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NAS PENSACOLA  
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HEALTH AND SAFETY PLAN PILOT SYSTEM INSTALLATION FOR THE TREATMENT OF  
CHLORINATED SOLVENTS IN THE GROUNDWATER AT SOLID WASTE MANAGEMENT  
UNIT 1 NAS PENSACOLA FL  
11/6/2007  
SOLUTIONS-IES

***HEALTH AND SAFETY PLAN  
PILOT SYSTEM INSTALLATION  
FOR THE TREATMENT OF  
CHLORINATED SOLVENTS  
IN THE GROUNDWATER  
AT SWMU 1  
NAS PENSACOLA***

SITE-SPECIFIC HEALTH AND SAFETY PLAN  
NAVAL AIR STATION  
190 RADFORD BOULEVARD  
PENSACOLA, FL 32508  
SOLUTIONS-IES PROJECT NO. 3910.07A3.NAVF

**A. GENERAL INFORMATION**

**Site Name:** Naval Air Station, Pensacola, Florida

**Location:** 190 Radford Boulevard  
Naval Air Station  
Storm Water Management Unit 1  
Pensacola, Florida 32508

**Date(s) of Planned Field Activities:** January 2008  
**Nature of Visit**

|                        |          |
|------------------------|----------|
| On-Site Reconnaissance | <u>✓</u> |
| GW Sampling            | <u>✓</u> |
| Well Installation      | <u>✓</u> |
| Core sampling          | <u>✓</u> |
| Substrate injection    | <u>✓</u> |

**B. REVIEW AND APPROVAL**

Corporate Health & Safety Officer                      Walter J. Beckwith, P.G.                      \_\_\_\_\_

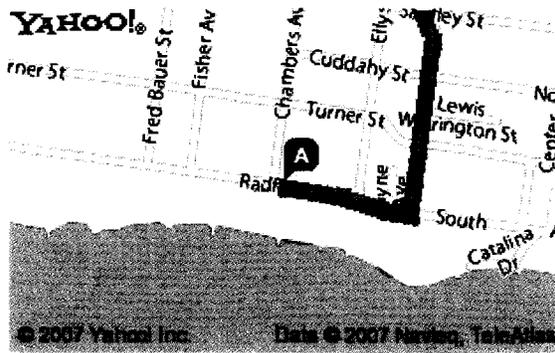
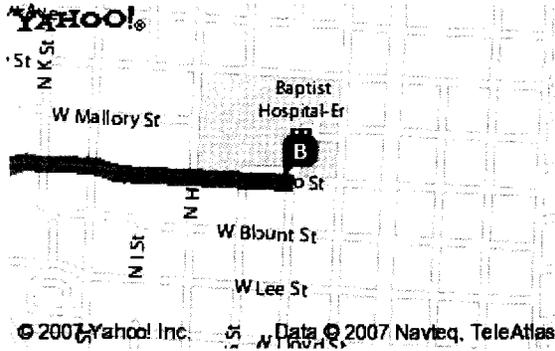
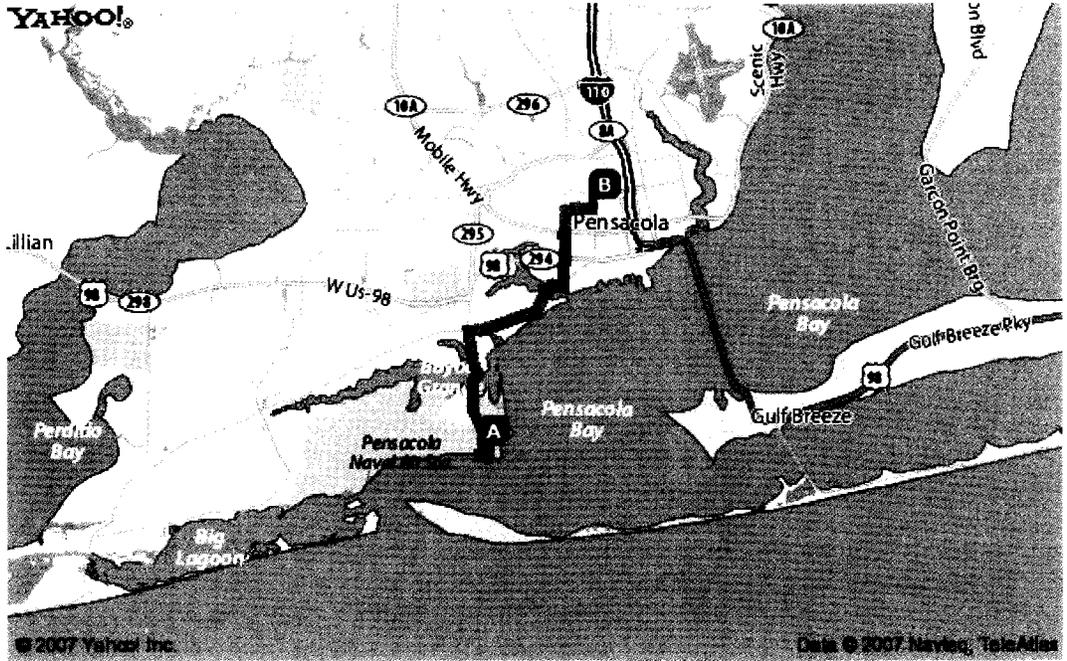
Project Manager    Jessica Dehart    \_\_\_\_\_

**C. EMERGENCY CONTACT INFORMATION**

Hospital: Baptist Hospital  
1000 West Moreno Street, Pensacola, FL  
(850) 434-4011

Approximate Distance From Site: 8.3 miles (22 min)  
(See Figure 1 for Hospital Route Map)  
EMS, FIRE, POLICE: 911

SOLUTIONS-IES HEALTH AND SAFETY OFFICER:  
Walt Beckwith, Office (919) 873-1060; Mobile (919) 345-1310



90 RADFORD BLVD, PENSACOLA, FL

1. Start at **90 RADFORD BLVD, PENSACOLA** go < **0.1** mi < 0.1 mi
2. Continue on **SOUTH AVE** go < **0.1** mi < 0.1 mi
3. Turn **L** LEFT on **WEST AVE** go **0.2** mi 0.2 mi
4. Bear **L** LEFT on **MURRAY RD** go **1.5** mi 1.7 mi
5. Continue on **DUNCAN RD(CR-295)** go **0.3** mi 2.0 mi
6. Continue on **S NAVY BLVD(SR-295)** go **1.0** mi 3.0 mi
7. Turn **R** RIGHT on **BARRANCAS AVE(SR-292)** go **2.6** mi 5.6 mi
8. Turn **L** LEFT to follow **SR-292** go **0.6** mi 6.2 mi
9. Continue on **N PACE BLVD(US-98)** go **0.6** mi 6.8 mi
10. Continue on **N PACE BLVD(SR-292)** go **0.5** mi 7.3 mi
11. Turn **R** RIGHT on **W BLOUNT ST** go **0.2** mi 7.5 mi
12. Continue on **W MORENO ST** go **0.4** mi 7.9 mi
13. Arrive at **1000 W MORENO ST, PENSACOLA**, on the **L** LEFT  
**B** **1000 W MORENO ST, PENSACOLA, FL**



**E. SITE CHARACTERIZATION AND DESCRIPTION**

The Naval Air Station (NAS) was built in 1826 as a Navy Yard and is used as a location to train Navy personnel. The Waste Water Treatment Plant (WWTP) has been used to process wastewater since 1941, when the sewage treatment plant was first installed. Industrial waste from electroplating and paint removal operations took place from the 1950's to the 1960's. Much of this waste was processed concurrently with sewer waste. In 1971, the WWTP upgraded to separate industrial and domestic waste. Wastewater treated at this site contained organic solvents (chlorinated ethene, benzene, and chlorobenzenes) phenols, chromium electroplating wastes (cyanide and heavy metals), and waste from the chemical conversion process for aluminum. Drying beds were used to dewater the sludge generated by the water treatment process for aluminum. The abandoned drying beds were the source of environmental contamination that was addressed under RCRA. In addition, a sulfuric acid spill in the 1980's occurred upgradient of the source area, lowering pH and mobilizing iron.

The drying beds used to dewater sludge is where the work will be performed. Excavation and capping of sludge drying beds occurred in 1989. The material in the drying beds was removed to a depth of 6 ft bgs and disposed of as hazardous waste. An iron catalyst solution was injected which led to an initial decline in chlorinated ethane concentrations. They were then backfilled with clean sand and capped with high density asphalt. As part of the closure procedure, a groundwater recovery system was put in place to pump and treat contaminated groundwater.

The United States Geological Survey monitored the area of interest, and they reported natural attenuation was occurring, therefore the pump and treat was discontinued in 1997.

