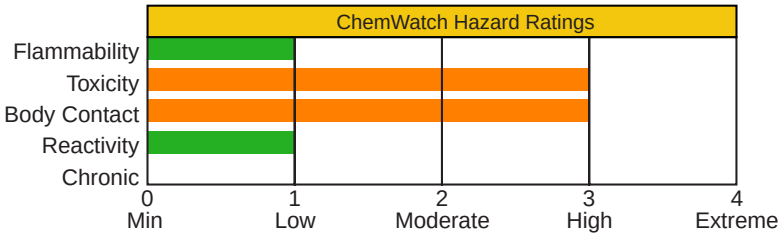
DFG (Germany) MAK
Skin.

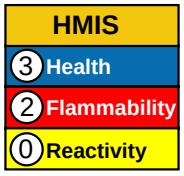
ACGIH TLV
TWA: 5 ppm; skin.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Danger!


Corrosive

☆☆☆☆☆ 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

See DOT ERG

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 excitory 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 glucoronide 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):

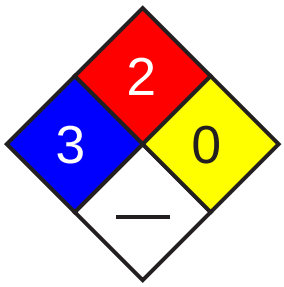
Determinant	Index	Sampling Time	Comments
Total phenol in blood	250 mg/gm creatinine	End of shift	B, NS

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: 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.

See DOT ERG



Fire Diamond

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.

Section 6 - Accidental Release Measures

See DOT ERG

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
Odor Threshold: 0.012 to 22.000 mg/m^3
Vapor Pressure (kPa): <0.13 at 38 °C
Vapor Density (Air=1): 3.72
Formula Weight: 108.15
Specific Gravity (H_2O=1, at 4 °C): 1.03 - 1.05
pH: < 7
Boiling Point: 191 °C (376 °F) to 203 °C (397 °F)
Freezing/Melting Point: 11 °C (51.8 °F) to 35 °C (95 °F)
Water Solubility: 1 part in about 50 parts 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.
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 $x10^{-7}$
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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Pentachlorophenol
PEN3470

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Pentachlorophenol **CAS Number:** 87-86-5
Chemical Formula: C_6HCl_5O
Structural Chemical Formula: C_6Cl_5OH
EINECS Number: 201-778-6
ACX Number: X1001598-0
Synonyms: ACUTOX; CHEM-PENTA; CHEM-TOL; CHLON; CHLOROPHEN; CRYPTOGIL OIL; CRYPTOGIL OL; DOW PENTACHLOROPHENOL DP-2 ANTIMICROBIAL; DOWCIDE 7; DOWICIDE 6; DOWICIDE 7; DOWICIDE 7 ANTIMICROBIAL; DOWICIDE EC-7; DURA TREET II; DUROTOX; EP 30; EPA PESTICIDE CHEMICAL CODE 063001; FORPEN-50 WOOD PRESERVATIVE; FUNGIFEN; GLAZD PENTA; GRUNDIER ARBEZOL; 1-HYDROXYPENTACHLOROBENZENE; LAUXTOL; LAUXTOL A; LIROPREM; ONTRACK WE HERBICIDE; OSMOSE WOOD PRESERVING COMPOUND; PCP; PENCHLOROL; PENTA; PENTA CONCENTRATE; PENTA READY; PENTA WR; PENTACHLOORFENOL; PENTACHLOROFENOL; PENTACHLOROPHENATE; 2,3,4,5,6-PENTACHLOROPHENOL; PENTACHLOROPHENOL; PENTACHLOROPHENOL,DOWICIDE EC-7; PENTACHLOROPHENOL,DP-2; PENTACHLOROPHENOL,TECHNICAL; PENTACHLORPHENOL; PENTACLOROFENOLO; PENTACON; PENTA-KIL; PENTASOL; PENWAR; PERATOX; PERMACIDE; PERMAGARD; PERMASAN; PERMATOX DP-2; PERMATOX PENTA; PERMITE; PREVENOL; PRILTOX; SANTOBRITE; SANTOPHEN; SANTOPHEN 20; SINITUHO; TERM-I-TROL; THOMPSON'S WOOD FIX; ORTHO TRIOX LIQUID VEGETATION KILLER; WATERSHED WOOD PRESERVATIVE; WEED AND BRUSH KILLER; WEEDONE; WITOPHEN P; WOODTREAT; WOODTREAT A
Derivation: Produced by chlorinating phenol.
General Use: Used as an insecticide for termite control; as a pre-harvest defoliant; general herbicide; molluscide; fungicide; bactericide; antimildew agent; wood preservative; in the synthesis of pentachlorophene esters; in cooling towers of electric plants; as additives to adhesives based on starch and vegetable and animal protein; in shingles, roof tiles, brick walls, concrete blocks, insulation, pipe sealant compounds, photographic solutions, and textiles; and in drilling mud in the petroleum industry.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Pentachlorophenol	87-86-5	

Trace Impurities: chlorodibenzodioxins, chlorodibenzofurans (commercial); polychlorophenols, chlorodibenzodioxins, chlorodibenzofurans, polychlorobenzenes, hydroxychlorodiphenyl ethers, 2-bromo-3,4,5,6-tetrachlorophenol (technical grade)

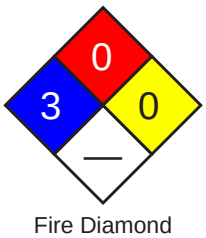
OSHA PEL
TWA: 0.5 mg/m^3; skin.

NIOSH REL
TWA: 0.5 mg/m^3; skin.

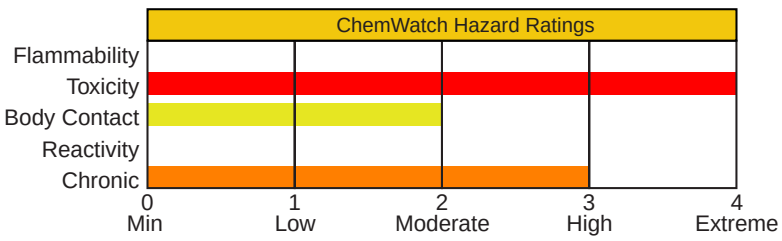
ACGIH TLV
TWA: 0.5 mg/m^3; skin.

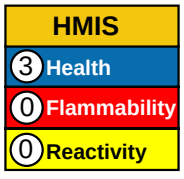
IDLH Level
2.5 mg/m^3.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Danger!


Poison

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

White or dark gray (technical grade) crystalline solid; phenolic odor. Severely irritating to eyes/skin/respiratory tract. Poison. Other Acute Effects: upset stomach, high fever, increased metabolic rate, heart failure. Chronic Effects: human carcinogen (animal data), mutations.

Potential Health Effects

Target Organs: Eyes, skin, liver, kidneys, and respiratory, central nervous (CNS), and cardiovascular systems

Primary Entry Routes: Inhalation, skin and/or eye contact, skin absorption

Acute Effects

Inhalation: Causes irritation, cough, sneezing, rapid breathing; and systemic effects.

Eye: Causes severe irritation or burns, pupil dilation, corneal opacity and numbness, and possibly permanent visual change or loss.

Skin: Causes severe irritation or burns, dermatitis and systemic effects including upset stomach, weakness, twitching, rapid breathing, polyuria (frequent urination), followed by oliguria (little urination), metabolic acidosis, anemia, hemolysis, high fever, profuse sweating, thirst, increased basal metabolic rate, rapid heart beat, seizures, collapse, heart failure, coma, cerebral edema (brain swelling), and death. Significant exposures may cause permanent damage including impaired autonomic nervous function and circulation.

Ingestion: Causes gastrointestinal tract irritation, loss of hunger, and systemic effects.

Carcinogenicity: NTP - Not listed; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; 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: Individuals with kidney, liver, or metabolic disorders may be at a higher risk from exposure to pentachlorophenol. *Note: Pentachlorophenol may cross the placenta and affect an unborn child.*

Chronic Effects: Chronic exposure to pentachlorophenol may cause dermatitis, chloracne, conjunctivitis, bronchitis, damage to the cardiovascular and immune systems, anorexia (appetite loss), anemia, weight loss, bruising, weakness, fever, sweating, dizziness, headache, anxiety, difficult breathing, kidney and liver damage, and possibly cancer.

Section 4 - First Aid Measures

See DOT ERG

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 or irritation persist.

Skin Contact: *Quickly* remove contaminated clothing and wash exposed area with soap and water, repeatedly. Get medical attention immediately.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. *Do not* induce vomiting due to risk of CNS depression and seizures.

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

Note to Physicians: Severe systemic poisoning results primarily from uncoupling of mitochondrial oxidative phosphorylation, with ensuing hyperpyrexia. Reduce temperature and replace fluid and electrolytes lost through sweating. Treat symptomatically and supportively. *Do not* administer salicylates. Treat severe acidosis with IV sodium bicarbonate. Monitor for electrolyte imbalance, metabolic acidosis, hemolytic anemia, methemoglobinemia, pancreatitis, and liver and kidney dysfunction. Administer oxygen by mask continuously to minimize tissue anoxia.

Section 5 - Fire-Fighting Measures

See DOT ERG

Flash Point: Not applicable; noncombustible solid

Autoignition Temperature: None reported.

LEL: None reported.

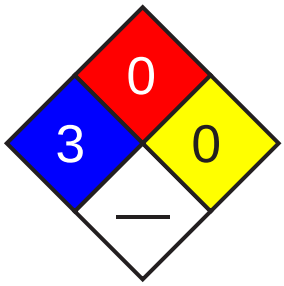
UEL: None reported.

Flammability Classification: Noncombustible solid

Extinguishing Media: Use agent suitable for surrounding fire.

General Fire Hazards/Hazardous Combustion Products: Include hydrogen chloride (HCl) and chlorinated phenols. May be dissolved in hydrocarbon solution.

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 the area for at least 80 to 160 feet. Ventilate area, deny entry, stay upwind. Stop leak if you can do so without risk. Cleanup personnel should protect against exposure.

See DOT ERG

Small Spills: If in solid form, *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. Cover with plastic sheet to prevent dispersion. *Do not* release into sewers or waterways. If in water, apply activated carbon (10 times the spilled amount of pentachlorophenol). Remove trapped material with suction hoses.

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

Section 7 - Handling and Storage

Handling Precautions: Use only with adequate ventilation to maintain concentrations at nonhazardous levels (Sec. 2). Wear personal protective clothing and equipment to prevent any contact with skin and eyes (Sec. 8), and avoid dust inhalation. Practice good personal hygiene procedures to prevent inadvertently ingesting this material. *Do not* attempt to handle broken containers without proper protective equipment. Immediately wash skin if contact with pentachlorophenol occurs. Shower and change into clean clothing after working with pentachlorophenol. 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. Protect containers from physical damage. Outside or detached storage is preferred.

Storage Requirements: Store according to USEPA hazardous waste storage regulations.

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. Whenever possible, automatically transfer pentachlorophenol from storage containers to process containers. Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PEL (Sec. 2). Local exhaust ventilation is preferred.

Administrative Controls: Educate workers about the hazards associated with this material. Train in work practices which minimize exposure. Consider preplacement and periodic medical exams with emphasis on the lungs, liver, kidneys, skin, cardiovascular and nervous systems.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent any skin contact. Nitrile rubber and Viton are recommended >8, neoprene and 4H >4. *Do not* use natural rubber or polyvinyl alcohol. Wear dust-proof eyeglasses (solid form) or chemical safety goggles (solution), 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 concentrations >= 2.5 mg/m^3: any chemical cartridge respirator with organic vapor cartridge(s) in combination with a dust, mist, and fume filter, or any powered, air-purifying respirator with organic vapor cartridge(s) in combination with a dust, mist and fume filter, or any supplied-air respirator, or any SCBA with a full facepiece; emergency/unknown concentrations/IDLH conditions: any SCBA that has a full facepiece and is operated in pressure-demand or other positive-pressure mode, or any supplied-air respirator that has a full facepiece and is operated in pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive-pressure mode; escape: any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having a high-efficiency particulate filter or any appropriate 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. Segregate contaminated clothing such that cleaning personnel *do not* come in contact with pentachlorophenol. Remove this material from your shoes and clean personal protective equipment. Immediately remove contaminated clothing. 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 or dark gray (technical grade) crystalline solid; may be in solution.

Physical State: Solid

Odor Threshold: PCP Soln 857 ug/l at 30 |'b0C

Vapor Pressure (kPa): 0.00011 mm Hg at 77 °F (25 °C)

Vapor Density (Air=1): 9.2

Formula Weight: 266.35
Specific Gravity (H_2O=1, at 4 °C): 1.978 at 22 °C/4 °C
Evaporation Rate: Low, calculated
Boiling Point: 588 °F (309 °C) (decomposes)
Freezing/Melting Point: 374 °F (190 °C)
Water Solubility: 514 mg/L at 68 °F (20 °C) (slight)
Other Solubilities: Soluble in methanol, ethanol, alcohol, pine oil, dilute alkali, and ether.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Pentachlorophenol is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Avoid contact with chemical incompatibles.

Storage Incompatibilities: Include strong oxidizers (contact may produce fire or explosion), strong acids or bases, acid chlorides, acid anhydrides, and ultraviolet light (solution).