In December of 1998, an In-Situ Chemical Oxidation (ISCO) was performed using 4,089 gallons of 50% hydrogen peroxide and equivalent volume of ferrous iron catalyst solution. In May of 1999, an additional 6,038 gallons of 50% hydrogen peroxide solution was injected. The ISCO initially decreased concentrations of TCE in the source area, but levels have rebounded since 2001 and are currently near pre-injection levels in monitoring well USGS-5.

Groundwater contaminants include, but are not limited to, the following chlorinated solvents:

- Trichloroethene (TCE) at 21,700 µg/L;
- cis-1,2-Dichloroethene (cis-1,2-DCE) at 280 µg/L;
- 1,1-Dichloroethene (1,1-DCE) at 34 µg/L;
- 1,2 Dichlorobenzene (1,2 DCB) at 77 µg/L;
- 1,3 Dichlorobenzene (1,3 DCB) at 27 µg/L;
- 1,4 Dichlorobenzene (1,4 DCB) at 53 µg/L;
- Chlorobenzene (CB) at 200 µg/L;

*(Pensacola USGS MNA 2006 Report-August Data)*

The WWTP is underlain by marine and fluvial terrace sediments deposits of Quaternary age. Sediments exposed at land surface and extending to a depth of about 40 feet are predominantly fine to medium sands that form a shallow water-table aquifer. This water-table aquifer is underlain by lower-permeability silts and clays of marine origin that act as a confining bed. This confining bed is underlain by permeable

sands and gravel that form a confined aquifer system. This confined aquifer is known locally as the "main producing zone" and has been used for water supply. At the WWTP, the confined main producing zone has higher water levels than the overlying water-table aquifer. Thus, the site is characterized by an upward hydraulic gradient. The combination of the confining bed and the upward hydrologic gradient prevents downward movement of ground water at this site (Ensafe/Allen and Hoshall, 1995). Because of this, most of the contaminants are present in the water-table aquifer between a depth of 20 to 40 feet below land surface. Pensacola Bay, located immediately adjacent to the WWTP, serves as the regional discharge area for both the shallow water-table aquifer and the underlying main producing zone.

In 2007, the average depth to groundwater in SWMU 1 ranged from 4.4 to 7.9 feet below ground surface. The shallow groundwater flow at the site mimics the local topography and generally flows to the north-northeast. The average hydraulic gradient across the area is relatively flat, likely inhibiting plume migration offsite.

## **F. WORK PLAN DESCRIPTION**

The scope of work includes taking core samples and installing injection wells with a Geoprobe<sup>®</sup>, substrate injection, bioaugmentation, groundwater sampling and well abandonment.

### **1. Soil Boring and Injection Well Installation**

One soil core will be advanced near existing source area monitoring well AE-01 and one near existing monitoring well USGS-5. A temporary injection well (IW-1) to be used for bioaugmentation will be constructed in the borehole adjacent to USGS-5. The third soil core will be advanced between the two existing monitoring wells. A new monitoring well (SI-01) will be installed in this borehole. An additional temporary injection well (IW-2) will be installed adjacent to SI-01 for introduction of the bioaugmentation culture.

Each injection well will be installed using 2-1/4 inch Geoprobe<sup>®</sup> casing with an expendable tip. The wells will be installed in a grass-covered portion of the site. The Geoprobe<sup>®</sup> casing will be pushed to the termination depth, estimated to be approximately 45 ft bgs. Ten feet of 1-inch diameter machine slotted PVC screen will be attached to 35 feet of 1-inch well casing. The well screen and riser will be placed in the Geoprobe<sup>®</sup> casing, and the casing will be removed from the borehole leaving the well screen behind. Fine filter sand will be placed in the annulus up to the top of the 10-ft screen. The top 5 feet of the borehole will be sealed with bentonite. Following installation, each well will be developed using a combination of surging and pumping. **Section G** discusses handling of contaminated soil and groundwater as investigation-derived waste (IDW).

### **2. Substrate Injection**

Solutions-IES will inject the AquaBupH<sup>®</sup> into the contaminated groundwater zone through the twelve injection wells. The injection will be performed using Geoprobe<sup>®</sup> technology to directly inject the substrate into the aquifer. The Geoprobe<sup>®</sup> tooling will be advanced to the bottom of the treatment zone (estimated to be around 45 feet below ground surface) and the rods will be pulled up simultaneously as the substrate is being injected into the treatment zone.

The volume of AquaBupH™ will be injected within the designated treatment zone to target the DNAPL present in this zone. The actual treatment zone will be determined by the preliminary soil cores advanced during the first mobilization. AquaBupH® is a low viscosity, emulsified vegetable oil that can be distributed over a large volume of aquifer to stimulate anaerobic biodegradation of chlorinated compounds while providing a buffer to low pH aquifers. The sequence of injection will depend on field testing the injection process.

Distribution of the emulsified oil away from the injection points and into the formation will be performed by direct push injection of diluted AquaBupH™® emulsion into the aquifer until the designated volume is achieved. Details of the injection process are provided below.

- Three drums of AquaBupH® concentrate will be delivered to the site.
- Solutions-IES will coordinate with NAS Pensacola to identify a suitable water source (e.g., a fire hydrant) for use in the injection process. Pre-treatment of the water to be used for dilution or chase, (e.g., to remove trihalomethanes from potable water), is not planned.
- AquaBupH® concentrate will be mixed on site in a mixing tank at a ratio of 1 part AquaBupH to 2 parts water and then injected using direct push injection method.

The volume of AquaBupH concentrate designed for each injection point is 13.75 gallons (127.5 lbs). The design will result in the emplacement of a total volume of liquid, comprised of diluted, metered AquaBupH® and chase water, of approximately 63 gallons per point. The total volume injected into the source will be approximately 756 gallons for the twelve injection points.

After the required volume of substrate has been injected, the injection tooling will be removed and the remaining borehole will be abandoned in accordance with FDEP regulations. No injection points (injection wells) will be left after the biostimulation injection.

### **3. Groundwater Sampling and Monitoring**

During injection, Solutions-IES will monitor the water levels in nearby existing monitoring wells. Water levels in these wells will be monitored before, once during, and immediately upon termination of the injection to evaluate whether groundwater mounding has occurred and, if so, how widespread it is observed and to what depth. This information will be used to help evaluate the impact and effectiveness of the injection process.

After the injection process is complete, groundwater sampling will be performed in the four designated monitoring wells. All field instruments will be calibrated in accordance with the manufacturer's recommendations. The depth to water in each well will be measured using an electronic water level indicator. The wells will be sampled using the low-flow sample in accordance with the Florida Department of Environmental Protection regulations. Parameters will be collected every 5 minutes until the well stabilizes. The samples will be shipped on ice under Chain-of-Custody control to KSA Environmental Laboratories for analysis of volatile organic compounds (VOCs) and sulfates.

### **4. Bioaugmentation**

*Dehalococcoides ethenogenes* is a naturally occurring microorganism that is the only known microorganism capable of complete dechlorination of chloroethenes (i.e., TCE, cis-1,2-DCE, and VC) to



B. Fire Extinguisher:  Yes  No Location: Solutions-IES Geoprobe

C. Communication:  Buddy  Radio  Hand Signals  Cell Phone

D. Personal Protective Equipment List: Level D

- Tyvek Suit
- Chemical Resistant Suit
- Fully Encapsulated Suit
- Steel Toed Boots
- Hard Hat
- Safety Glasses
- Ear Plugs (See attached hearing protection policy)
- Gloves, inner (specify) \_\_\_\_\_
- Gloves, outer (specify) Nitrile
- Respirator, Type:  Half-face  Full-face  SCBA
- Respirator Cartridge Type: HEPA Filter
- Water Cooler
- Orange DOT Safety Vest (to be determined on site)
- Cell Phone
- Other (specify) \_\_\_\_\_

E. Decontamination Equipment

- Pressure Washer (Geoprobe)
- Solvent Rinse
- Steam Ginny (Drill Rig)
- Water
- Alconox/Liquinox
- 5-Gallon Carboy of Deionized Water
- Other (specify) \_\_\_\_\_

F. Decontamination Procedure

All non-disposable hand held equipment that comes into contact with the contaminated soil or groundwater will be decontaminated in a Liquinox/DI solution, rinsed with DI water, placed on a clean sheet of plastic or aluminum foil to dry.

- Level D If Level D personal protective equipment contacts contaminated soil or groundwater, boot soles and safety glasses will be washed and rinsed, nitrile gloves will be removed, when necessary, and standard work clothes will be removed and replaced with dry items. If background PID reading are above 10 ppm, work will be stopped and the Health and Safety officer will be notified for further instructions.

Emergency Precautions: Hazards anticipated are skin contact with contaminated soil or groundwater and the inhalation of dangerous vapors.

Possible Exposure Route/First Aid: The following is an explanation first aid that will implemented as a result of exposure to the identified contaminants of concern via the listed exposure routes.

| <u>Exposure Route</u> | <u>Exposure Method</u>     | <u>First Aid</u>                                    |
|-----------------------|----------------------------|---|
| Eyes                  | Yes, Splash                | Flush with clean water for at least 15 minutes.     |
| Skin                  | Yes, Splash                | Wash with soap and copious amounts of clean water.  |
| Inhalation            | Yes, Released<br>Volatiles | Move upwind from the area of concern.               |
| Ingestion             | Yes, Splash, Spill         | Flush the mouth with copious amounts of clean water |

With any exposure route, inform the Health and Safety officer if unusual symptoms occur.

I. **HAZARD EVALUATION**

| A. Substance(s)        | Quantity   | Toxicity (PEL/TLV) |
|------------------------|------------|--------------------|
| Cis-1,2-Dichloroethene | 280 µg/L   | 200 ppm            |
| 1,2 Dichlorobenzene    | 420 µg/L   | 50 ppm             |
| 1,3 Dichlorobenzene    | 610 µg/L   | 50 ppm             |
| 1,4 Dichlorobenzene    | 510 µg/L   | 75 ppm             |
| Chlorobenzene          | 390 µg/L   | 75 ppm             |
| Trichloroethene        | 8,000 µg/L | 100 ppm            |
| 1,1-Dichloroethene     | 34 µg/L    | 100 ppm            |

(See attached MSDS sheets)

Ambient Field Monitoring

1. Equipment required:

\_\_\_\_\_ ✓ \_\_\_\_\_ PID \_\_\_\_\_ Detection Tubes and Pumps



No  
 Yes (specify) Florida Well drillers license (for well installation)

Special Medical Monitoring beyond standard OSHA program required?

No  
 Yes (specify) \_\_\_\_\_

**APPENDIX A**

**SOLUTIONS-IES HEARING PROTECTION PROTOCOL**

## **HEARING PROTECTION PROTOCOL**

All personnel must wear OSHA-approved hearing protection - with a Noise Reduction Rating (NRR) of at least 30 - when noise levels exceed 85 dB. When it is difficult to hear a co-worker at normal conversation distance, the noise level is approaching or exceeding 85 dB, and hearing protection is necessary.

Exposure to average noise levels over the OSHA action level of 85 dB or greater during an 8-hour workday can cause temporary impairment of hearing; prolonged and repeated exposure can cause permanent damage to hearing. The risk and severity of hearing loss increases with the intensity and duration of exposure to noise. In addition to damaging hearing, noise can impair voice communication, thereby increasing the risk of accidents on site.

Whenever possible, equipment that does not generate excessive noise levels will be used. If the use of noisy equipment is unavoidable, barriers or increased distance will be used to minimize worker exposure to noise, and all personnel will be required to wear hearing protection.

All personnel will be required to wear hearing protection while operating or working in the vicinity of Geoprobe, chainsaws, core drills, drill rigs, or whenever noise levels are suspected to be above 85 dB.

### **GEOPROBE**

The 5400 series Geoprobe produces approximately 104dB at 3 ft., 99dB at 9 ft., and 92 dB at 27 ft. therefore all personnel working within 30 feet of the Geoprobe® are required to wear OSHA-approved hearing protection with a NRR of at least 30. The operator and all personnel working within 4 feet of the Geoprobe® are encouraged to wear noise-reduction earmuffs in addition to earplugs to further reduce sound levels.

### **SUBCONTRACTORS**

Heavy Equipment and Geoprobe subcontractors are required to provide a hearing conservation program to cover all personnel exposed to noise levels in excess of 85 dB. Hearing protection is mandatory for all personnel in noise hazard areas, such as around heavy equipment. As a general rule, sound levels that cause speech interference at normal conversation distance (2 feet) may indicate the need for noise monitoring and potential use of hearing protection.

## **MONITORING**

Solutions-IES will not routinely monitor noise levels of equipment at project sites. If noise levels are questionable, employees will utilize hearing protection. All site personnel who may be exposed to high noise levels in an occupational setting must receive baseline and annual audiograms and training as to the causes and prevention of hearing loss.

**APPENDIX B**

**JOB SAFETY ANALYSIS**

| <b>Task Breakdown</b>                 | <b>Potential Hazards</b>       | <b>Critical Safety Practices</b>  | <b>Personal Protective Clothing and Equipment</b>   | <b>Monitoring Devices</b>                |
|---------------------------------------|--------------------------------|---|---|--|
| Well Installation and Geoprobe Points | Underground Overhead Utilities | <ul style="list-style-type: none"> <li>Identify and mark all utilities around the site before work commences</li> <li>Cease work immediately if unknown utility markers are uncovered</li> <li>Install wells no closer than 3 feet from known utilities</li> <li>Overhead utility clearance shall conform with 29 CFR 1926.955 (high voltage &gt;700 kV) 15 feet phase to ground clearance; 31 feet phase-to-phase clearance. Contact Solutions-IES office if high voltage lines are within the work area before initiating work.</li> </ul>  | Level D PPE (as specified in the HASP and Amendments)   | None                                     |
|                                       | High Noise Levels              | <ul style="list-style-type: none"> <li>Use hearing protection when exposed to excessive noise levels (greater than 85 dBA over an 8-hour work period)</li> <li>All workers and site personnel will use hearing protection when working within 30 feet of the drill rig or Geoprobe</li> </ul>   | Ear plugs or muffs<br>NRR of 29 or greater  | None                                     |
|                                       | Physical Hazards               | <ul style="list-style-type: none"> <li>Daily safety inspection of equipment</li> <li>Ensure appropriate guards are installed or suitable barriers to forewarn personnel of dangers. Observe potential pinch points.</li> <li>Personnel clear during set up, clear of moving parts</li> <li>Loose clothing, long hair, and jewelry to be safely secured</li> <li>Kill switch installed, clearly identified and operational</li> <li>Rig placed in neutral and parking brake set when operator not at controls</li> <li>Ensure all personnel not involved in drilling operation are clear of operation to a suitable safe distance</li> </ul> | Level D PPE<br><br>In addition Hardhat, Safety Glasses, Steel Toe Boots and hearing protection will be worn by workers.<br><br>With additional PPE upgrade (respiratory protection) as required by Site Specific Health & Safety Plan | None                                     |
|                                       | High/Low Ambient Temperature   | <ul style="list-style-type: none"> <li>Monitor for Heat/Cold stress in accordance with Solutions-IES HASP.</li> <li>Elevated temperatures - Provide water cooler on site and additional electrolyte-containing fluids to prevent worker dehydration</li> <li>Cold temperatures – Provide ample “warm-up” breaks with warm drinks.</li> </ul>  | Hot Weather<br><br>Level D PPE as modified for task. No tank top shirts or shorts are allowed.<br><br>Cold Weather Insulated Clothing (subject to ambient temperature),   | As specified in HASP.<br><br>Thermometer |

| Task Breakdown                   | Potential Hazards                                     | Critical Safety Practices  | Personal Protective Clothing and Equipment  | Monitoring Devices             |
|----------------------------------|---|--|---|--------------------------------|
| Well Installation<br>(continued) | Handling Heavy Objects                                | <ul style="list-style-type: none"> <li>• Use mechanical lifting equipment (hand carts, trucks) to move heavy, large, or awkward loads wherever possible</li> <li>• When manual lifting is required, use proper lifting techniques and sensible lifting limits (50 lb. Recommended maximum weight per person for manual lifting).</li> </ul>  | Level D PPE as modified for task<br><br>Back support belt   | None                           |
|                                  | Slips, Trips, Falls                                   | <ul style="list-style-type: none"> <li>• Clear walkways and work areas of equipment, tools, vegetation, excavated material, drill rods, and debris</li> <li>• Cleanup spills or excess bentonite. Hydrated bentonite can present very slippery surfaces.</li> <li>• Mark, identify, or barricade other obstructions</li> <li>• A barrier will be constructed using caution tape to prevent observers from entering.</li> </ul>   | Equipment-<br>Spill kit for liquids, shovel and broom for solids.   | None                           |
|                                  | Skin Contact with Hazardous Substances                | <ul style="list-style-type: none"> <li>• Provide workers proper skin, eye and respiratory protection based on the exposure hazards present</li> <li>• Review hazardous properties of site contaminants, reagents and material supplies with workers before beginning task and daily.</li> <li>• Prevention of hand to mouth contact while working in the contaminated area. Workers will not smoke or eat in the work area. A break area will be identified before beginning site work.</li> <li>• Follow proper decontamination procedures to prevent ingestion of contaminants</li> <li>•</li> </ul> | Level D minimum. Additional clothing such as Tyvek® coveralls safety glasses, face shield and gloves may be needed to minimize exposure to dust solids and liquids. | None                           |
| Well Development                 | Inhalation and Skin Contact with Hazardous Substances | <ul style="list-style-type: none"> <li>• Provide workers proper skin, eye and respiratory protection based on the exposure hazards present</li> <li>• Review hazardous properties of site contaminants with workers before operations begin</li> <li>• Monitor breathing zone air to determine levels of contaminants</li> <li>• Follow proper decontamination procedures to prevent ingestion of contaminants</li> </ul>  | Level D<br>Additional clothing may be recommended such as Tyvek® coveralls or, neoprene apron, gloves, safety glasses or face shield.                               | Photoionization detector (PID) |