Hazardous Decomposition Products: Thermal oxidative decomposition of pentachlorophenol can produce hydrogen chloride (HCl), chlorinated phenols, and carbon monoxide.

Section 11 - Toxicological Information

Acute Oral Effects:

Man, oral, LD_{Lo}: 401 mg/kg caused toxic effects: change in motor activity (specific assay); sweating; body temperature increase.

Rat, oral, LD_{50}: 27 mg/kg produced toxic effects: BP elevation not characterized in autonomic section; hyperglycemia; body temperature increase.

Acute Inhalation Effects:

Rat, inhalation, LC_{50}: 355 mg/m^3; toxic effects: excitement, muscle contraction or spasticity; dyspnea.

Acute Skin Effects:

Rabbit, skin, LD_{Lo}: 40 mg/kg; toxic effects: muscle weakness; BP elevation not characterized in autonomic section; urine volume increased.

Rat, skin, LD_{50}: 96 mg/kg; toxic effects: excitement, muscle contraction or spasticity; dyspnea.

Mouse, subcutaneous: 46 mg/kg; toxic effects: tumorigenic - equivocal tumorigenic agent by RTECS criteria; lungs, thorax, or respiration - tumors; liver - tumors.

Irritation Effects:

Rabbit, open draize test: 10 mg/24 hr: mild irritation.

Other Effects:

Rat, oral: 84 mg/kg for 28 days, intermittent; toxic effects: endocrine - other changes; changes in serum composition.

Rat, oral: 840 mg/kg for 12 weeks, continuous; toxic effects: changes in liver weight; changes in erythrocite (RBC) cell count; weight loss or decreased weight gain.

Tumorgenicity, mouse, oral: 8736 mg/kg for 2 years, continuous; toxic effects: tumorigenic - carcinogenic by RTECS criteria; endocrine - tumors.

Mutagenicity - *S. typhimurium*, 40 nmol/plate induced mutation. *S. Cerevisiae*, 400 mg/L induced mutation.

Rat, female, oral: 50 mg/kg, administered on gestational days 6-15 produced specific developmental abnormalities - musculoskeletal system.

Rat, female, oral: 4 g/kg, administered 77 days prior to mating produced effects on newborn - weaning or lactation index; growth statistics.

Rat, female, oral: 60 mg/kg, administered on gestational day 9 produced effects on embryo or fetus - fetotoxicity.

See *RTECS* SM6300000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it will be subject to slow biodegradation and leaching into groundwater. If released in water, it will adsorb to sediment, photodegrade (especially at high pH) and slowly biodegrade. Bioconcentration in fish will be moderate. In air, it will be lost due to photolysis and reaction with photochemically produced hydroxyl radicals. Half-life in soil: weeks to 3 months. Very low mobility in soil. It tends to adsorb to soil and sediment. However, leaching to groundwater is possible. K_{oc} - 1000, calculated; 3000-4000 (measured, sediment)

Ecotoxicity: Pentachlorophenol is highly toxic to algae, crustaceans, and fish. Trout, fresh water, 5 ppm for 3 hr: lethal. Mallard duck, LC_{50}: 4500 ppm. *Daphnia magna*, 7 day LC_{50}: 0.53 mg/L. Fathead minnow, small, 24 hr LC_{50}: 0.24 mg/L. *Poecilia reticulata*, >7 day LC_{50}: 0.38 mg/L.

Henry's Law Constant: 2.45 x 10^{-8} atm-m^3/mole at 77 °F

Octanol/Water Partition Coefficient: log K_{ow} = 5.12

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 burn in a chemical incinerator equipped with a scrubber and ash disposal facility. Handle empty containers carefully as hazardous residues may still remain. *Do not* reuse empty containers. Combustible containers should be burned in a pesticide incinerator or disposed of in a specified landfill.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Pentachlorophenol
ID: UN3155
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:**

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed See F027 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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Phenol
CAS Number: 108-95-2
Chemical Formula: C_6H_6O
Structural Chemical Formula: C_6H_5OH
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.

ACGIH TLV
TWA: 5 ppm; skin.

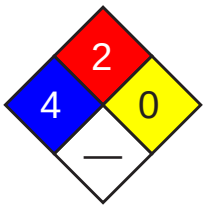
EU OEL
TWA: 2 ppm.

NIOSH REL
TWA: 5 ppm (19 mg/m^3); Ceiling: 15.6 ppm (60 mg/m^3) (15-minute); skin.

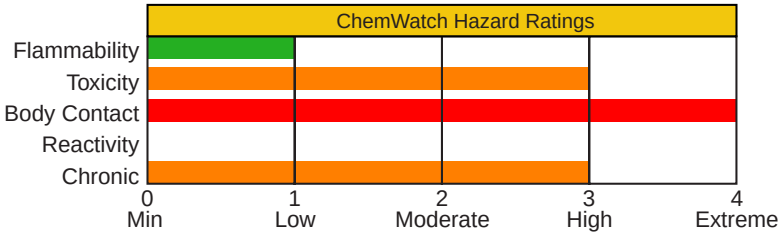
IDLH Level
250 ppm.

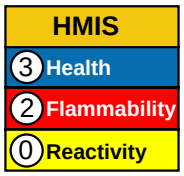
DFG (Germany) MAK
Skin.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Danger!


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

See DOT ERG

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.
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 excitory 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 glucoronide 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):

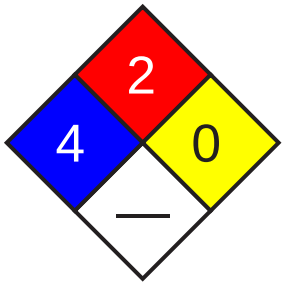
Determinant	Index	Sampling Time	Comments
Total phenol in blood	250 mg/gm creatinine	End of shift	B, NS

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 (CO_2).
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.

See DOT ERG



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).

See DOT ERG

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/m^3
Vapor Pressure (kPa): 101.33 at 181 °C
Vapor Density (Air=1): 3.24
Formula Weight: 94.11
Specific Gravity (H_2O=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) LD_{50}: 317 mg/kg
Oral (human) LD_{Lo}: 140 mg/kg
Inhalation (rat) LC_{50}: 316 mg/m^3
Dermal (rabbit) LD_{50}: 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: LC_{50} 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; LC_{50} Rainbow trout 5.6-11.3 mg/l/24 hr in a static bioassay; LC_{50} Ophicephalus punctatus 46.0 mg/l/48 hr in a static bioassay; TL_m Mercenaria mercenaria (hard clam) egg 5.263 $x10^4$ 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: LD_0 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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

1,2,4-Trichlorobenzene
TRI2350

Section 1 - Chemical Product and Company Identification 61

Material Name: 1,2,4-Trichlorobenzene **CAS Number:** 120-82-1
Chemical Formula: $C_6H_3Cl_3$
Structural Chemical Formula: $C_6H_3Cl_3$
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

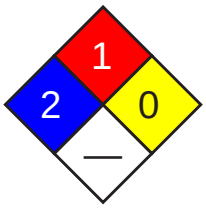
NIOSH REL
Ceiling: 5 ppm (40 mg/m^3).

DFG (Germany) MAK
Skin.

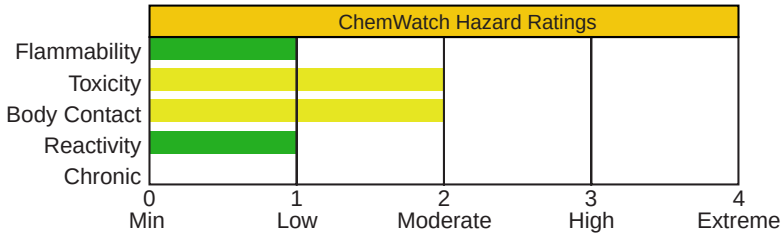
ACGIH TLV
Ceiling: 5 ppm.

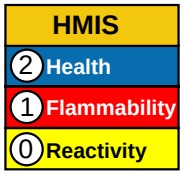
EU OEL
TWA: 2 ppm; STEL: 5 ppm.

Section 3 - Hazards Identification



Fire Diamond





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.

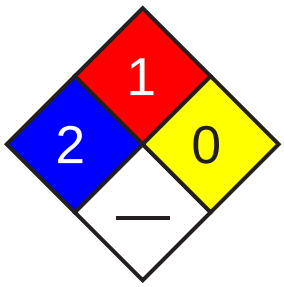
Section 4 - First Aid Measures

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.

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.



Fire Diamond

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.

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
Odor Threshold: 24.0 mg/m^3
Vapor Pressure (kPa): 0.1 at 40 °C
Vapor Density (Air=1): >6
Formula Weight: 181.44
Specific Gravity (H_2O=1, at 4 °C): 1.46
pH: Not applicable
pH (1% Solution): Not applicable
Boiling Point: 213.5 °C (416 °F) at 760 mm Hg
Freezing/Melting Point: 17 °C (62.6 °F)
Water Solubility: 19 ppm at 22 °C 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) TD_{Lo}: 1800 mg/kg
Oral (rat) LD_{50}: 756 mg/kg
Intraperitoneal (mouse) LD_{50}: 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: LC_{50} 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; LC_{50} Poecilia reticulata (guppy) 2.4 ppm/14 days /Conditions of bioassay not specified; LC_{50} 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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Polychlorinated Biphenyls (PCBs)
POL2140

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; PHENOCLOR; 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.

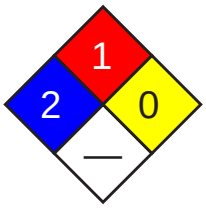
Section 2 - Composition / Information on Ingredients

Name	CAS	%
polychlorinated biphenyls (PCB's)	1336-36-3	100

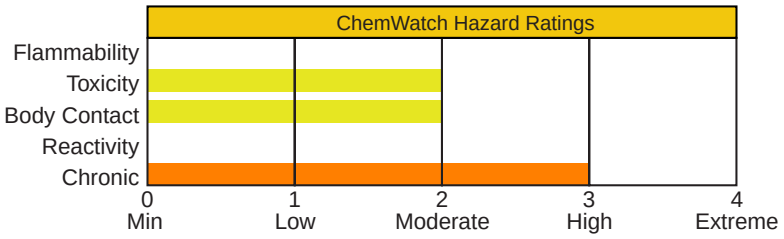
OSHA PEL **NIOSH REL**

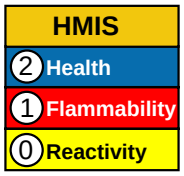
ACGIH TLV

Section 3 - Hazards Identification



Fire Diamond





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 inflammed 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 hepatoxicants, reproductive toxicants, immunotoxicants and procarcinogens) by interaction with a cytostolic 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 thyroxin (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

See DOT ERG

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.

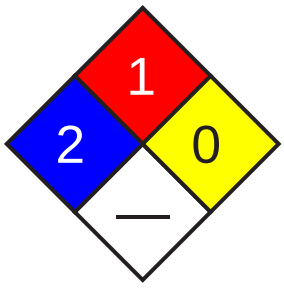
After first aid, get appropriate in-plant, paramedic, or community medical support.

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.

Section 5 - Fire-Fighting Measures

See DOT ERG

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 Diamond

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.

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).

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 (H_2O=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) LD_{Lo}: 500 mg/kg
Oral (rat) LD_{50}: 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: LD_{50} 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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Diesel Fuel Oil No. 2-D
DIE1400

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Diesel Fuel Oil No. 2-D **CAS Number:** 68334-30-5
Chemical Formula: Un
Structural Chemical Formula: Unspecified; variable
EINECS Number: 269-822-7
ACX Number: X1012054-0
Synonyms: AUTOMOTIVE DIESEL OIL; DIESEL FUEL; DIESEL FUEL OIL NO. 2-D; DIESEL OIL (PETROLEUM); DIESEL OILS; DIESEL TEST FUEL; FUELS,DIESEL; OLEJ NAPEDOWY III; SANTOS MOOMBA DISTILLATE
Derivation: Fuel oil may be a distilled fraction of petroleum, a residuum from refinery operations, a crude petroleum or a blend of two or more of these.
General Use: This medium viscosity residual fuel oil has both light and heavy grades, and is used in furnaces and boilers of utility and industrial power plants, ships, locomotives, and metallurgical operations.

Section 2 - Composition / Information on Ingredients

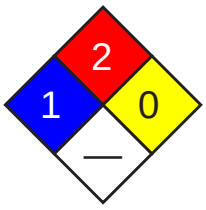
Name	CAS	%
Diesel fuel oil no. 2-D	68334-30-5	ca 100% vol;

diesel fuels consist primarily of aliphatic (64% vol), aromatic (35% vol), and olefinic (1-2% vol) hydrocarbons.
Trace Impurities: May contain sulfur (< 0.5), benzene (<100 ppm), and additives such as sulfurized esters.

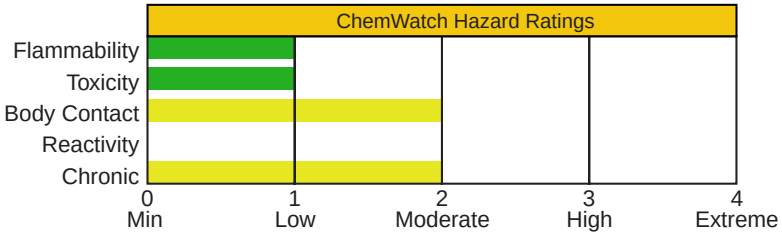
OSHA PEL **NIOSH REL**

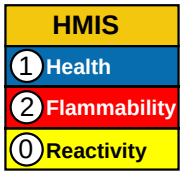
ACGIH TLV
TWA: 100 mg/m^3; skin.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Warning!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Brown, slightly viscous liquid; kerosene-like odor. Irritating to skin/respiratory tract. Other Acute Effects: headache, nausea, vomiting, diarrhea, CNS depression, tachycardia, cyanosis, pulmonary edema, liver/kidney injury. Flammable.

Potential Health Effects

Target Organs: Skin, CNS, cardiovascular system (CVS), respiratory system, liver, kidneys
Primary Entry Routes: Inhalation, ingestion, skin contact/absorption
Acute Effects
Inhalation: Euphoria, respiratory irritation, cardiac dysrhythmia, increased respiration rates, cyanosis, pulmonary edema, hemoptysis (spitting up blood from the respiratory tract), respiratory arrest, renal (kidney) and liver injury, and CNS toxicity can result from inhalation of diesel fuel oil no. 2-D mist or vapor.
Eye: Contact may result in irritation.
Skin: Contact may cause irritation, systemic effects, and block the sebaceous (oil) glands, resulting in a rash of acne-like pimples and spots, usually on the arms and legs.

Ingestion: Gastrointestinal irritation, vomiting, diarrhea, and in severe cases, CNS depression progressing to coma and death and other systemic effects can result. Aspiration can result in transient CNS depression or excitement, hypoxia, infection, pneumatocele (abnormal cavities in lungs) formation, and chronic lung dysfunction.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; 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: Prolonged or repeated skin contact causes dermatitis and possible systemic toxicity. Prolonged or repeated inhalation can cause CNS and peripheral nervous system damage.

Section 4 - First Aid Measures

See DOT ERG

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 followed by washing the 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. Have the *conscious and alert* person drink 1 to 2 glasses of water. Contact a poison control center. Because of aspiration risk, *do not* induce vomiting unless the poison control center advises otherwise.

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

Note to Physicians: Gastric lavage is contraindicated due to aspiration risk. Instead, consider administration of charcoal or milk. If ingestion amount is large, gastric emptying in the alert patient can be accomplished through administration of Syrup of Ipecac. Treat overexposure symptomatically and supportively.

Section 5 - Fire-Fighting Measures

See DOT ERG

Flash Point: 100.4 °F (38 °C), Closed Cup

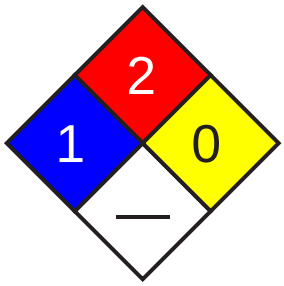
Autoignition Temperature: 351-624 °F (177-329 °C)

LEL: 1.3% v/v

UEL: 75% v/v

Flammability Classification: OSHA Class II Combustible Liquid

Extinguishing Media: Use dry chemical, carbon dioxide, foam, low velocity water fog or spray. Use a smothering technique to extinguish fire. Water may be ineffective in putting out a fire involving diesel fuel oil no. 2-D, and a solid water stream may spread the flames; however, a water spray may be used to cool fire-exposed containers, and flush spills away from ignition sources.



Fire Diamond

General Fire Hazards/Hazardous Combustion Products: Heating diesel fuel oil no. 2-D to decomposition can produce acrid smoke and irritating vapors. Vapor or mist can form explosive mixtures in air. In still air, the heavier-than-air vapors of diesel fuel oil no. 2-D from a large source may travel along low-lying surfaces to distant sources of ignition and flash back to the material source. Containers 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.

Section 6 - Accidental Release Measures

See DOT ERG

Spill/Leak Procedures: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Ground all equipment used when handling this product. *Do not* touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A fire fighting foam may be used to suppress vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean non-sparking tools to collect absorbed material.

Small Spills: Absorb diesel fuel oil no. 2-D with vermiculite, earth, sand or similar material.

Large Spills: For large spills, consider downwind evacuation of at least 1000 ft (300 m). Dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways. Ground all equipment. Use non-sparking tools. Spills can be absorbed with materials such as peat, activated carbon, polyurethane foam, or straw. Sinking agents, gelling agents, dispersants, and mechanical systems can also be use to treat oil spills.

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

Section 7 - Handling and Storage

Handling Precautions: Avoid vapor or mist inhalation, and skin and eye contact. Use only with ventilation sufficient to reduce airborne concentrations to non-hazardous levels (see Sec. 2). Wear protective gloves (or use barrier cream), and clothing (see Sec. 8). Keep away from heat and ignition sources. Ground and bond all containers during transfers to prevent static sparks. Use non-sparking tools to open and close 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: Store in tightly closed container in cool, well-ventilated area, away from heat, ignition sources and incompatibles (see Sec. 10). Periodically inspect stored materials. Equip drums with self-closing valves, pressure vacuum bungs, and flame arrestors.

Regulatory Requirements: Follow applicable OSHA regulations. Also 29 CFR 1910.106 for Class II Combustible Liquid.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations. 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: Enclose operations and/or provide local exhaust ventilation appropriately designed for flammable mist and vapor at the site of chemical release. Where possible, transfer diesel fuel oil no. 2-D from drums or other storage containers directly to process containers. Minimize sources of ignition in surrounding low-lying areas.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets. 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: Brown, slightly viscous; kerosene-like odor.

Physical State: Liquid

Odor Threshold: 0.7 ppm

Vapor Pressure (kPa): < 0.1 mm Hg at 68 °F (20 °C)

Vapor Density (Air=1): > 6

Formula Weight: N/A

Specific Gravity (H_2O=1, at 4 °C): < 0.86

Boiling Point: 340-676 °F (171-358 °C)

Freezing/Melting Point: -29.2 °F (-34 °C)

Viscosity: 1.9-4.1 centistoke at 104 °F (40 °C)

Surface Tension: 23-32 dynes/cm at 68 °F (20 °C)

Water Solubility: Insoluble

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Diesel fuel oil no. 2-D is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Exposure to heat and ignition sources.

Storage Incompatibilities: Include strong oxidizing agents.

Hazardous Decomposition Products: Thermal oxidative decomposition of diesel fuel oil no. 2-D can produce low molecular weight hydrocarbons, hydrocarbon derivatives, carbon oxides (CO_x), and sulfur oxides (SO_x).

Section 11 - Toxicological Information

Acute Oral Effects:
Rat, oral, LD_{50}: 7500 mg/kg.
Acute Skin Effects:
Rabbit, skin, LD: > 5 mL/kg.
Irritation Effects:
Rabbit, skin, standard Draize test: 500 µL/24 hr, resulted in severe reaction.
Other Effects:
Rat, inhalation: 2 g/m^3/6 hr/3 weeks, intermittently, resulted in changes in blood erythrocyte (RBC) count, and focal fibrosis (pneumonoconiosis) and other changes in the lung, thorax or respiration.
Rat, inhalation: 400 $\mu g/m^3$/16 hr/2.5 years, intermittently, caused other changes in the blood, and biochemical effects - transaminases.
Rabbit, skin: 80 mL/kg/12 days, continuously, resulted in other changes in the liver, kidney, ureter, and bladder, and death.

See *RTECS* HZ1800000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Diesel fuel oil no. 2-D will evaporate from water or soil. In surface water, it may partition from the water column to suspended sediments. Biodegradation may occur in soil and water.
Ecotoxicity: Juvenile American shad, salt water TL_m: 204 mg/L/24 hr; mallard duck, LD_{50}=20 mg/kg.

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: Diesel fuel
ID: NA1993
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: III - Minor Danger
Symbols: D - Domestic transportation
Label Codes: None
Special Provisions: 144, B1, IB3, T4, TP1, TP29
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:**

Shipping Name and Description: Diesel fuel
ID: UN1202
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: III - Minor Danger
Symbols: I - International transportation
Label Codes: 3 - Flammable Liquid
Special Provisions: 144, 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: 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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Unleaded Petrol
AUT5000

Section 1 - Chemical Product and Company Identification 61

Material Name: Unleaded Petrol **CAS Number:** 8006-61-9
Chemical Formula: Mixture of hydrocarbons
EINECS Number: 232-349-1
ACX Number: X1003056-5
Synonyms: AUTOMOTIVE GASOLINE, LEAD-FREE; GASOLINE; MOTOR FUEL; MOTOR SPIRITS; NATURAL GASOLINE; PETROL; UNLEADED PETROL
General Use: Lead free motor fuel for internal combustion engines, 2-stroke and 4-stroke.

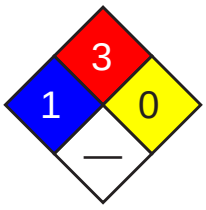
Section 2 - Composition / Information on Ingredients

Name	CAS	%
gasoline	8006-61-9	>90
benzene	71-43-2	5 max.

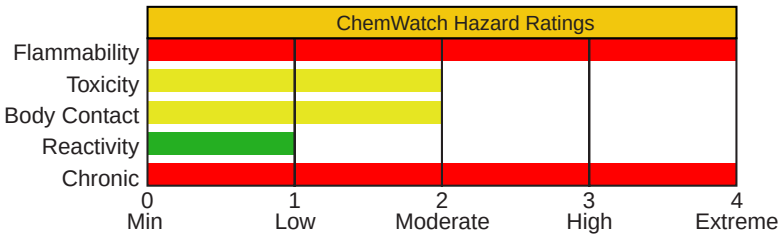
OSHA PEL **NIOSH REL**

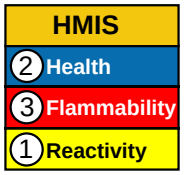
ACGIH TLV
TWA: 300 ppm, 890 mg/m^3;
STEL: 500 ppm, 1480 mg/m^3.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear liquid; distinctive odor. Irritating to eyes/skin/respiratory tract. Other Acute Effects: dizziness, drunkenness, unconsciousness. Chronic Effects: dermatitis. Possible cancer hazard. Flammable.

Potential Health Effects

Target Organs: skin, eye, respiratory system, central nervous system (CNS)
Primary Entry Routes: inhalation, ingestion, skin contact

Acute Effects

Inhalation: The vapor is discomforting to the upper respiratory tract and may be harmful if exposure is prolonged. 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. WARNING: Intentional misuse by concentrating/inhaling contents may be lethal. High inhaled concentrations of mixed hydrocarbons may produce narcosis characterized by nausea, vomiting and lightheadedness. Inhalation of aerosols may produce severe pulmonary edema, pneumonitis and pulmonary hemorrhage. Inhalation of petroleum hydrocarbons consisting substantially of low molecular weight species may produce irritation of mucous membranes, incoordination, giddiness, nausea, vertigo, confusion, headache, appetite loss, drowziness, tremors and anesthetic stupor. Massive exposures may produce central nervous system depression with sudden collapse and deep coma; fatalities have been recorded. Irritation of the brain and/or apneic anoxia may produce convulsions. Although recovery following overexposure is generally complete, cerebral micro- hemorrhage of focal post-inflammatory scarring may produce eleptiform seizures some months after the exposure. Pulmonary episodes may include chemical pneumonitis with edema and hemorrhage. The lighter hydrocarbons may produce kidney and neurotoxic effects. Liquid paraffins may produce anesthesia and depressant actions leading to weakness, dizziness, slow and shallow respiration, unconsciousness, convulsions and death. C_{5-7} paraffins may also produce polyneuropathy. Aromatic hydrocarbons accumulate in lipid-rich tissues (typically the brain, spinal cord and peripheral nerves) and may produce functional impairment manifested by nonspecific symptoms such as nausea, weakness, fatigue, vertigo; severe exposures may produce inebriation or unconsciousness. Many of the petroleum hydrocarbons are cardiac sensitizers and may cause ventricular fibrillations.

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. Petroleum hydrocarbons may produce pain after direct contact with the eyes. Slight, but transient, disturbances of the corneal epithelium may also result. The aromatic fraction may produce irritation and lachrymation. The material may produce moderate eye irritation leading to inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The material is moderately discomforting to the skin if exposure is prolonged. The material contains a component that may be absorbed through the skin and may cause drying of the skin, which may lead to dermatitis from repeated exposures over long periods. 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 dermatitis condition.

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. Ingestion of petroleum hydrocarbons may produce irritation of the pharynx, esophagus, stomach and small intestine with edema and mucosal ulceration. Resulting symptoms include a burning sensation in the mouth and throat. Large amounts may produce narcosis with nausea and vomiting, weakness or dizziness, slow and shallow respiration, swelling of the abdomen, unconsciousness and convulsions. Myocardial injury may produce arrhythmias, ventricular fibrillation and electrocardiographic changes. Central nervous system depression may also occur. Light aromatic hydrocarbons produce a warm, sharp, tingling sensation on contact with taste buds and may anesthetize the tongue. Aspiration into the lungs may produce coughing, gagging, and a chemical pneumonitis with pulmonary edema and hemorrhage.