| <b>Task Breakdown</b>        | <b>Potential Hazards</b>                         | <b>Critical Safety Practices</b>  | <b>Personal Protective Clothing and Equipment</b>   | <b>Monitoring Devices</b> |
|------------------------------|--|---|---|---------------------------|
| Well Abandonment             | Handling Heavy Objects                           | <ul style="list-style-type: none"> <li>Observe proper lifting techniques</li> <li>Obey sensible lifting limits (50 lb. Recommended maximum per person manual lifting)</li> </ul>  |   | None                      |
| Well Abandonment (continued) | Skin Contact with cement powder and cement grout | <ul style="list-style-type: none"> <li>Provide workers proper skin and eye protection based on the exposure hazards present.</li> <li>Stay upwind of grout mixing operation</li> </ul>  | Level D<br>With safety glasses or face shield and non-permeable (nitrile) gloves Coveralls may be beneficial  | None                      |
|                              | Pressurized hoses                                | <ul style="list-style-type: none"> <li>Fittings and pressurized lines will be checked that they are in good repair before use. All lines will be secured to prevent whipping.</li> <li>Workers will assure all pressure has been removed from lines before breaking. By shutting off pumps, closing valves and opening bleed ports. Pressure gauges will be used to monitor pressures.</li> </ul> | Level D<br>Additional clothing may be recommended for splash protection such as Tyvek® coveralls or, neoprene apron, gloves, safety glasses or face shield. | None                      |
|                              | Slips, Trips, Falls                              | <ul style="list-style-type: none"> <li>Clear walkways, work areas of equipment, tools, vegetation, and debris. Liquid cement and bentonite grouts can be very slippery. Do not overfill boreholes and clean up spills promptly.</li> <li>Mark, identify, or barricade other obstructions</li> </ul>   | Equipment on hand as necessary to clean up spills and mark or barricade obstructions  | None                      |

**APPENDIX C**

**MSDS SHEETS**

CHEM SERVICE INC -- TRICHLOROETHENE, 0-664 -- 6810-00N054678

=====  
===== Product Identification =====

Product ID:TRICHLOROETHENE, 0-664

MSDS Date:01/07/1993

FSC:6810

NIIN:00N054678

MSDS Number: BVYRM

=== Responsible Party ===

Company Name:CHEM SERVICE INC

Box:3108

City:WEST CHESTER

State:PA

ZIP:19381

Country:US

Info Phone Num:215-692-3026

Emergency Phone Num:215-692-3026

CAGE:84898

=== Contractor Identification ===

Company Name:CHEM SERVICE INC

Box:3108

City:WEST CHESTER

State:PA

ZIP:19381

Country:US

Phone:215-692-3026

CAGE:84898

Company Name:CHEM SERVICE, INC

Address:660 TOWER LN

Box:599

City:WEST CHESTER

State:PA

ZIP:19301-9650

Country:US

Phone:610-692-3026

CAGE:8Y898

=====  
===== Composition/Information on Ingredients =====

Ingred Name:ETHYLENE, TRICHLORO-; (TRICHLOROETHYLENE) (SARA III)

CAS:79-01-6

RTECS #:KX4550000

OSHA PEL:100 PPM

ACGIH TLV:50 PPM;100 PPM STEL

EPA Rpt Qty:100 LBS

DOT Rpt Qty:100 LBS

Ingred Name:SUPP DATA: BRTHG ADMIN ARTF RESPS.IF PATIENT IS IN CARD

ARREST ADMIN CPR. CONTINUE LIFE SUPPORTING MEASURES UNTIL(ING 3)

RTECS #:9999999ZZ

OSHA PEL:N/K

ACGIH TLV:N/K

Ingred Name:ING 2: MEDICAL ASSISTANCE HAS ARRIVED. INGESTION: CALL MD

IMMEDIATELY .

RTECS #:9999999ZZ

OSHA PEL:N/K  
ACGIH TLV:N/K

Ingrid Name:EYE PROTECTION: FULL LENGTH FACESHIELD .  
RTECS #:9999999ZZ  
OSHA PEL:N/K  
ACGIH TLV:N/K

===== Hazards Identification =====

LD50 LC50 Mixture:LD50 (ORAL,RAT): 4920 MG/KG.  
Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES  
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO  
Health Hazards Acute and Chronic:CONT LENSES SHOULD NOT BE WORN IN LAB.  
ALL CHEMS SHOULD BE CONSIDERED HAZ-AVOID DIRECT PHYS CONT!  
SUSPECTED CARCIN-MAY PRDCE CANCER. MAY BE HARMFUL IF ABSORB THRU  
SKIN. MAY BE HARMFUL IF INHALED. MAY BE HARMFUL IF SWALLOWED.  
LACHRYMATOR-CAUSES SEV EYE IRRIT. VAPS &/OR DIRECT EYE CONT CAN  
CAUSE SEV EYE (EFTS OF OVEREXP)  
Explanation of Carcinogenicity:NOT RELEVANT.  
Effects of Overexposure:HLTH HAZ: BURNS. CAN CAUSE EYE IRRIT. CAN CAUSE  
SKIN IRRIT. CAN CAUSE SKIN BURNS. CAN CAUSE SEV SKIN BURNS. EXPOS  
CAN CAUSE LIVER DMG. EXPOS CAN CAUSE KIDNEY DMG. CAN CAUSE GI  
DISTURB. CAN BE IRRIT TO MUC MEMBS. PRLNGD EXPOS MAY CAUSE  
NAUS/HDCH/DIZZ &/OR EYE DMG.CAN CAUSE SENSIT BY SKIN CONT.  
CHLOROCARBON MATLS(SUPDAT)  
Medical Cond Aggravated by Exposure:NONE SPECIFIED BY MANUFACTURER.

===== First Aid Measures =====

First Aid:AN ANTIDOTE IS SUBSTANCE INTENDED TO COUNTERACT EFT OF POIS.  
IT SHOULD BE ADMIN ONLY BY PHYS/TRAINED EMER PERS. MED ADVICE CAN  
BE OBTAINED FROM POIS CNTRL CNTR. EYE: FLUSH CONTINUOUSLY W/WATER  
FOR AT LST 15-20 MINS. SKIN: FLUSH W/WATER FOR15-20 MINS. IF NOT  
BURNS HAVE OCCURED-USE SOAP & WATER TO CLEANSE SKIN. INHAL: REMOVE  
PATIENT TO FRESH AIR. ADMIN OXYGEN IF PATIENT IS HAVING DFCLTY  
(SUPDAT)

===== Fire Fighting Measures =====

Flash Point:NON-FLAMMABLE  
Lower Limits:11%  
Upper Limits:41%  
Extinguishing Media:CARBON DIOXIDE, DRY CHEMICAL POWDER OR SPRAY.  
Fire Fighting Procedures:WEAR NIOSH/MSHA APPROVED PRESSURE DEMAND SCBA  
AND FULL PROTECTIVE EQUIPMENT .  
Unusual Fire/Explosion Hazard:THERMAL DECOMPOSITION PRODUCTS MAY  
INCLUDE HCL AND PHOSGENE .

===== Accidental Release Measures =====

Spill Release Procedures:EVACUATE AREA. WEAR APPROPRIATE OSHA REGULATED  
EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE OR SIMILAR  
MATERIAL. SWEEP UP AND PLACE IN AN APPROPRIATE CONTAINER. HOLD FOR  
DISPOSAL. WASH CONTAMINATE D SURFACES TO REMOVE ANY RESIDUES.  
Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER.

=====  
===== Handling and Storage =====

Handling and Storage Precautions:AVOID CONTACT WITH SKIN, EYES AND CLOTHING. KEEP TIGHTLY CLOSED IN COOL DRY PLACE. STORE ONLY WITH COMPATIBLE CHEMICALS.

Other Precautions:NO SMOKING IN AREA OF USE. DO NOT USE IN GENERAL VICINITY OF ARC WELDING, OPEN FLAMES OR HOT SURFACES. HEAT AND/OR UV RADIATION MAY CAUSE FORMATION OF HCL AND/OR PHOSGENE .

=====  
===== Exposure Controls/Personal Protection =====

Respiratory Protection:WEAR NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR EXPOSURE OF CONCERN .

Ventilation:CHEMICAL SHOULD BE HANDLED ONLY IN HOOD.