Carcinogenicity: NTP - Not listed; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A3, Animal carcinogen; EPA - Not listed; 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. Chronic poisoning may occur from vapor inhalation or skin absorption. The most significant toxic effect is insidious and irreversible injury to the blood-forming tissue by benzene. Leukemia may develop. Chronic exposure may cause headache, fatigue, loss of appetite and lassitude with incipient blood effects including anemia and blood changes. Gasoline "sniffing" has caused severe nerve damage. Repeated or prolonged exposure to mixed hydrocarbons may produce narcosis with dizziness, weakness, irritability, concentration and/or memory loss, tremor in the fingers and tongue, vertigo, olfactory disorders, constriction of visual field, paresthesias of the extremities, weight loss and anemia and degenerative changes in the liver and kidney. Chronic exposure by petroleum workers to the lighter hydrocarbons has been associated with visual disturbances, damage to the central nervous system, peripheral neuropathies (including numbness and paresthesias), psychological and neurophysiological deficits, bone marrow toxicities (including hypoplasia, possibly due to benzene) and hepatic and renal involvement. Chronic dermal exposure to petroleum hydrocarbons may result in defatting which produces localized dermatoses. Surface cracking and erosion may also increase susceptibility to infection by microorganisms.

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 ERG

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: 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, 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 petroleum distillates or related hydrocarbons:

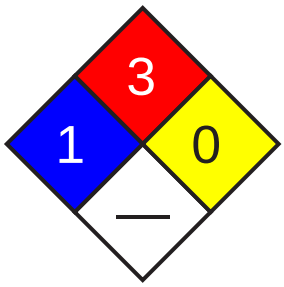
1. Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.
2. Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes 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: -43 °C
Autoignition Temperature: 280 °C
LEL: 1.4% v/v
UEL: 7.6% v/v

See DOT ERG

Extinguishing Media: Foam. Dry chemical powder.
Bromochlorodifluoromethane (BCF) (where regulations permit). Carbon dioxide.



Fire Diamond

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 oxidizing agents, i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc., as ignition may result.

Fire-Fighting Instructions: Alert 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 water ways. If safe, switch off electrical equipment until vapour 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 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. Alert 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 water ways. No smoking, naked 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 labelled 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: 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. If inhalation risk of overexposure exists, wear a NIOSH approved organic-vapor respirator. Correct respirator fit is essential to obtain adequate protection. In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus. 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 PVC gloves. Safety footwear. Do NOT use this product to clean the skin.

Respiratory Protection:

Exposure Range >300 to 1000 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range >1000 to 15,000 ppm: Air Purifying, Negative Pressure, Full Face
Exposure Range >15,000 to 300,000 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face
Exposure Range >300,000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black

Other: Overalls. Ensure that there is ready access to eye wash unit. Ensure there is ready access to an emergency shower.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Purple, highly flammable, volatile liquid with characteristic sharp odor. Floats on water. Consists of a complex mixture of hydrocarbons with small amounts of residual benzene from the refining operations.

Physical State: Liquid
Odor Threshold: 0.005 ppm
Vapor Pressure (kPa): 53.33 at 20 °C
Vapor Density (Air=1): > 2
Formula Weight: Not applicable.
Specific Gravity (H_2O=1, at 4 °C): 0.72-0.735 at 15 °C
Evaporation Rate: Fast
pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: 38.89 °C (102 °F)
Freezing/Melting Point: Not available
Volatile Component (% Vol): 100
Decomposition Temperature (°C): Not available.
Water Solubility: Insoluble

Section 10 - Stability and Reactivity

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

Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Toxicity
Oral (rat) LD_{50}: 18800 mg/kg

Irritation
Skin (rabbit): 500 mg/24h mild

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: No data found.
Biochemical Oxygen Demand (BOD): 8%, 5 days

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible. Follow all applicable federal, state, and local laws. Incinerate residue at an approved site. Recycle containers where possible, or dispose of in an authorized landfil.
BEWARE: Empty solvent, paint, lacquer and flammable liquid drums present a severe explosion hazard if cut by flame torch or welded. Even when thoroughly cleaned or reconditioned, the drum seams may retain sufficient solvent to generate an explosive atmosphere in the drum.

Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Shipping Name and Description: Gasoline
ID: UN1203
Hazard Class: 3 - Flammable and combustible liquid
Packing Group: II - Medium Danger
Symbols:
Label Codes: 3 - Flammable Liquid
Special Provisions: 139, B33, B101, T8
Packaging: **Exceptions:** 150 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** E **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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Propane
PRO2710

Section 1 - Chemical Product and Company Identification 61

Material Name: Propane **CAS Number:** 74-98-6
Chemical Formula: C_3H_8
Structural Chemical Formula: $CH_3CH_2CH_3$
EINECS Number: 200-827-9
ACX Number: X1003352-2
Synonyms: A-108; BOTTLED GAS; DIMETHYL METHANE; DIMETHYLMETHANE; HYDROCARBON PROPELLANT A-108; N-PROPANE; PROPANE; PROPANE; PROPYL HYDRIDE; PROPYLDIHYDRIDE; R 290
General Use: A household and industrial fuel gas, sometimes mixed with butane.
An aerosol propellant. As a refrigerant (CARE 40). In the manufacture of ethylene.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
propane	74-98-6	>99

OSHA PEL
TWA: 1000 ppm; 1800 mg/m^3.

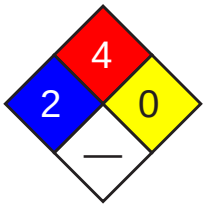
NIOSH REL
TWA: 1000 ppm (1800 mg/m^3).

DFG (Germany) MAK
TWA: 1000 ppm; PEAK: 2000 ppm.

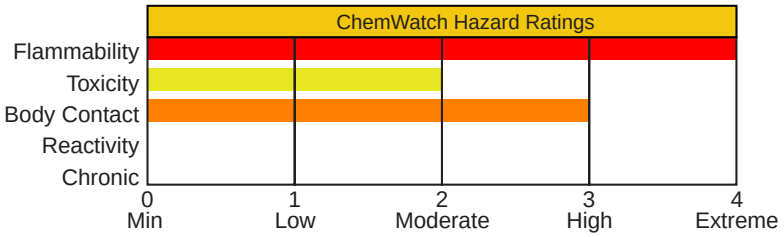
ACGIH TLV
TWA: 2500 ppm.

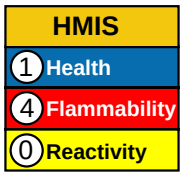
IDLH Level
2100 ppm (10% LEL).

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Danger!


Flammable Compressed Gas

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless, odorless gas; may have additives to smell like rotten eggs. Irritating to eyes/respiratory tract. Stored as a compressed gas which can cause frostbite. Other Acute Effects: asphyxiation (reduced oxygen available for breathing). Flammable.

Potential Health Effects

Target Organs: central nervous system (CNS)
Primary Entry Routes: inhalation
Acute Effects

Inhalation: The gas is a simple asphyxiant (precludes access to oxygen).
Material is highly volatile and may quickly form concentrated atmosphere in confined or unventilated area. Vapor is heavier than air and may displace and replace air in breathing zone, acting as a simple asphyxiant. This may happen with little warning of overexposure.
If present in sufficient concentration to reduce the oxygen level of inhaled air below 18%, symptoms such as rapid respiration, mental dullness, lack of coordination, poor judgement, nausea and vomiting, and cyanosis may occur even leading to unconsciousness and death.
Propane may be a narcotic in high concentrations.

Eye: The gas is non-irritating to the eyes.
The liquid is extremely discomforting to the eyes and may cause severe cold burns and is capable of causing severe damage with loss of sight.

Skin: The liquid is highly discomforting to the skin and may rapidly cause severe cold burns.
Vaporizing liquid causes rapid cooling and contact may cause cold burns, frostbite.
Ignited gas may result in burns and the onset of shock.
Ingestion: Not normally a risk due to extreme volatility of liquid.
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: No data found.

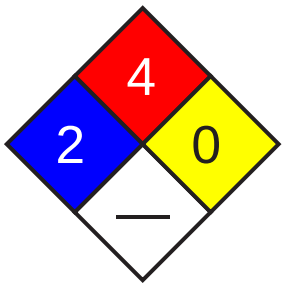
Section 4 - First Aid Measures

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: In case of cold burns (frost-bite): 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: 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: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:
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.
For frostbite from liquified petroleum gas: If part has not thawed, place in warm water bath (41-45 °C) for 15-60 minutes, until skin turns pink or red. Analgesia will be necessary while thawing.
If there has been massive exposure, the general body temperature must be depressed, and the patient must be immediately rewarmed, by whole-body immersion in a bath at the above temperature.
Shock may occur during rewarming.
Administer tetanus toxoid booster after hospitalization. Prophylactic antibiotics useful. May require anticoagulants and oxygen.

Section 5 - Fire-Fighting Measures

Flash Point: -104.444 °C Closed Cup
Autoignition Temperature: 450 °C
LEL: 2.1% v/v
UEL: 9.5% v/v
Extinguishing Media: Water spray or fog; dry chemical powder.
Carbon dioxide.
General Fire Hazards/Hazardous Combustion Products: Flammable gas. Dangerous hazard when exposed to heat or flame.
Liquid and vapor are highly flammable.
Severe vapor explosion hazard, when exposed to flame or spark.
Gas may form explosive mixtures with air over a wide area.
Emits toxic fumes of carbon monoxide (CO) on combustion.
Other combustion products include, carbon dioxide (CO_2).
Fire Incompatibility: Avoid reaction with oxidizing agents.
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.
Cool fire-exposed containers with water spray from a protected location.
Water spray or fog may be used to disperse vapor.
If safe to do so, stop flow of gas.
If flow of gas cannot be stopped, leave gas to burn.
Do not approach cylinders suspected to be hot.
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: Avoid breathing vapor and any contact with liquid or gas. Protective equipment including respirator should be used. Do NOT enter confined spaces where gas may have accumulated. Shut of all sources of possible ignition and increase ventilation. Clear area of personnel. Stop leak only if safe to so do. Remove leaking cylinders to safe place. Release pressure under safe controlled conditions by opening valve. Keep area clear of personnel until gas has dispersed.

See DOT ERG

Large Spills: .....Clear area of all unprotected personnel and move upwind.
Contact fire department and advise them of the location and nature of hazard.
May be violently or explosively reactive.
Wear full body clothing with breathing apparatus.
Prevent by any means available, spillage from entering drains and waterways.
Consider evacuation.
Shut off all possible sources of ignition and increase ventilation.
No smoking or bare lights within area.
Use extreme caution to prevent violent reaction.
Stop leak only if safe to so do.
Water spray or fog may be used to disperse vapor.
Do NOT enter confined space where gas may have collected.
Keep area clear until gas has dispersed.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid smoking, bare lights or ignition sources.
Avoid breathing vapors and contact with skin and eyes.
Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Avoid sources of heat. Avoid physical damage to containers.
Wear protective clothing and gloves when handling containers.
Use in a well-ventilated area. Use spark-free tools when handling.
Keep containers securely sealed when not in use.
If possible, use outdoors.
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.
Transport containers on a trolley.
Use good occupational work practices.

DO NOT transfer gas from one cylinder to another.
Natural gases contain a contaminant, radon-222, a naturally occurring radioactive gas. During subsequent processing, radon tends to concentrate in liquified petroleum streams and in product streams having similar boiling points.
Industry experience indicates that the commercial product may contain small amounts of radon-222 and its radioactive decay products (radon daughters). The actual concentration of radon-222 and radioactive daughters in process equipment (IE lines, filters, pumps and reactor units) may reach significant levels and produce potentially damaging levels of gamma radiation. A potential external radiation hazard exists at or near any pipe, valve or vessel containing a radon enriched stream or containing internal deposits of radioactive material. Field studies, however, have not shown that conditions exist that expose the worker to cumulative exposures in excess of general population limits. Equipment containing gamma-emitting decay products should be presumed to be internally contaminated with alpha- emitting decay products which may be hazardous if inhaled or ingested.
During maintenance operations that require the opening of contaminated process equipment, the flow of gas should be stopped and a four hour delay enforced to allow gamma-radiation to drop to background levels. Protective equipment (including high efficiency particulate respirators (P3) suitable for radionucleotides or supplied air) should be worn by personnel entering a vessel or working on contaminated process equipment to prevent skin contamination or inhalation of any residue containing alpha-radiation.
Airborne contamination may be minimized by handling scale and/or contaminated materials in a wet state.

Recommended Storage Methods: Aerosol pack. 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.
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: Use in a well-ventilated area. 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.
Packed as liquid under pressure and remains liquid only under pressure.
Sudden release of pressure or leakage may result in rapid vaporization with generation of large volume of highly flammable/explosive gas.
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.
Obtain a work permit before attempting any repairs.
Do not attempt repair work on lines, vessels under pressure.
Atmospheres must be tested and O. K. before work resumes after leakage.

Personal Protective Clothing/Equipment:

Eyes: Safety glasses with side shields.

Hands/Feet: No special precautions required for gas.
Wear full protective clothing including gloves and safe footwear for contact with liquid.

Respiratory Protection:
Exposure Range >1000 to <2100 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask
Exposure Range 2100 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.
3. Ensure availability of lifeline.

Staff should be trained in all aspects of rescue work.
Operators should be trained in correct use & maintenance of respirators.

Section 9 - Physical and Chemical Properties

Appearance/General Info: A colorless liquified gas, odorless when pure. Transport of unodorized propane gas without Component Authority is prohibited. Burns with a smoky, luminous flame. Contact with water causes liquified gas to boil. Slightly soluble in alcohol and ether. Non-corrosive. Forms a dense vapor cloud at atmospheric conditions. Stored as a liquid under its own vapor pressure.

Physical State: Liquefied gas
Odor Threshold: 5000 to 20000 ppm
Vapor Pressure (kPa): 853 at 21°C
Vapor Density (Air=1): 1.97 at 0 °C
Formula Weight: 44.11
Specific Gravity (H_2O=1, at 4 °C): 0.5 (liquid)
Evaporation Rate: Not applicable

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: -42.1 °C (-44 °F) at 1 atm
Freezing/Melting Point: -189.7 °C (-309.46 °F)
Volatile Component (% Vol): 100
Decomposition Temperature (°C): 650
Water Solubility: 62.4 ppm in water at 25 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Presence of an ignition source. Presence of heat source. Product is considered stable and hazardous polymerization will not occur.
Storage Incompatibilities: Avoid reaction with oxidizing agents.

Section 11 - Toxicological Information

No relevant toxicological data found at time of research.

See *RTECS* TX 2275000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Photolysis, hydrolysis and bioconcentration are not expected to be important environmental fate processes. Biodegradation may occur in soil and water; however, volatilization is expected to be the dominant fate process. To a lesser extent, adsorption may also occur. A K_{oc} range of 450 to 460 indicates a medium mobility class in soil. In aquatic systems, it may partition from the water column to organic matter contained in sediments and suspended materials. A Henry's Law constant of 7.07 $x10^{-1}$ atm-cu m/mole at 25 °C suggests extremely rapid volatilization from environmental waters. The volatilization half lives from a model river and a model pond, the latter considers the effect of adsorption, have been estimated to be 1.9 hr and 2.3 days, respectively. It is expected to exist almost entirely in the vapor phase in ambient air. Reactions with photochemically produced hydroxyl radicals in the atmosphere have been shown to occur (average half life of 13 days). Data also suggests that nighttime reactions with radical species and nitrogen oxides may contribute to atmospheric transformation.
Ecotoxicity: No data found.
Henry's Law Constant: calculated at 7.07 $x10^{-1}$
BCF: estimated at 1.56
Biochemical Oxygen Demand (BOD): none
Octanol/Water Partition Coefficient: log K_{ow} = 2.36
Soil Sorption Partition Coefficient: K_{oc} = estimated at 450

Section 13 - Disposal Considerations

Disposal: Evaporate or incinerate residue at an approved site.
Return empty containers to supplier.
Ensure damaged or non-returnable cylinders are gas-free before disposal.
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: Propane *see also* Petroleum gases, liquefied
ID: UN1978
Hazard Class: 2.1 - Flammable gas
Packing Group:
Symbols:
Label Codes: 2.1 - Flammable Gas
Special Provisions: 19, T50

Packaging: **Exceptions:** 306 **Non-bulk:** 304 **Bulk:** 314, 315
Quantity Limitations: **Passenger aircraft/rail:** Forbidden **Cargo aircraft only:** 150 kg
Vessel Stowage: **Location:** E **Other:** 40

Shipping Name and Description: Petroleum gases, liquefied *or* Liquefied petroleum gas
ID: UN1075
Hazard Class: 2.1 - Flammable gas
Packing Group:
Symbols:
Label Codes: 2.1 - Flammable Gas
Special Provisions: T50

Packaging: **Exceptions:** 306 **Non-bulk:** 304 **Bulk:** 314, 315
Quantity Limitations: **Passenger aircraft/rail:** Forbidden **Cargo aircraft only:** 150 kg
Vessel Stowage: **Location:** E **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.

Material Safety Data Sheet Collection
Genium group inc.
1171 RiverFront Center, Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2006-06

Section 1 - Chemical Product and Company Identification 61

Material Name: Isobutene **CAS Number:** 115-11-7
Chemical Formula: C_4H_8
Structural Chemical Formula: $(CH_3)_2C=CH_2$
EINECS Number: 204-066-3
ACX Number: X1003822-9
Synonyms: Isobutene; ISOBUTYLENE; ASYM-DIMETHYLETHYLENE; GAMMA-BUTYLENE; 1,1-DIMETHYLETHYLENE; ISO-BUTENE; ISOBUTENE; ISOPROPYLIDENEMETHYLENE; LIQUEFIED PETROLEUM GAS; 2-METHYL-1-PROPENE; 2-METHYLPROPENE; 2-METHYLPROPYLENE; 1-PROPENE,2-METHYL-; PROPENE,2-METHYL-; UNSYM. DIMETHYLETHYLENE
General Use: Production of butene polymers used as adhesives, tackifiers, oil additives.
Butyl rubbers, copolymer resins with butadiene, acrylates and methacrylates.
Also to produce anti-oxidants for foods, food supplements, plastics and in production of isooctane and high-octane aviation gasoline.
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.

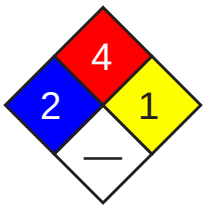
Section 2 - Composition / Information on Ingredients

Name	CAS	%
isobutene	115-11-7	>99

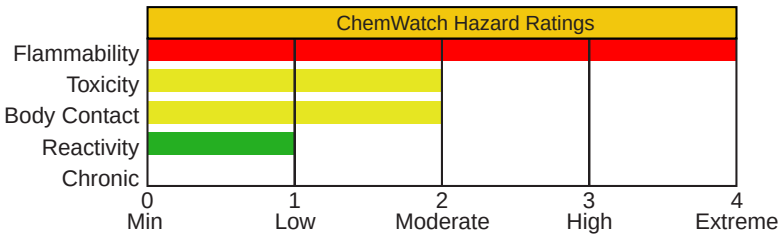
OSHA PEL **NIOSH REL**

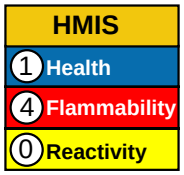
ACGIH TLV

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless gas. Acute Effects: Simple asphyxiant which can displace available oxygen; initial symptoms: rapid respiration, air hunger, diminished mental alertness, impaired muscular coordination. Can form explosive mixtures in air. Flammable.

Potential Health Effects

Target Organs: None reported
Primary Entry Routes: inhalation
Acute Effects
Inhalation: The gas is a simple asphyxiant (precludes access to oxygen) and is harmful if exposure is prolonged and inhalation may cause loss of consciousness.

Acute effects from inhalation of high concentrations of gas / 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 atmosphere of gas is prolonged this may lead to narcosis, unconsciousness, even coma, and unless resuscitated, death.
Iso-butene is a simple asphyxiant and may have a narcotic action.
Material is highly volatile and may quickly form concentrated atmosphere in confined or unventilated area. Vapor is heavier than air and may displace and replace air in breathing zone, acting as a simple asphyxiant. This may happen with little warning of overexposure.
Hydrocarbons may sensitize the heart to adrenalin and other circulatory catecholamines; as a result cardiac arrhythmias and ventricular fibrillation may occur. Abrupt collapse may produce traumatic injury.
Central nervous system (CNS) depression may be evident early. Symptoms of moderate poisoning may include giddiness, headache, dizziness and nausea.
Serious poisonings may result in respiratory depression and may be fatal.
The paraffin gases C1-4 are practically non-toxic below their lower flammability limits (18000-50000 ppm). Above this level, incidental effects include CNS depression and irritation but these are reversible upon cessation of the exposure. The C3 and iso-C5 hydrocarbons show increasing narcotic properties; branching of the chain also enhances the effect.
The C4 hydrocarbons appear to be more highly neurotoxic than the C3 and C5 members. Several fatalities due to voluntary inhalation of butane have been reported, possibly due to central, respiratory and circulatory effects resulting from anesthesia, laryngeal edema, chemical pneumonia or the combined effects of cardiac toxicity and increased sympathomimetic effects.
Inhalation of petroleum gases may produce narcosis, due in part to olefinic impurities. Displacement of oxygen in the air may cyanosis.
If present in sufficient quantity these gases may reduce the oxygen level to below 18% producing asphyxiation.
Symptoms include rapid respiration, mental dullness, lack of coordination, poor judgement, nausea and vomiting.
The onset of cyanosis may lead to unconsciousness and death.

Eye: The liquid is highly discomforting and may cause severe cold burns 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 gas is regarded as non-irritating to the eyes.

Skin: Vaporizing liquid causes rapid cooling and contact may cause cold burns, frostbite.The liquid is discomforting to the skin and may rapidly cause severe cold burns.
Bare unprotected skin should not be exposed to this material.
There is no evidence of skin absorption but contact may cause frostbite,

Ingestion: Overexposure is unlikely in this form.
Considered an unlikely route of entry in commercial/industrial environments.
The liquid is highly discomforting if swallowed and may cause severe cold burns.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: Chronic overexposure may produce dermatitis.

Section 4 - First Aid Measures

Inhalation: Avoid becoming a casualty and remove to fresh air.
Lay patient down. If breathing is shallow or has stopped, ensure clear airway and apply resuscitation.
If available, medical oxygen should be administered by trained personnel.
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: In case of cold burns (frost-bite): 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: 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.

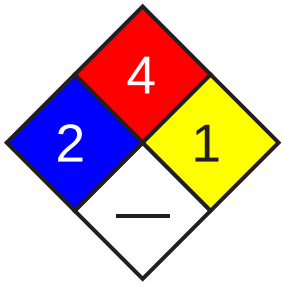
Note to Physicians: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:
1.Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.

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: -76.111 °C
Autoignition Temperature: 465 °C
LEL: 1.8% v/v
UEL: 9.6% v/v
Extinguishing Media: Water spray or fog; dry chemical powder.
Carbon dioxide.
Foam.

See DOT ERG



Fire Diamond

General Fire Hazards/Hazardous Combustion Products: Flammable gas. Liquid and vapor are highly flammable.
Dangerous hazard when exposed to heat, flame and oxidizers.
Gas may form explosive mixtures with air over a wide area.
Decomposes on heating and produces toxic fumes of carbon monoxide (CO) and carbon dioxide (CO_2).
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 full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Do not extinguish burning gas. If safe to do so, stop flow of gas.
If flow of gas cannot be stopped, leave gas to burn.
Cool fire-exposed containers with water spray from a protected location.
Do not approach cylinders suspected to be hot.
If safe to do so, remove containers from path of fire.
Fight fire from a safe distance, with adequate cover.

Section 6 - Accidental Release Measures

Small Spills: Avoid breathing vapor and any contact with liquid or gas. Protective equipment including respirator should be used. Do NOT enter confined spaces where gas may have accumulated. Shut of all sources of possible ignition and increase ventilation. Clear area of personnel. Stop leak only if safe to so do. Remove leaking cylinders to safe place. Release pressure under safe controlled conditions by opening valve. Keep area clear of personnel until gas has dispersed.

See DOT ERG

Large Spills: DO NOT touch the spill material. Shut off all possible sources of ignition and increase ventilation. Restrict access to area. Clear area of personnel and move upwind.
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.
Avoid spraying water onto liquid pools.
Use extreme caution to avoid a violent reaction.
Stop leak if safe to do so.
DO NOT enter confined places where gas may have collected. Remove leaking cylinders to a safe place. Fit vent pipes. Release pressure under safe, controlled conditions by opening valve. Burn issuing gas at vent pipes.
Do not exert excessive pressure on valve; do not attempt to operate damaged valve.
Keep area clear of personnel until gas has dispersed
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Use good occupational work practices. Use in a well-ventilated area.

Obtain a work permit before attempting any repairs.
Do not attempt repair work on lines, vessels under pressure.
Atmospheres must be tested and O.K. before work resumes after leakage.
Wear protective clothing and gloves when handling containers.
No smoking, bare lights, heat or ignition sources.
Use spark-free tools when handling. Ground all lines and equipment.
Prevent concentration in hollows and sumps. DO NOT enter confined spaces until atmosphere has been checked.
Gas may travel a considerable distance to source of ignition.
Vapor may ignite on pumping or pouring due to static electricity.
Avoid physical damage to containers.
DO NOT transfer gas from one cylinder to another.
Natural gases contain a contaminant, radon-222, a naturally occurring radioactive gas. During subsequent processing, radon tends to concentrate in liquified petroleum streams and in product streams having similar boiling points.
Industry experience indicates that the commercial product may contain small amounts of radon-222 and its radioactive decay products (radon daughters). The actual concentration of radon-222 and radioactive daughters in process equipment (IE lines, filters, pumps and reactor units) may reach significant levels and produce potentially damaging levels of gamma radiation. A potential external radiation hazard exists at or near any pipe, valve or vessel containing a radon enriched stream or containing internal deposits of radioactive material. Field studies, however, have not shown that conditions exist that expose the worker to cumulative exposures in excess of general population limits. Equipment containing gamma-emitting decay products should be presumed to be internally contaminated with alpha- emitting decay products which may be hazardous if inhaled or ingested.
During maintenance operations that require the opening of contaminated process equipment, the flow of gas should be stopped and a four hour delay enforced to allow gamma-radiation to drop to background levels. Protective equipment (including high efficiency particulate respirators (P3) suitable for radionucleotides or supplied air) should be worn by personnel entering a vessel or working on contaminated process equipment to prevent skin contamination or inhalation of any residue containing alpha-radiation.
Airborne contamination may be minimized by handling scale and/or contaminated materials in a wet state.