Protective Gloves:IMPERVIOUS GLOVES .

Eye Protection:ANSI APPRVD CHEM WORKERS GOGG & (ING 4)

Other Protective Equipment:USE APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.EMER EYEWASH & DELUGE SHOWER WHICH MEET ANSI DESIGN STANDARDS.

Work Hygienic Practices:NONE SPECIFIED BY MANUFACTURER.

Supplemental Safety and Health

EFTS OF OVEREXP: HAVE PRDCED SENSIT OF MYOCARDIUM TO EPINEPHRINE IN LAB ANIMALS & COULD HAVE SIMILAR EFT IN HUMANS. ADRENOMIMETICS (E.G., EPINEPHRINE) MAY BE CONTRAINDICATED EXCEPT FOR LIFE-SUSTAINING USES IN HUMANS ACUTELY/CHRONICALLY EXPOS TO CHLOROCARBONS . FIRST AID PROC: BRTHG. IF PATIENT HAS STOPPED (ING 2)

=====  
===== Physical/Chemical Properties =====

Boiling Pt:B.P. Text:189F,87C

Melt/Freeze Pt:M.P/F.P Text:-125F,-87C

Vapor Pres:58 @ 20C

Spec Gravity:1.462

Solubility in Water:INSOLUBLE

Appearance and Odor:COLORLESS LIQUID.

=====  
===== Stability and Reactivity Data =====

Stability Indicator/Materials to Avoid:YES

STRONG BASES, STRONG OXIDIZING AGENTS.

Stability Condition to Avoid:NONE SPECIFIED BY MANUFACTURER.

Hazardous Decomposition Products:DECOMPOSITION LIBERATES TOXIC FUMES. DECOMPOSITION PRODUCTS ARE CORROSIVE. HCL, PHOSGENE .

=====  
===== Disposal Considerations =====

Waste Disposal Methods:BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER. DISPOSE OF IN ACCORDANCE WITH FEDERAL, STATE, AND LOCAL REGULATIONS .

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CHEM SERVICE INC -- F29 1,1-DICHLOROETHENE -- 6550-00F037520

=====  
Product Identification  
=====

Product ID:F29 1,1-DICHLOROETHENE  
MSDS Date:10/13/1992  
FSC:6550  
NIIN:00F037520  
MSDS Number: BWJGQ  
=== Responsible Party ===  
Company Name:CHEM SERVICE INC  
Address:660 TOWER LN  
Box:3108  
City:WEST CHESTER  
State:PA  
ZIP:19381-3108  
Country:US  
Info Phone Num:215-692-3026/800-452-9994  
Emergency Phone Num:215-692-3026/800-452-9994  
CAGE:84898

==== Contractor Identification ====

Company Name:CHEM SERVICE INC  
Box:3108  
City:WEST CHESTER  
State:PA  
ZIP:19381  
Country:US  
Phone:215-692-3026  
CAGE:84898  
Company Name:CHEM SERVICE, INC  
Address:660 TOWER LN  
Box:599  
City:WEST CHESTER  
State:PA  
ZIP:19301-9650  
Country:US  
Phone:610-692-3026  
CAGE:8Y898

=====  
Composition/Information on Ingredients  
=====

Ingred Name:VINYLIDENE CHLORIDE, 1,1-DICHLOROETHENE,  
1,1-DICHLOROETHYLENE, VDC  
CAS:75-35-4  
RTECS #:KV9275000  
Other REC Limits:5 PPM  
OSHA PEL:1 PPM  
ACGIH TLV:5 PPM  
EPA Rpt Qty:100 LBS  
DOT Rpt Qty:100 LBS

=====  
Hazards Identification  
=====

LD50 LC50 Mixture:ORAL LD50 (RAT/MOUSE): 200 MG/KG  
Routes of Entry: Inhalation:YES Skin:NO Ingestion:YES  
Reports of Carcinogenicity:NTP:NO IARC:NO OSHA:NO  
Health Hazards Acute and Chronic:LACHRYMATOR-EYES: SEVERE IRRITATION.

SKIN: IRRITATION/ALLERGIC REACTIION/SENSITIZATION. INHALATION:  
MUCOUS MEMBRANE IRRITATION. EXPOSURE CAN CAUSE LIVER & KIDNEY  
DAMAGE/NERVOUS & CARDIOVASCULAR SYSTEM INJURY/DELAYED ADVERS  
HEALTH EFFECTS. NARCOTIC AT HIGH CONCENTRATIONS.

Explanation of Carcinogenicity:NONE  
Effects of Overexposure:IRRITATION.

=====  
First Aid Measures

First Aid:EYES: FLUSH CONTINUOUSLY W/WATER FOR 15-20 MINS. SKIN: FLUSH  
W/WATER FOR 15-20 MINS. IF NOT BURNED, WASH W/SOAP & WATER.  
INHALATION: REMOVE TO FRESH AIR. GIVE CPR/OXYGEN IF NEEDED. KEEP  
WARM & QUIET. INGESTION: DON'T INDUCE VOMITING/GIVE LIQUIDS IF  
UNCONSCIOUS/CONVULSING. IF VOMITING OCCURS, WATCH CLOSELY FOR ANY  
AIRWAY OBSTRUCTION. OBTAIN MEDICAL ATTENTION IN ALL CASES.

=====  
Fire Fighting Measures

Flash Point:5F  
Extinguishing Media:CO2, DRY CHEMICAL POWDER. DON'T USE WATER.  
Unusual Fire/Explosion Hazard:FLAMMABLE CHEMICAL. EXPLOSIVE. TENDS TO  
DEVELOP PRESSUE ON STANDING. SENSITIVE TO HEAT & AIR. MAY  
POLYMERIZE UPON STANDING.

=====  
Accidental Release Measures

Spill Release Procedures:EVACUATE AREA. WEAR APPROPRIATE OSHA  
REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR  
MATERIAL. SWEEP UP & PLACE IN APPROPRIATE CONTAINER/HOLD FOR  
DISPOSAL. WASH CONTAMINATED SURFAC ES TO REMOVE ANY RESIDUES.

=====  
Handling and Storage

Handling and Storage Precautions:STORE IN A COOL DRY PLACE ONLY  
W/COMPATIBLE CHEMICALS. KEEP TIGHTLY CLOSED. STORE UNDER NITROGEN &  
REFRIGERATION. FOR LABORATORY USE ONLY.  
Other Precautions:AVOID CONTACT W/SKIN, EYES & CLOTHING. DON'T BREATH  
VAPORS. CONTACT LENSES SHOULDN'T BE WORN IN THE LABORATORY. ALL  
CHEMICALS SHOULD BE CONSIDERED HAZARDOUS. AVOID DIRECT PHYSICAL  
CONTACT.

=====  
Exposure Controls/Personal Protection

Respiratory Protection:WEAR APPROPRIATE OSHA/MSHA APPROVED SAFETY  
EQUIPMENT.  
Ventilation:CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.  
Eye Protection:EYE SHIELDS  
Work Hygienic Practices:REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE  
REUSE.  
Supplemental Safety and Health

=====  
Physical/Chemical Properties

Boiling Pt:B.P. Text:87.06F  
Melt/Freeze Pt:M.P/F.P Text:-188.5F  
Solubility in Water:INSOLUBLE  
Appearance and Odor:COLORLESS LIQUID W/FRUITY/PLEASANT ODOR.

===== Stability and Reactivity Data =====

Stability Indicator/Materials to Avoid:NO  
Stability Condition to Avoid:HEAT, AIR, UPON STANDING.  
Conditions to Avoid Polymerization:UPON STANDING.

===== Disposal Considerations =====

Waste Disposal Methods:BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN  
AFTERBURNER & SCRUBBER IAW/FEDERAL, STATE & LOCAL REGULATIONS.

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particular situation.

MSDS Number: **D2208** \* \* \* \* *Effective Date: 08/17/06* \* \* \* \* *Supersedes:*  
*11/12/03*

**MSDS** **Material Safety Data Sheet**

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



24 Hour Emergency Telephone: 908-659-2151  
CHEMTREC: 1-800-424-9363

National Response in Canada  
CANUTEC: 613-996-6565

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

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

All non-emergency questions should be directed to Customer Service (1-800-882-2637) for assistance.