Recommended Storage Methods: Packaging as recommended by manufacturer.
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.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated areaIf gas concentrations are high: or If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Used in closed pressurized systems; fitted with temperature and pressure safety relief valves which are vented to allow safe dispersal.
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: Protective gloves eg. leather gloves or gloves with leather facing. Neoprene rubber gloves.
Safety footwear.

Other: Operators should be trained in correct use & maintenance of respirators Ensure that there is ready access to breathing apparatus.
Protective overalls, closely fitted at neck and wrist. Eye-wash unit.
IN CONFINED SPACES:
1. Non-sparking protective boots.
2. Static-free clothing.
3. Ensure availability of lifeline.
Staff should be trained in all aspects of rescue work.
Ensure there is ready access to an emergency shower.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Easily liquified flammable gas or colorless highly volatile liquid. Packed as liquid under pressure and remains liquid only under pressure. Sudden release of pressure or leakage may result in rapid vaporization with generation of large volume of highly flammable / explosive gas. Strong gasoline odor. Floats and boils on water giving a flammable / explosive, visible cloud. Soluble in alcohol, ether, benzene and sulphuric acid.

Physical State: Liquefied gas
Odor Threshold: 1.3 to 3.0 mg/m^3
Vapor Pressure (kPa): 182 kPa at 10 °C
Vapor Density (Air=1): 2.01
Formula Weight: 56.11
Specific Gravity (H_2O=1, at 4 °C): 0.59
Evaporation Rate: Very rapid
pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point: -6.9 °C (20 °F)
Freezing/Melting Point: -140.35 °C (-220.63 °F)
Volatile Component (% Vol): 100
Water Solubility: Practically 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 contact with oxidizing agents.

The interaction of alkenes and alkynes with nitrogen oxides and oxygen may produce explosive addition products; these may form at very low temperatures and explode on heating to higher temperatures (the addition products from 1,3-butadiene and cyclopentadiene form rapidly at -150 °C and ignite or explode on warming to -35 to -15 C). These derivatives ("pseudo- nitrosites") were formerly used to characterize terpene hydrocarbons.

Exposure to air must be kept to a minimum so as to limit the build-up of peroxides which will concentrate in bottoms if the product is distilled.

The product must not be distilled to dryness if the peroxide concentration is substantially above 10 ppm (as active oxygen) since explosive decomposition may occur. Distillate must be immediately inhibited to prevent peroxide formation. The effectiveness of the antioxidant is limited once the peroxide levels exceed 10 ppm as active oxygen. Addition of more inhibitor at this point is generally ineffective.

Prior to distillation it is recommended that the product should be washed with aqueous ferrous ammonium sulfate to destroy peroxides; the washed product should be immediately re-inhibited.

A range of exothermic decomposition energies for double bonds is given as 40-90 kJ/mol. The relationship between energy of decomposition and processing hazards has been the subject of discussion; it is suggested that values of energy released per unit of mass, rather than on a molar basis (J/g) be used in the assessment. For example, in "open vessel processes" (with man-hole size openings, in an industrial setting), substances with exothermic decomposition energies below 500 J/g are unlikely to present a danger, whilst those in "closed vessel processes" (opening is a safety valve or bursting disk) present some danger where the decomposition energy exceeds 150 J/g.

Avoid reactions with oxidizing agents, organic acids, inorganic acids halogenated compounds, polymerizable esters, oxygen, cyanohydrins and molten sulphur.

Section 11 - Toxicological Information

Toxicity
Inhalation (rat) LC_{50}: 620000 mg/m^3/4h

Irritation
Nil reported

See *RTECS* UD 0890000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: No data found.
BCF: no food chain concentration potential
Biochemical Oxygen Demand (BOD): none

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options.
Discharge to burning flare. Return empty cylinders to supplier.

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: Isobutylene *see also* Petroleum gases, liquefied
ID: UN1055
Hazard Class: 2.1 - Flammable gas
Packing Group:
Symbols:
Label Codes: 2.1 - Flammable Gas
Special Provisions: 19, T50
Packaging: **Exceptions:** 306 **Non-bulk:** 304 **Bulk:** 314, 315
Quantity Limitations: **Passenger aircraft/rail:** Forbidden **Cargo aircraft only:** 150 kg
Vessel Stowage: **Location:** E **Other:** 40

Shipping Name and Description: Petroleum gases, liquefied *or* Liquefied petroleum gas
ID: UN1075
Hazard Class: 2.1 - Flammable gas
Packing Group:
Symbols:
Label Codes: 2.1 - Flammable Gas
Special Provisions: T50
Packaging: **Exceptions:** 306 **Non-bulk:** 304 **Bulk:** 314, 315
Quantity Limitations: **Passenger aircraft/rail:** Forbidden **Cargo aircraft only:** 150 kg
Vessel Stowage: **Location:** E **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.

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MSDS No: M00370

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Buffer Solution pH 10.01 ± 0.02
Catalog Number: 2283656

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00370
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Not applicable
Hazard: May cause irritation.
Date of MSDS Preparation:
Day: 22
Month: September
Year: 2009

2. COMPOSITION / INFORMATION ON INGREDIENTS

Sodium Carbonate
CAS No.: 497-19-8
TSCA CAS Number: 497-19-8
Percent Range: < 1.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 4090 mg/kg
LC50: Inhalation rat LC50 = 2300 mg/m^3/2hr
TLV: Not established
PEL: Not established
Hazard: Causes moderate eye irritation.

Demineralized Water
CAS No.: 7732-18-5
TSCA CAS Number: 7732-18-5
Percent Range: > 99.0
Percent Range Units: volume / volume
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: No effects anticipated.

Other components, each
CAS No.: Not applicable
TSCA CAS Number: Not applicable

Percent Range: < 1.0
Percent Range Units: volume / volume
LD50: Not applicable
LC50: Not applicable
TLV: Not established
PEL: Not established
Hazard: Any ingredient(s) of this product listed as "Other component(s)" is not considered a health hazard to the user of this product.

Sodium Bicarbonate
CAS No.: 144-55-8
TSCA CAS Number: 144-55-8
Percent Range: < 1.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 4220 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Clear, blue
Odor: None

HMIS:
Health: 1
Flammability: 0
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 0
Flammability: 0
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: May cause irritiation
Skin Contact: May cause irritiation
Skin Absorption: No effects anticipated
Target Organs: Not applicable
Ingestion: None reported
Target Organs: None reported
Inhalation: No effects anticipated
Target Organs: Not applicable
Medical Conditions Aggravated: None reported
Chronic Effects: None reported
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.

This product does NOT contain any IARC listed chemicals.

This product does NOT contain any NTP listed chemicals.

Additional Cancer / Reproductive Toxicity Information: None reported
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician.
Skin Contact (First Aid): Wash skin with plenty of water. Call physician if irritation develops.
Ingestion (First Aid): Give large quantities of water. Call physician immediately.
Inhalation: None required.

5. FIRE FIGHTING MEASURES

Flammable Properties: Material will not burn.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not applicable
Hazardous Combustion Products: None
Fire / Explosion Hazards: None reported
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance.
Containment Technique: Stop spilled material from being released to the environment.
Clean-up Technique: Cover spilled material with a dry acid, such as citric or boric. Scoop up slurry into a large beaker. Adjust to a pH between 6 and 9 with an acid, such as sulfuric or citric. Flush reacted material to the drain with a large excess of water.
Evacuation Procedure: Evacuate as needed to perform spill clean-up. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: None

7. HANDLING / STORAGE

Handling: Avoid contact with eyes Wash thoroughly after handling. Maintain general industrial hygiene practices when using this product.
Storage: Protect from: heat Keep container tightly closed when not in use.
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: disposable latex gloves lab coat
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes Wash thoroughly after handling.
TLV: Not established
PEL: Not established

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Clear, blue
Physical State: Liquid
Molecular Weight: Not applicable
Odor: None
pH: 10.0
Vapor Pressure: Not determined
Vapor Density (air = 1): Not determined
Boiling Point: ~100°C (~212°F)
Melting Point: ~0°C (~32°F)
Specific Gravity (water = 1): 0.990
Evaporation Rate (water = 1): 0.76
Volatile Organic Compounds Content: Not applicable
Partition Coefficient (n-octanol / water): Not determined
Solubility:
Water: Soluble
Acid: Soluble
Other: Not determined
Metal Corrosivity:
Steel: Not determined
Aluminum: Not determined

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Heat Evaporation
Reactivity / Incompatibility: None reported
Hazardous Decomposition: None reported
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: None reported
Mutation Data: None reported
Reproductive Effects Data: None reported
Ingredient Toxicological Data: None reported

12. ECOLOGICAL INFORMATION

Product Ecological Information: No information available for this product.

Ingredient Ecological Information: None reported

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: None
Special Instructions (Disposal): Adjust to a pH between 6 and 9 with an acid, such as sulfuric or citric. Open cold water tap completely, slowly pour the reacted material to the drain.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--
DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA
I.M.O.:
I.M.O. Proper Shipping Name: Not Currently Regulated
--
I.M.O. Hazard Class: NA
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: NA
I.M.O. Packing Group: NA
Additional Information: There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is NOT in a set or kit, the classification given above applies. If the item IS part of a set or kit, the classification would change to the following: UN3316 Chemical Kit, Class 9, PG II or III. If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

U.S. Federal Regulations:
O.S.H.A.: This product meets the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)
E.P.A.:
S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): Immediate (Acute) Health Hazard
S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.
--

302 (EHS) TPQ (40 CFR 355): Not applicable
304 CERCLA RQ (40 CFR 302.4): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
Clean Water Act (40 CFR 116.4): Not applicable
RCRA: Contains no RCRA regulated substances.
C.P.S.C.: Not applicable
State Regulations:
California Prop. 65: No Prop. 65 listed chemicals are present in this product.
Identification of Prop. 65 Ingredient(s): None
California Perchlorate Rule CCR Title 22 Chap 33:
Trade Secret Registry: Not applicable
National Inventories:
U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).
TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Buffer
References: 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor). Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992. Technical Judgment. In-house information.
Revision Summary: Updates in Section(s) 14,

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MSDS No: M00369

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Buffer Solution pH 7.00 ± 0.02
Catalog Number: 2283556

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00369
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Not applicable
Hazard: Practically non-toxic.
Date of MSDS Preparation:
Day: 24
Month: July
Year: 2009

2. COMPOSITION / INFORMATION ON INGREDIENTS

Potassium Phosphate, Monobasic
CAS No.: 7778-77-0
TSCA CAS Number: 7778-77-0
Percent Range: < 1.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 7100 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

Demineralized Water
CAS No.: 7732-18-5
TSCA CAS Number: 7732-18-5
Percent Range: >95.0
Percent Range Units: volume / volume
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: No effects anticipated.

Other components, each
CAS No.: Not applicable

TSCA CAS Number: Not applicable
Percent Range: < 1.0
Percent Range Units: volume / volume
LD50: Not applicable
LC50: Not applicable
TLV: Not established
PEL: Not established
Hazard: Any ingredient(s) of this product listed as "Other component(s)" is not considered a health hazard to the user of this product.

Sodium Phosphate, Dibasic
CAS No.: 7558-79-4
TSCA CAS Number: 7558-79-4
Percent Range: < 1.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 17 g/kg.
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Clear, yellow liquid
Odor: None

HMIS:
Health: 0
Flammability: 0
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 0
Flammability: 0
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: No effects are anticipated
Skin Contact: No effects are anticipated
Skin Absorption: No effects anticipated
Target Organs: Not applicable
Ingestion: No Effects Anticipated
Target Organs: Not applicable
Inhalation: No effects anticipated
Target Organs: Not applicable
Medical Conditions Aggravated: None reported
Chronic Effects: No effects anticipated
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.

This product does NOT contain any IARC listed chemicals.

This product does NOT contain any NTP listed chemicals.

Additional Cancer / Reproductive Toxicity Information: None reported
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Flush eyes with water. Call physician if irritation develops.
Skin Contact (First Aid): Wash skin with plenty of water.
Ingestion (First Aid): Give large quantities of water. Call physician immediately.
Inhalation: None required.

5. FIRE FIGHTING MEASURES

Flammable Properties: Material will not burn.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not applicable
Hazardous Combustion Products: None reported
Fire / Explosion Hazards: None reported
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance.
Containment Technique: Stop spilled material from being released to the environment.
Clean-up Technique: Absorb spilled liquid with non-reactive sorbent material. Place material in a plastic bag. Mark bag 'Non-hazardous trash', and dispose of as normal refuse.
Evacuation Procedure: Evacuate as needed to perform spill clean-up. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: None

7. HANDLING / STORAGE

Handling: Avoid contact with eyes Wash thoroughly after handling.
Storage: Protect from: heat Keep container tightly closed when not in use.
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: Not applicable
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes Wash thoroughly after handling.
TLV: Not established
PEL: Not established

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Clear, yellow liquid
Physical State: Liquid
Molecular Weight: Not applicable
Odor: None
pH: 7.0 at 20°C
Vapor Pressure: Not determined
Vapor Density (air = 1): Not determined
Boiling Point: ~100°C (~212°F)
Melting Point: ~0°C (~32°F)
Specific Gravity (water = 1): ~1.0
Evaporation Rate (water = 1): Not determined
Volatile Organic Compounds Content: Not applicable
Partition Coefficient (n-octanol / water): Not determined
Solubility:
Water: Soluble
Acid: Soluble
Other: Not determined
Metal Corrosivity:
Steel: Not determined
Aluminum: Not determined

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Heat Evaporation
Reactivity / Incompatibility: None reported
Hazardous Decomposition: None reported
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: None reported
Mutation Data: None reported
Reproductive Effects Data: None reported
Ingredient Toxicological Data: --
No toxicological data available for the ingredients of this product.

12. ECOLOGICAL INFORMATION

Product Ecological Information: --
No ecological data available for this product.
Ingredient Ecological Information: --
No ecological data available for the ingredients of this product.

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: None
Special Instructions (Disposal): Open cold water tap completely, slowly pour the material to the drain.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--
DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA
I.M.O.:
I.M.O. Proper Shipping Name: Not Currently Regulated
--
I.M.O. Hazard Class: NA
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: NA
I.M.O. Packing Group: NA
Additional Information: There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is NOT in a set or kit, the classification given above applies. If the item IS part of a set or kit, the classification would change to the following: UN3316 Chemical Kit, Class 9, PG II or III. If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

U.S. Federal Regulations:
O.S.H.A.: This product does not meet the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)
E.P.A.:
S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): This product is not hazardous under 29 CFR.1910.1200 and therefore is not covered by Title III under SARA.
S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.

302 (EHS) TPQ (40 CFR 355): Not applicable

304 CERCLA RQ (40 CFR 302.4): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
Clean Water Act (40 CFR 116.4): Not applicable
RCRA: Contains no RCRA regulated substances.
C.P.S.C.: Not applicable
State Regulations:
California Prop. 65: No Prop. 65 listed chemicals are present in this product.
Identification of Prop. 65 Ingredient(s): None
California Perchlorate Rule CCR Title 22 Chap 33: Not applicable
Trade Secret Registry: Not applicable
National Inventories:
U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).
TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Buffer
References: 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor). Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992. Technical Judgment. In-house information.
Revision Summary: Updates in Section(s) 14, 2, 15,

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MSDS No: M00368

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Buffer Solution pH 4.01 ± 0.02
Catalog Number: 2283456

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00368
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Not applicable
Hazard: Practically non-toxic.
Date of MSDS Preparation:
Day: 09
Month: September
Year: 2009

2. COMPOSITION / INFORMATION ON INGREDIENTS

Demineralized Water
CAS No.: 7732-18-5
TSCA CAS Number: 7732-18-5
Percent Range: >95.0
Percent Range Units: weight / weight
LD50: None reported
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: No effects anticipated.

Other components, each
CAS No.: Not applicable
TSCA CAS Number: Not applicable
Percent Range: < 1.0
Percent Range Units: volume / volume
LD50: Not applicable
LC50: Not applicable
TLV: Not established
PEL: Not established
Hazard: Any ingredient(s) of this product listed as "Other component(s)" is not considered a health hazard to the user of this product.

Potassium Acid Phthalate

CAS No.: 877-24-7
TSCA CAS Number: 877-24-7
Percent Range: 1.0 - 5.0
Percent Range Units: weight / volume
LD50: Oral rat LDLo = 3200 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: May cause irritation.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: Clear, red liquid
Odor: None

HMIS:
Health: 0
Flammability: 0
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 0
Flammability: 0
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: No effects are anticipated
Skin Contact: No effects are anticipated
Skin Absorption: No effects anticipated
Target Organs: Not applicable
Ingestion: No Effects Anticipated
Target Organs: Not applicable
Inhalation: No effects anticipated
Target Organs: Not applicable
Medical Conditions Aggravated: None reported
Chronic Effects: No effects anticipated
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.

This product does NOT contain any IARC listed chemicals.

This product does NOT contain any NTP listed chemicals.

Additional Cancer / Reproductive Toxicity Information: None reported
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Flush eyes with water. Call physician if irritation develops.
Skin Contact (First Aid): Wash skin with soap and plenty of water.

Ingestion (First Aid): Give large quantities of water. Call physician immediately.
Inhalation: None required.

5. FIRE FIGHTING MEASURES

Flammable Properties: Material will not burn.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not applicable
Hazardous Combustion Products: Not applicable
Fire / Explosion Hazards: None reported
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance.
Containment Technique: Stop spilled material from being released to the environment.
Clean-up Technique: Cover spilled material with an alkali, such as soda ash or sodium bicarbonate. Scoop up slurry into a large beaker. Adjust to a pH between 6 and 9 with an alkali, such as soda ash or sodium bicarbonate. Flush reacted material to the drain with a large excess of water. Decontaminate the area of the spill with a soap solution.
Evacuation Procedure: Evacuate as needed to perform spill clean-up. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: None

7. HANDLING / STORAGE

Handling: Avoid contact with eyes Wash thoroughly after handling.
Storage: Keep container tightly closed when not in use.
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: disposable latex gloves
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes Wash thoroughly after handling.
TLV: Not established
PEL: Not established

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: Clear, red liquid
Physical State: Liquid
Molecular Weight: Not applicable
Odor: None
pH: 4.01
Vapor Pressure: Not determined
Vapor Density (air = 1): Not determined
Boiling Point: > 100°C (> 212°F)
Melting Point: < 0°C (< 32°F)
Specific Gravity (water = 1): 1.002
Evaporation Rate (water = 1): Not determined
Volatile Organic Compounds Content: Not applicable
Partition Coefficient (n-octanol / water): Not determined
Solubility:
- ***Water:*** Soluble
- ***Acid:*** Soluble
- ***Other:*** Not determined

Metal Corrosivity:
- ***Steel:*** Not determined
- ***Aluminum:*** Not determined

---

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Extreme temperatures
Reactivity / Incompatibility: None reported
Hazardous Decomposition: None reported
Hazardous Polymerization: Will not occur.

---

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
- ***LD50:*** None reported
- ***LC50:*** None reported
- ***Dermal Toxicity Data:*** None reported
- ***Skin and Eye Irritation Data:*** None reported
- ***Mutation Data:*** None reported
- ***Reproductive Effects Data:*** None reported

Ingredient Toxicological Data: Potassium Acid Phthalate: Oral rat LD_{Lo} = 3200 mg/kg

---

12. ECOLOGICAL INFORMATION

Product Ecological Information: --
No ecological data available for this product.
Ingredient Ecological Information: --
No ecological data available for the ingredients of this product.

---

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: None

Special Instructions (Disposal): Adjust to a pH between 6 and 9 with an alkali, such as soda ash or sodium bicarbonate. Open cold water tap completely, slowly pour the reacted material to the drain.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--
DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA
I.C.A.O.:
I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA
I.M.O.:
I.M.O. Proper Shipping Name: Not Currently Regulated
--
I.M.O. Hazard Class: NA
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: NA
I.M.O. Packing Group: NA
Additional Information: There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is NOT in a set or kit, the classification given above applies. If the item IS part of a set or kit, the classification would change to the following: UN3316 Chemical Kit, Class 9, PG II or III. If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

U.S. Federal Regulations:
O.S.H.A.: This product does not meet the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)
E.P.A.:
S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): This product is not hazardous under 29 CFR.1910.1200 and therefore is not covered by Title III under SARA.
S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.
--
302 (EHS) TPQ (40 CFR 355): Not applicable
304 CERCLA RQ (40 CFR 302.4): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
Clean Water Act (40 CFR 116.4): Not applicable
RCRA: Contains no RCRA regulated substances.
C.P.S.C.: Not applicable
State Regulations:
California Prop. 65: No Prop. 65 listed chemicals are present in this product.

Identification of Prop. 65 Ingredient(s): --
California Perchlorate Rule CCR Title 22 Chap 33: Not applicable
Trade Secret Registry: Not applicable
National Inventories:
U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).
TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Buffer
References: 29 CFR 1900 - 1910 (Code of Federal Regulations - Labor). Air Contaminants, Federal Register, Vol. 54, No. 12. Thursday, January 19, 1989. pp. 2332-2983. TLV's Threshold Limit Values and Biological Exposure Indices for 1992-1993. American Conference of Governmental Industrial Hygienists, 1992. Technical Judgment. In-house information. Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Fire Protection Guide on Hazardous Materials, 10th Ed. Quincy, MA: National Fire Protection Association, 1991.
Revision Summary: Updates in Section(s) 14,

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume
NV - Not Available	v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

World Headquarters
Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

MSDS No: M00901

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Alconox Detergent
Catalog Number: 2088000

Hach Company
P.O.Box 389
Loveland, CO USA 80539
(970) 669-3050

Emergency Telephone Numbers:
(Medical and Transportation)
(303) 623-5716 24 Hour Service
(515)232-2533 8am - 4pm CST

MSDS Number: M00901
Chemical Name: Not applicable
CAS No.: Not applicable
Chemical Formula: Not applicable
Chemical Family: Surfactants
Hazard: May cause irritation.
Date of MSDS Preparation:
Day: 01
Month: October
Year: 2010

2. COMPOSITION / INFORMATION ON INGREDIENTS

Sodium Pyrophosphate
CAS No.: 7722-88-5
TSCA CAS Number: 7722-88-5
Percent Range: 10-30
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 4000 mg/kg; oral mouse LD50 = 2980 mg/kg
LC50: None reported
TLV: 5 mg/m^3
PEL: 5 mg/m^3
Hazard: Causes irritation.

Sodium Carbonate
CAS No.: 497-19-8
TSCA CAS Number: 497-19-8
Percent Range: 5.0 - 15.0
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 4090 mg/kg
LC50: Inhalation rat LC50 = 2300 mg/m^3/2hr
TLV: Not established
PEL: Not established
Hazard: Causes moderate eye irritation.

Sodium Tripolyphosphate
CAS No.: 7758-29-4
TSCA CAS Number: 7758-29-4
Percent Range: 10-30
Percent Range Units: weight / weight
LD50: Oral rat LD50 = 3120 mg/kg
LC50: None reported
TLV: Not established
PEL: Not established

Hazard: May cause irritation.

Sodium Dodecylbenzenesulfonate
CAS No.: 25155-30-0
TSCA CAS Number: 25155-30-0
Percent Range: 10-30
Percent Range Units: weight / weight
LD50: Oral rat LD 50 = 438 mg/kg; oral mouse LD 50 = 1330 mg/kg.
LC50: None reported
TLV: Not established
PEL: Not established
Hazard: Harmful if swallowed Harmful if inhaled. May cause eye irritation. May cause allergic reaction.

3. HAZARDS IDENTIFICATION

Emergency Overview:
Appearance: White powder
Odor: None
MAY CAUSE EYE, SKIN AND RESPIRATORY TRACT IRRITATION

HMIS:
Health: 1
Flammability: 0
Reactivity: 0
Protective Equipment: X - See protective equipment, Section 8.
NFPA:
Health: 1
Flammability: 0
Reactivity: 0
Symbol: Not applicable
Potential Health Effects:
Eye Contact: May cause irritiation
Skin Contact: May cause irritiation
Skin Absorption: No effects anticipated
Target Organs: Not applicable
Ingestion: May cause: abdominal pain vomiting diarrhea
Target Organs: None reported
Inhalation: May cause: irritation of nose and throat
Target Organs: Not applicable
Medical Conditions Aggravated: Eye conditions Skin conditions Respiratory conditions
Chronic Effects: None reported
Cancer / Reproductive Toxicity Information:
This product does NOT contain any OSHA listed carcinogens.

This product does NOT contain any IARC listed chemicals.

This product does NOT contain any NTP listed chemicals.

Additional Cancer / Reproductive Toxicity Information: None reported
Toxicologically Synergistic Products: None reported

4. FIRST AID

Eye Contact: Immediately flush eyes with water for 15 minutes. Call physician if irritation develops.
Skin Contact (First Aid): Wash skin with plenty of water. Call physician if irritation develops.
Ingestion (First Aid): Give large quantities of water. Call physician immediately. Never give anything by mouth to an unconscious person.
Inhalation: Remove to fresh air.