# O-DICHLOROBENZENE

## 1. Product Identification

**Synonyms:** 1,2-dichlorobenzene; ortho-Dichlorobenzene; DCB

**CAS No.:** 95-50-1

**Molecular Weight:** 147.00

**Chemical Formula:** C<sub>6</sub>H<sub>4</sub>Cl<sub>2</sub>

**Product Codes:**

J.T. Baker: 9217, 9233

Mallinckrodt: 1830

## 2. Composition/Information on Ingredients

| Ingredient        | CAS No   | Percent   |
|-------------------|----------|-----------|
| Hazardous         |          |           |
| -----             | -----    | -----     |
| o-Dichlorobenzene | 95-50-1  | > 99%     |
| Yes               |          |           |
| p-Dichlorobenzene | 106-46-7 | 0 - 0.16% |
| Yes               |          |           |

### 3. Hazards Identification

#### Emergency Overview

---

**DANGER! ASPIRATION MAY CAUSE LUNG DAMAGE. VAPORS CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT. LIQUID CAUSES SKIN IRRITATION AND SEVERE EYE IRRITATION. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS LIVER, KIDNEYS AND BLOOD. COMBUSTIBLE LIQUID AND VAPOR. POSSIBLE CANCER HAZARD. CONTAINS P-DICHLOROBENZENE WHICH MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends upon duration and level of exposure.**

**SAF-T-DATA<sup>(tm)</sup>** Ratings (Provided here for your convenience)

---

Health Rating: 2 - Moderate (Poison)

Flammability Rating: 2 - Moderate

Reactivity Rating: 0 - None

Contact Rating: 3 - Severe

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

Storage Color Code: Red (Flammable)

---

#### Potential Health Effects

---

##### **Inhalation:**

Causes irritation to the respiratory tract. Can cause headache, nausea, swelling around the eyes, runny nose, loss of appetite and weight loss. Higher concentrations may cause drowsiness, central nervous system depression, kidney and liver damage, unconsciousness, and death.

##### **Ingestion:**

Toxic! A liver and kidney poison. May cause systemic poisoning with/symptoms paralleling inhalation. May be an aspiration hazard if swallowed.

##### **Skin Contact:**

Skin contact causes irritations and possibly burns if contact is repeated or prolonged. May be absorbed through the skin.

##### **Eye Contact:**

Vapors cause irritation, redness, and pain. Contact with liquid may cause burning of the eyes and tissue damage.

##### **Chronic Exposure:**

Chronic exposure may damage blood, liver and kidneys. p-Dichlorobenzene is a possible carcinogen. Prolonged or repeated skin exposure may cause dermatitis and blisters. Prolonged or repeated exposure through any route may cause symptoms paralleling acute inhalation.

**Aggravation of Pre-existing Conditions:**

Persons with pre-existing skin problems, kidney or liver damage may be more susceptible to the affects of this material.

---

## 4. First Aid Measures

**Inhalation:**

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

**Ingestion:**

Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately.

**Skin Contact:**

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

**Eye Contact:**

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

---

## 5. Fire Fighting Measures

**Fire:**

Flash point: 66C (151F) CC

Autoignition temperature: 648C (1198F)

Flammable limits in air % by volume:

lcl: 2.2; ucl: 9.2

Combustible.

**Explosion:**

Above flash point, vapor-air mixtures are explosive within flammable limits noted above.

**Fire Extinguishing Media:**

Water spray, dry chemical, alcohol foam, or carbon dioxide. Water spray may be used to keep fire exposed containers cool.

**Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Combustion by-products include phosgene and hydrogen chloride gases.

---

## 6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

## 7. Handling and Storage

Keep in a tightly closed container. Store in a cool, dry, ventilated area away from sources of heat or ignition. Protect against physical damage. Store separately from reactive or combustible materials, and out of direct sunlight. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

## 8. Exposure Controls/Personal Protection

### **Airborne Exposure Limits:**

-OSHA Permissible Exposure Limit (PEL):

50 ppm Ceiling limit

for p-Dichlorobenzene: 75 ppm (TWA)

-ACGIH Threshold Limit Value (TLV):

25 ppm (TWA) 50 ppm (STEL), listed as A4, Not classifiable as a human carcinogen  
for p-Dichlorobenzene: 10 ppm (TWA), listed as A3, animal carcinogen.

### **Ventilation System:**

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

### **Personal Respirators (NIOSH Approved):**

If the exposure limit is exceeded, a full facepiece respirator with organic vapor cartridge and dust/mist filter may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air

purifying respirators do not protect workers in oxygen-deficient atmospheres. This compound possibly exists in both particulate and vapor phase. A dust/mist prefilter should be used for the particulate.

**Skin Protection:**

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

**Eye Protection:**

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

## 9. Physical and Chemical Properties

**Appearance:**

Colorless to yellowish liquid.

**Odor:**

Pleasant odor.

**Solubility:**

Practically insoluble in water.

**Specific Gravity:**

1.30 @ 20C/4C

**pH:**

No information found.

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

No information found.

**Boiling Point:**

180C (356F)

**Melting Point:**

-17.6C (0F)

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

5.1

**Vapor Pressure (mm Hg):**

1.2 @ 20C (68F)

**Evaporation Rate (BuAc=1):**

< 1

## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage.

**Hazardous Decomposition Products:**

May emit oxides of carbon and hydrogen chloride gas when heated to decomposition.

May produce carbon monoxide, carbon dioxide, hydrogen chloride and phosgene when heated to decomposition.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

Strong oxidizers, aluminum or aluminum alloys.

**Conditions to Avoid:**

Heat, flames, ignition sources and incompatibles.

## 11. Toxicological Information

Oral rat LD50: 500 mg/kg. Investigated as a tumorigen, mutagen, reproductive effector.

| -----\Cancer Lists\-----     |                      |             |      |
|------------------------------|----------------------|-------------|------|
| Ingredient<br>Category       | ---NTP Carcinogen--- |             | IARC |
|                              | Known                | Anticipated |      |
| o-Dichlorobenzene (95-50-1)  | No                   | No          | 3    |
| p-Dichlorobenzene (106-46-7) | No                   | Yes         | 2B   |

## 12. Ecological Information

**Environmental Fate:**

When released into the soil, this material may biodegrade to a moderate extent. When released into the soil, this material may leach into groundwater. When released into the soil, this material may evaporate to a moderate extent. When released into water, this material may biodegrade to a moderate extent. When released into water, this material may evaporate to a moderate extent. Although this material has a relatively short half-life in water, it can also readily be adsorbed to sediment and persist for decades. When released into water, this material is expected to have a half-life between 10 and 30 days. This material has an experimentally-determined bioconcentration factor (BCF) of greater than 100. This material may bioaccumulate to some extent. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition. When released into air, this material is expected to have a half-life between 10 and 30 days.

**Environmental Toxicity:**

For o-Dichlorobenzene:

96 Hr EC50 *Selenastrum capricornutum*: 91.6 mg/L;

96 Hr LC50 *Pimephales promelas*: 9.47 mg/L [flow-through]; 96 Hr LC50 *Pimephales promelas*: 5.8 mg/L [static];

96 Hr LC50 *Brachydanio rerio*: 5.2 mg/L [flow-through];

96 Hr LC50 *Lepomis macrochirus*: 5.6 mg/L [static];

24 Hr EC50 *Daphnia magna*: 1.7 mg/L

Microtox data for o-Dichlorobenzene:

5 min EC50 Photobacterium phosphoreum: 4.76 mg/L;

15 min EC50 Photobacterium phosphoreum: 4.98 mg/L;

30 min EC50 Photobacterium phosphoreum: 5.99 mg/L

## 13. Disposal Considerations

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

## 14. Transport Information

### Domestic (Land, D.O.T.)

-----

**Proper Shipping Name:** O-DICHLOROBENZENE

**Hazard Class:** 6.1

**UN/NA:** UN1591

**Packing Group:** III

**Information reported for product/size:** 4L

### International (Water, I.M.O.)

-----

**Proper Shipping Name:** ORTHO-DICHLOROBENZENE

**Hazard Class:** 6.1

**UN/NA:** UN1591

**Packing Group:** III

**Information reported for product/size:** 4L

### International (Air, I.C.A.O.)

-----

**Proper Shipping Name:** ORTHO-DICHLOROBENZENE

**Hazard Class:** 6.1

**UN/NA:** UN1591

**Packing Group:** III

**Information reported for product/size:** 4L

## 15. Regulatory Information

```

-----\Chemical Inventory Status - Part 1\-----
-----
Ingredient                                TSCA  EC   Japan
Australia
-----
o-Dichlorobenzene (95-50-1)              Yes   Yes   Yes
Yes
p-Dichlorobenzene (106-46-7)            Yes   Yes   Yes
Yes

```

```

-----\Chemical Inventory Status - Part 2\-----
-----
Ingredient                                Korea  DSL   NDSL
Phil.
-----
o-Dichlorobenzene (95-50-1)              Yes   Yes   No
Yes
p-Dichlorobenzene (106-46-7)            Yes   Yes   No
Yes

```

```

-----\Federal, State & International Regulations - Part 1\-----
-----
313-----
Ingredient                                -SARA 302-  -----SARA
Chemical Catg.                            RQ      TPQ     List
-----
o-Dichlorobenzene (95-50-1)              No     No     Yes
No
p-Dichlorobenzene (106-46-7)            No     No     Yes
No

```

```

-----\Federal, State & International Regulations - Part 2\-----
-----
TSCA-
Ingredient                                CERCLA  261.33  8(d)
-----
o-Dichlorobenzene (95-50-1)              100     U070    No
p-Dichlorobenzene (106-46-7)            100     U072    No

```

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

**WARNING:**

**THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.**

**Australian Hazchem Code: 2Z**

**Poison Schedule:** None allocated.

**WHMIS:**

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

## 16. Other Information

**NFPA Ratings:** Health: 2 Flammability: 2 Reactivity: 0

**Label Hazard Warning:**

DANGER! ASPIRATION MAY CAUSE LUNG DAMAGE. VAPORS CAUSE IRRITATION TO EYES AND RESPIRATORY TRACT. LIQUID CAUSES SKIN IRRITATION AND SEVERE EYE IRRITATION. HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS LIVER, KIDNEYS AND BLOOD. COMBUSTIBLE LIQUID AND VAPOR. POSSIBLE CANCER HAZARD. CONTAINS P-DICHLOROBENZENE WHICH MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends upon duration and level of exposure.