5. FIRE FIGHTING MEASURES

Flammable Properties: Material will not burn.
Flash Point: Not applicable
Method: Not applicable
Flammability Limits:
Lower Explosion Limits: Not applicable
Upper Explosion Limits: Not applicable
Autoignition Temperature: Not determined
Hazardous Combustion Products: carbon monoxide, carbon dioxide.
Fire / Explosion Hazards: None reported
Static Discharge: None reported.
Mechanical Impact: None reported
Extinguishing Media: Use media appropriate to surrounding fire conditions
Fire Fighting Instruction: As in any fire, wear self-contained breathing apparatus pressure-demand and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Spill Response Notice:
Only persons properly qualified to respond to an emergency involving hazardous substances may respond to a spill according to federal regulations (OSHA 29 CFR 1910.120(a)(v)) and per your company's emergency response plan and guidelines/procedures. See Section 13, Special Instructions for disposal assistance.
Containment Technique: Stop spilled material from being released to the environment.
Clean-up Technique: Sweep up material. Place material in a plastic bag. Mark bag 'Non-hazardous trash', and dispose of as normal refuse. Decontaminate the area of the spill with a soap solution.
Evacuation Procedure: Evacuate as needed to perform spill clean-up. If conditions warrant, increase the size of the evacuation.
Special Instructions (for accidental release): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
D.O.T. Emergency Response Guide Number: None

7. HANDLING / STORAGE

Handling: Avoid contact with eyes Wash thoroughly after handling. Maintain general industrial hygiene practices when using this product.
Storage: Keep container tightly closed when not in use.
Flammability Class: Not applicable

8. EXPOSURE CONTROLS / PROTECTIVE EQUIPMENT

Engineering Controls: Maintain general industrial hygiene practices when using this product.
Personal Protective Equipment:
Eye Protection: safety glasses with top and side shields
Skin Protection: Not applicable
Inhalation Protection: adequate ventilation
Precautionary Measures: Avoid contact with: eyes Wash thoroughly after handling.
TLV: Not established
PEL: Not established

9. PHYSICAL / CHEMICAL PROPERTIES

Appearance: White powder
Physical State: Solid
Molecular Weight: Not applicable
Odor: None
pH: 9.5 (1% solution)
Vapor Pressure: Not applicable
Vapor Density (air = 1): Not applicable

Boiling Point: Not applicable
Melting Point: Not determined
Specific Gravity/ Relative Density (water = 1; air =1): Not determined
Evaporation Rate (water = 1): Not applicable
Volatile Organic Compounds Content: Not applicable
Partition Coefficient (n-octanol / water): Not applicable
Solubility:
Water: Soluble
Acid: Not determined
Other: Not determined
Metal Corrosivity:
Steel: Not determined
Aluminum: Not determined

10. STABILITY / REACTIVITY

Chemical Stability: Stable when stored under proper conditions.
Conditions to Avoid: Excess moisture
Reactivity / Incompatibility: Incompatible with: oxidizers strong acids
Hazardous Decomposition: Heating to decomposition releases toxic fumes of carbon monoxide and carbon dioxide.
Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Product Toxicological Data:
LD50: None reported
LC50: None reported
Dermal Toxicity Data: None reported
Skin and Eye Irritation Data: None reported
Mutation Data: None reported
Reproductive Effects Data: None reported
Ingredient Toxicological Data: Sodium dodecylbenzenesulfonate: oral rat LD50 = 438 mg/kg; sodium carbonate: oral rat LD50 = 4090 mg/kg; tetrasodium pyrophosphate: oral rat LD50 = 4000 mg/kg; sodium phosphate: oral rat lD50 = 3120 mg/kg.
No toxicological data available for the ingredients of this product.

12. ECOLOGICAL INFORMATION

Product Ecological Information: --
No ecological data available for this product.
Ingredient Ecological Information: --
No ecological data available for the ingredients of this product.

13. DISPOSAL CONSIDERATIONS

EPA Waste ID Number: None
Special Instructions (Disposal): Place material in a plastic bag. Mark bag 'Non-hazardous trash', and dispose of as normal refuse.
Empty Containers: Rinse three times with an appropriate solvent. Dispose of empty container as normal trash.
NOTICE (Disposal): These disposal guidelines are based on federal regulations and may be superseded by more stringent state or local requirements. Please consult your local environmental regulators for more information.

14. TRANSPORT INFORMATION

D.O.T.:
D.O.T. Proper Shipping Name: Not Currently Regulated
--

DOT Hazard Class: NA
DOT Subsidiary Risk: NA
DOT ID Number: NA
DOT Packing Group: NA

I.C.A.O.:

I.C.A.O. Proper Shipping Name: Not Currently Regulated
--
ICAO Hazard Class: NA
ICAO Subsidiary Risk: NA
ICAO ID Number: NA
ICAO Packing Group: NA

I.M.O.:

I.M.O. Proper Shipping Name: Not Currently Regulated
--
I.M.O. Hazard Class: NA
I.M.O. Subsidiary Risk: NA
I.M.O. ID Number: NA
I.M.O. Packing Group: NA

Additional Information: There is a possibility that this product could be contained in a reagent set or kit composed of various compatible dangerous goods. If the item is NOT in a set or kit, the classification given above applies. If the item IS part of a set or kit, the classification would change to the following: UN3316 Chemical Kit, Class 9, PG II or III. If the item is not regulated, the Chemical Kit classification does not apply.

15. REGULATORY INFORMATION

U.S. Federal Regulations:

O.S.H.A.: This product does not meet the criteria for a hazardous substance as defined in the Hazard Communication Standard. (29 CFR 1910.1200)

E.P.A.:

S.A.R.A. Title III Section 311/312 Categorization (40 CFR 370): This product is not hazardous under 29 CFR.1910.1200 and therefore is not covered by Title III under SARA.

S.A.R.A. Title III Section 313 (40 CFR 372): This product does NOT contain any chemical subject to the reporting requirements of Section 313 of Title III of SARA.

--

302 (EHS) TPQ (40 CFR 355): Not applicable
304 CERCLA RQ (40 CFR 302.4): Not applicable
304 EHS RQ (40 CFR 355): Not applicable
Clean Water Act (40 CFR 116.4): Not applicable
RCRA: Contains no RCRA regulated substances.

C.P.S.C.: Not applicable

State Regulations:

California Prop. 65: No Prop. 65 listed chemicals are present in this product.
Identification of Prop. 65 Ingredient(s): None
California Perchlorate Rule CCR Title 22 Chap 33: Not applicable

Trade Secret Registry: Not applicable

National Inventories:

U.S. Inventory Status: All ingredients in this product are listed on the TSCA 8(b) Inventory (40 CFR 710).
TSCA CAS Number: Not applicable

16. OTHER INFORMATION

Intended Use: Surfactant
References: Vendor Information. Technical Judgment.

Revision Summary: Updates in Section(s) 14,

Legend:

NA - Not Applicable	w/w - weight/weight
ND - Not Determined	w/v - weight/volume

NV - Not Available v/v - volume/volume

USER RESPONSIBILITY: Each user should read and understand this information and incorporate it in individual site safety programs in accordance with applicable hazard communication standards and regulations.

THE INFORMATION CONTAINED HEREIN IS BASED ON DATA CONSIDERED TO BE ACCURATE. HOWEVER, NO WARRANTY IS EXPRESSED OR IMPLIED REGARDING THE ACCURACY OF THESE DATA OR THE RESULTS TO BE OBTAINED FROM THE USE THEREOF.

ARCADIS

Appendix F

TCP/STAR Plan Template

Site Traffic Awareness and Response (STAR) Plan for Private Roadways and Parking Areas

1.0 GENERAL

Project Name	
Project Number	
STAR Plan Developer Name	
Reviewed By:	
Duration of Work (hours or days)	
Time restrictions (state times, describe in Section 2.0)	
Posted Speed Limits for Roadway	
Number of Lanes for Roadway (each direction)	

2.0 WORK DESCRIPTION

Provide a brief description of work activities in the roadway or parking area.

3.0 TRAFFIC TYPE

Check all that apply:

- ☐ Automobiles
- ☐ Straight Trucks
- ☐ Semi Trucks
- ☐ Construction Equipment
- ☐ Forklifts
- ☐ Bicycles
- ☐ Pedestrian
- ☐ Other – Specify:

4.0 TRAFFIC CONTROL LAYOUT

For roadway and parking area work, check all that apply and click link to print layout and attach. Manually revise to address specific requirement.

Roadway Work:

- ☐ Work Beyond the Shoulder (DOT Facts-301i)
- ☐ Work on the Shoulder (DOT Facts-301j)
- ☐ Short Duration Work or Mobile Operations Work on the Shoulder (DOT Facts-301k)
- ☐ Shoulder Closure with Minor Encroachment (DOT Facts-301m)
- ☐ Lane Closure on 2 Lane Road with Flagger (DOT Facts-301n)
- ☐ Lane Closure on 2 Lane Road with Low Traffic Flow (DOT Facts-301o)

☐ Temporary Road Closure (DOT Facts-301p)

☐ Haul Road Crossing (DOT Facts-301q)

☐ Work in the Center of Low Volume Traffic Road (DOT Facts-301r)

☐ Atypical Roadway Layout or Work in Congested Facilities (Attach Drawing) (DOT Facts-301u)

Parking Area Work:

DOT Fact Sheets for parking areas have numbered scenarios. Select applicable scenario(s) and work duration (S-Short, I – Intermediate, L – Long)

☐ Short Duration (<1 Hour) Retail Gas Station or Small Single Business (DOT Facts-302a) 1 2 3 4 5

☐ Intermediate Duration (1-8 Hours) Retail Gas Station or Small Single Business (DOT Facts-302b) 1 2 3 4

☐ Long Duration (>8 Hours) Retail Gas Station or Small Single Business (DOT Facts-302c) 1 2 3

☐ Multi Business Parking Lot (Malls, Strip Malls, etc) (DOT Facts-302e) 1 2 3 4 5 6 7 8 9 S I L

☐ Facility Parking Area (DOT Facts-302e) 1 2 3 4 5 6 7 8 9 S I L

☐ Parking Garage (develop drawing for controls)

☐ Other:

5.0 REQUIRED TRAFFIC CONTROL DEVICES

Need Sign Help? DOT Facts-301d
Need Channelizing Device Help? DOT Facts-302d (see also DOT Facts-301e)
Need Flagger Help? DOT Facts-301f
Review Flagger training and certification requirements by state: DOT Facts-301w.

Device	Number Required	Wording or Pictogram	Comments
Warning Signs			
Warning Signs			
Stop/Slow Paddle			
Red Flag			
Channelizing Cones 10 lb			
Channelizing Cones 30 lb			
Cones			
Drums[1]			
Tubular Markers			
Vertical Panels[1]			
Barricade[1] (Type I)			
Barricade[1] (Type II)			
Barricade[1] (Type III)			
Arrow Panels			
Other:			

Notes:

1) Provide with warning lights if night work or traffic control use is required at night.

All vehicles used in the roadways or parking areas should be equipped with functioning high intensity rotating, flashing, oscillating, or strobe lights. If the vehicle is not equipped with supplemental lighting devices use vehicle flashers (be aware of battery drain when using any of the lighting devices).

Personal protective equipment required for this work is listed in the applicable project Job Loss analysis (JLA) or project specific HASP. A Class II (minimum) high visibility vest is required.

6.0 WORK SEQUENCE FOR ROADWAY WORK (PHASING)

Safely enter street and place cones and barricade type II around work area. Always conduct work facing traffic and be aware of traffic and have another person stand watch for dangerous traffic situation. Upon completion of work, remove roadway equipment with caution.

7.0 APPROVALS

STAR Plan Developer	Nicole Chisholm
Designated HASP Reviewer[1]	

1) An individual with Engineering Judgment may also approve this STAR Plan, even if not a designated HASP Reviewer

8.0 REVIEWED BY:

To be signed by each employee working on the project affected by this STAR Plan:

Name Printed	**Signature**

Attach Applicable DOT Fact Sheets or Drawings

ARCADIS

Appendix G

Shipping/Transportation
Determination Template

SHIPPING/TRANSPORTATION DETERMINATION

(Rev.4, 8/10)

General Information *(Need Help?)*

Revision Number	
Project Name	
Project Number	
City of Shipment	
City of Destination	
Analytical/MSDS/Hazard Information Attached?	

Description of Material to be Shipped/Transported

Determination

	Not Restricted/Regulated
	Hazardous Material

Complete for Hazardous Materials (Refer to 49 CFR 172.101 or IATA DGR section 4.2)

Proper Shipping Name	
UN or ID Number	
Hazard Class	
Packing Group	

"X"	*How Do You Want to Ship/Transport This Material?*	*24/7 Emergency Number Required? (FedEx criteria)*	*Packing Instruction / Shipping Guide / Support Package*
	Materials of Trade Exception	No	
	Excepted Quantity	No	
	Limited Quantity (Ltd Qty)	Ground –Yes Air - No	
	Special Permit/49 CFR 173.13	Ltd Qty Ground –Yes Ltd Qty Air – No Non-Ltd Qty- Yes	
	UN Specification Ground, Non-Bulk	Yes	
	UN Specification Ground, Bulk	Yes	
	UN Specification Air, Passenger or Cargo Aircraft	Yes	
	UN Specification Air, Cargo Aircraft Only	Yes	
	Other:	Yes/No	
	Batteries (Excepted)	No	ARCADIS Guide US050
	Compressed Gases (Non-flammable)	Yes	ARCADIS Guide US020
	Dry Ice	No	ARCADIS Guide US015
	Radioactive Material, Excepted Package, Limited Quantity of Material	No	ARCADIS Guide US016
	Sample Coolers (Print Guide and provide to field staff)	NA	ARCADIS Guide US001

Other Determinations

	This material is a Hazardous Waste (being offered under a Hazardous Waste Manifest)
	This material is a Hazardous Substance (49 CFR 172.101 appendix A)
	This material is a Marine Pollutant or Severe Marine Pollutant (49 CFR 172.101 appendix B)

Method of Shipment/Transportation

	FedEx Freight		Ground (FedEx)		Air (FedEx)		Lab Courier
	FedEx Custom Critical		Ground (UPS)		Air (UPS)		Rail
	Freight Other		ARCADIS Transport		Non DOT Spec.		Other
Comments:							

Special Instructions

☐

Rationale for Determination

Regulatory Reference/Interpretation

Determination Performed By

Name Printed	Signature	Date

QA/QC Check Performed By

Name Printed	Signature	Date