**Label Precautions:**

- Do not breathe vapor.
- Do not get in eyes, on skin, or on clothing.
- Keep container closed.
- Use only with adequate ventilation.
- Wash thoroughly after handling.
- Keep away from heat and flame.

**Label First Aid:**

Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Get medical attention. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

MSDS Section(s) changed since last revision of document include: 3, 12.

**Disclaimer:**

\*\*\*\*\*  
\*\*\*\*\*

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\*\*\*\*\*

\*\*\*\*\*

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

# Material Safety Data Sheet

## cis-1,2-Dichloroethylene, 97%

ACC# 97773

### Section 1 - Chemical Product and Company Identification

**MSDS Name:** cis-1,2-Dichloroethylene, 97%

**Catalog Numbers:** AC113380000, AC113380025, AC113380100

**Synonyms:** cis-Acetylene dichloride.

**Company Identification:**

Acros Organics N.V.

One Reagent Lane

Fair Lawn, NJ 07410

**For information in North America, call:** 800-ACROS-01

**For emergencies in the US, call CHEMTREC:** 800-424-9300

### Section 2 - Composition, Information on Ingredients

| CAS#     | Chemical Name            | Percent | EINECS/ELINCS |
|----------|--------------------------|---------|---------------|
| 156-59-2 | cis-1,2-Dichloroethylene | 97      | 205-859-7     |

### Section 3 - Hazards Identification

#### EMERGENCY OVERVIEW

Appearance: Clear liquid. Flash Point: 6 deg C.

**Warning!** *Flammable liquid and vapor.* Harmful if inhaled. Unstabilized substance may polymerize. Causes eye and skin irritation. May be harmful if swallowed. May cause respiratory tract irritation.

**Target Organs:** Central nervous system, respiratory system, eyes, skin.

#### Potential Health Effects

**Eye:** Causes moderate eye irritation.

**Skin:** Causes moderate skin irritation. May cause dermatitis.

**Ingestion:** May cause gastrointestinal irritation with nausea, vomiting and diarrhea. May be harmful if swallowed. May cause central nervous system depression.

**Inhalation:** May cause respiratory tract irritation. May cause narcotic effects in high concentration. Eye irritation, vertigo, and nausea were reported in humans exposed at 2200 ppm.

**Chronic:** Not available. Some German investigators reported fatty degeneration of the liver upon repeated narcotic doses in rats and

## Section 4 - First Aid Measures

**Eyes:** In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical aid.

**Skin:** In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.

**Ingestion:** If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical aid.

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

**Notes to Physician:** Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors may form an explosive mixture with air. Use water spray to keep fire-exposed containers cool. Flammable liquid and vapor. Fire or excessive heat may result in violent rupture of the container due to bulk polymerization. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas. Hazardous polymerization may occur under fire conditions.

**Extinguishing Media:** Use water fog, dry chemical, carbon dioxide, or regular foam.

**Flash Point:** 6 deg C ( 42.80 deg F)

**Autoignition Temperature:** 440 deg C ( 824.00 deg F)

**Explosion Limits, Lower:** 9.70 vol %

**Upper:** 12.80 vol %

**NFPA Rating:** (estimated) Health: 2; Flammability: 3; Instability: 2

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.

**Spills/Leaks:** Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Remove all sources of ignition. Use a spark-proof tool. Provide ventilation.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Use spark-proof tools and explosion proof equipment. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Avoid ingestion and inhalation. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames. Use only with adequate ventilation. Pure vapor will be uninhibited and may polymerize in vents or other confined spaces.

**Storage:** Keep away from sources of ignition. Store in a tightly closed container. Flammables-area. Store protected from light and air.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.

### Exposure Limits

| Chemical Name            | ACGIH       | NIOSH       | OSHA - Final PELs |
|--------------------------|-------------|-------------|-------------------|
| cis-1,2-Dichloroethylene | 200 ppm TWA | none listed | none listed       |

**OSHA Vacated PELs:** cis-1,2-Dichloroethylene: No OSHA Vacated PELs are listed for this chemical.

### Personal Protective Equipment

**Eyes:** Wear chemical splash goggles.

**Skin:** Wear appropriate protective gloves to prevent skin exposure.

**Clothing:** Wear appropriate protective clothing to prevent skin exposure.

**Respirators:** Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

## Section 9 - Physical and Chemical Properties

**Physical State:** Liquid

**Appearance:** Clear

**Odor:** Pleasant odor

**pH:** Not available.

**Vapor Pressure:** 201 mm Hg @ 25 deg C

**Vapor Density:** 3.34 (air=1)  
**Evaporation Rate:** Not available.  
**Viscosity:** Not available.  
**Boiling Point:** 60 deg C @ 760 mm Hg  
**Freezing/Melting Point:** -80 deg C  
**Decomposition Temperature:** Not available.  
**Solubility:** Insoluble.  
**Specific Gravity/Density:** 1.2800  
**Molecular Formula:** C<sub>2</sub>H<sub>2</sub>Cl<sub>2</sub>  
**Molecular Weight:** 96.94

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures. This material is a monomer and may polymerize under certain conditions if the stabilizer is lost.  
**Conditions to Avoid:** Light, ignition sources, exposure to air, excess heat.  
**Incompatibilities with Other Materials:** Strong oxidizing agents, strong bases, copper.  
**Hazardous Decomposition Products:** Hydrogen chloride, phosgene, carbon monoxide, carbon dioxide.  
**Hazardous Polymerization:** May occur.

## Section 11 - Toxicological Information

**RTECS#:**  
**CAS#** 156-59-2: KV9420000  
**LD50/LC50:**  
CAS# 156-59-2:  
Inhalation, rat: LC50 = 13700 ppm;

**Carcinogenicity:**  
CAS# 156-59-2: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

**Epidemiology:** No data available.  
**Teratogenicity:** No data available.  
**Reproductive Effects:** No data available.  
**Mutagenicity:** No data available.  
**Neurotoxicity:** No data available.  
**Other Studies:**

## Section 12 - Ecological Information

No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

**RCRA P-Series:** None listed.

**RCRA U-Series:** None listed.

## Section 14 - Transport Information

|                       | US DOT   | Canada TDG           |
|-----------------------|--|----------------------|
| <b>Shipping Name:</b> | DOT regulated - small quantity provisions apply (see 49CFR173.4) | 1,2-DICHLOROETHYLENE |
| <b>Hazard Class:</b>  |  | 3                    |
| <b>UN Number:</b>     |  | UN1150               |
| <b>Packing Group:</b> |  | II                   |

## Section 15 - Regulatory Information

### US FEDERAL

#### TSCA

CAS# 156-59-2 is listed on the TSCA inventory.

#### Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

#### Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

#### Section 12b

None of the chemicals are listed under TSCA Section 12b.

#### TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

#### CERCLA Hazardous Substances and corresponding RQs

None of the chemicals in this material have an RQ.

#### SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

**Section 313** No chemicals are reportable under Section 313.

**Clean Air Act:**

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

**Clean Water Act:**

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

None of the chemicals in this product are listed as Priority Pollutants under the CWA.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

**OSHA:**

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

**STATE**

CAS# 156-59-2 can be found on the following state right to know lists:  
Pennsylvania, Massachusetts.

**California Prop 65**

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

**European/International Regulations**

**European Labeling in Accordance with EC Directives**

**Hazard Symbols:**

XN F

**Risk Phrases:**

R 11 Highly flammable.

R 20 Harmful by inhalation.

R 52/53 Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

**Safety Phrases:**

S 16 Keep away from sources of ignition - No smoking.

S 29 Do not empty into drains.

S 7 Keep container tightly closed.

S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

**WGK (Water Danger/Protection)**

CAS# 156-59-2: No information available.

**Canada - DSL/NDSL**

CAS# 156-59-2 is listed on Canada's NDSL List.

**Canada - WHMIS**

WHMIS: Not available.

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

**Canadian Ingredient Disclosure List**

**Section 16 - Additional Information**

**MSDS Creation Date: 2/09/1998**  
**Revision #5 Date: 3/16/2007**

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

MSDS Number: C2475 \* \* \* \* \* Effective Date: 08/17/05 \* \* \* \* \* Supercedes:  
02/18/03

**MSDS** Material Safety Data Sheet

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



24 Hour Emergency Telephone: 938-859-2151  
CHEMTREC: 1-800-424-9300

National Response in Canada  
CANUTEC: 613-596-5555

Outside U.S. and Canada  
Chemtrec: 703-527-3687

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

All non-emergency questions should be directed to Customer Service (1-800-552-2637) for assistance.

# CHLOROBENZENE

## 1. Product Identification

**Synonyms:** Monochlorobenzene; Chlorobenzol; Phenyl chloride; Benzene chloride

**CAS No.:** 108-90-7

**Molecular Weight:** 112.56

**Chemical Formula:** C<sub>6</sub>H<sub>5</sub>Cl

**Product Codes:**

J.T. Baker: 5153, 5163, 9179

Mallinckrodt: 4419, 4426

## 2. Composition/Information on Ingredients

| Ingredient    | CAS No   | Percent   |
|---------------|----------|-----------|
| Hazardous     |          |           |
| -----         | -----    | -----     |
| -----         |          |           |
| Chlorobenzene | 108-90-7 | 99 - 100% |
| Yes           |          |           |

### 3. Hazards Identification

#### Emergency Overview

---

**WARNING! FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM AND LIVER.**

**SAF-T-DATA<sup>(tm)</sup>** Ratings (Provided here for your convenience)

---

Health Rating: 2 - Moderate (Life)

Flammability Rating: 2 - Moderate

Reactivity Rating: 1 - Slight

Contact Rating: 3 - Severe

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER

Storage Color Code: Red (Flammable)

---

#### Potential Health Effects

---

##### **Inhalation:**

Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath. Affects central nervous system causing dizziness, incoordination and unconsciousness.

##### **Ingestion:**

Causes irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea. Toxic! May cause systemic poisoning with symptoms paralleling those of inhalation.

##### **Skin Contact:**

Causes irritation to skin. Symptoms include redness, itching, and pain. May be slowly absorbed through the skin with possible systemic effects.

##### **Eye Contact:**

Vapors cause eye irritation. Splashes cause severe irritation, possible corneal burns and eye damage.

##### **Chronic Exposure:**

Prolonged or repeated skin exposure may cause dermatitis or skin burns. Prolonged or repeated exposure may cause liver, kidney, or lung damage.

##### **Aggravation of Pre-existing Conditions:**

Persons with pre-existing skin, eye or central nervous system disorders, or impaired liver, kidney, or pulmonary function may be more susceptible to the effects of this substance.

---

## 4. First Aid Measures

### **Inhalation:**

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

### **Ingestion:**

Give large amounts of water to drink. Never give anything by mouth to an unconscious person. Get medical attention.

### **Skin Contact:**

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

### **Eye Contact:**

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

## 5. Fire Fighting Measures

### **Fire:**

Flash point: 28C (82F) CC

Autoignition temperature: 593C (1099F)

Flammable limits in air % by volume:

lel: 1.3; uel: 9.6

Flammable Liquid

### **Explosion:**

Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Reactions with incompatibles may pose an explosion hazard. Vapors can flow along surfaces to distant ignition source and flash back. Sealed containers may rupture when heated. Sensitive to static discharge.

### **Fire Extinguishing Media:**

Dry chemical, foam or carbon dioxide. Water spray may be used to keep fire exposed containers cool, dilute spills to nonflammable mixtures, protect personnel attempting to stop leak and disperse vapors.

### **Special Information:**

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. This highly flammable liquid must be kept from sparks, open flame, hot surfaces, and all sources of heat and ignition. Combustion by-products include phosgene and hydrogen chloride gases.

## 6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

## 7. Handling and Storage

Protect against physical damage. Outside or detached storage is preferred. Inside storage should be in a standard flammable liquids storage room or cabinet. Separate from oxidizing materials. Storage and use areas should be No Smoking areas. Containers should be bonded and grounded for transfers to avoid static sparks. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

## 8. Exposure Controls/Personal Protection

### **Airborne Exposure Limits:**

-OSHA Permissible Exposure Limit (PEL):  
75 ppm (TWA)

-ACGIH Threshold Limit Value (TLV):  
10 ppm (TWA)

### **Ventilation System:**

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

### **Personal Respirators (NIOSH Approved):**

If the exposure limit is exceeded and engineering controls are not feasible, a half-face organic vapor respirator may be worn for up to ten times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator

supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

**Skin Protection:**

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

**Eye Protection:**

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

---

## 9. Physical and Chemical Properties

**Appearance:**

Clear, colorless liquid.

**Odor:**

Faint, almond like odor.

**Solubility:**

Insoluble in water.

**Specific Gravity:**

1.11 @ 20C/4C

**pH:**

No information found.

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

100

**Boiling Point:**

132C (270F)

**Melting Point:**

-45C (-49F)

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

3.9

**Vapor Pressure (mm Hg):**

11.8 @ 25C (77F)

**Evaporation Rate (BuAc=1):**

1.1

---

## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage.

**Hazardous Decomposition Products:**

May produce carbon monoxide, carbon dioxide, hydrogen chloride and phosgene when heated to decomposition.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

Oxidizing agents, dimethyl sulfoxide, silver perchlorate, silver chromate.

**Conditions to Avoid:**

Heat, flames, ignition sources and incompatibles.

## 11. Toxicological Information

For Chlorobenzene: Oral rat LD50: 1110 mg/kg; Inhalation rat LC50: 2965 ppm.

Investigated as a tumorigen, mutagen, reproductive effector.

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

| Ingredient<br>Category   | ---NTP Carcinogen--- |             | IARC |
|--------------------------|----------------------|-------------|------|
|                          | Known                | Anticipated |      |
| Chlorobenzene (108-90-7) | No                   | No          |      |
| None                     |                      |             |      |

## 12. Ecological Information

**Environmental Fate:**

When released into the soil, this material may evaporate to a moderate extent. When released into the soil, this material is not expected to biodegrade. When released into the soil, this material may leach into groundwater. When released to water, this material is expected to quickly evaporate. When released into the water, this material is expected to have a half-life of less than 1 day. When released into water, this material is not expected to biodegrade. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days.

**Environmental Toxicity:**

The LC50/96-hour values for fish are between 10 and 100 mg/l. This material is expected to be slightly toxic to aquatic life.

## 13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

## 14. Transport Information

### Domestic (Land, D.O.T.)

-----  
**Proper Shipping Name:** RQ, CHLOROBENZENE

**Hazard Class:** 3

**UN/NA:** UN1134

**Packing Group:** III

**Information reported for product/size:** 52L

### International (Water, I.M.O.)

-----  
**Proper Shipping Name:** CHLOROBENZENE

**Hazard Class:** 3

**UN/NA:** UN1134

**Packing Group:** III

**Information reported for product/size:** 52L

### International (Air, I.C.A.O.)

-----  
**Proper Shipping Name:** CHLOROBENZENE

**Hazard Class:** 3

**UN/NA:** UN1134

**Packing Group:** III

**Information reported for product/size:** 52L

## 15. Regulatory Information

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

| Ingredient               | TSCA  | EC    | Japan |
|--------------------------|-------|-------|-------|
| Australia                |       |       |       |
| -----                    | ----- | ----- | ----- |
| Chlorobenzene (108-90-7) | Yes   | Yes   | Yes   |
| Yes                      |       |       |       |

| -----\Chemical Inventory Status - Part 2\----- |       |            |      |
|--|-------|------------|------|
| Ingredient<br>Phil.                            | Korea | --Canada-- |      |
|  |       | DSL        | NDSL |
| Chlorobenzene (108-90-7)                       | Yes   | Yes        | No   |

| -----\Federal, State & International Regulations - Part 1\----- |            |     |           |
|---|------------|-----|-----------|
| 313-----<br>Ingredient<br>Chemical Catg.                        | -SARA 302- |     | -----SARA |
|   | RQ         | TPQ | List      |
| Chlorobenzene (108-90-7)  | No         | No  | Yes       |

| -----\Federal, State & International Regulations - Part 2\----- |        |        |      |
|---|--------|--------|------|
| TSCA-<br>Ingredient   | CERCLA | -RCRA- | -    |
|   |        | 261.33 | 8(d) |
| Chlorobenzene (108-90-7)  | 100    | U037   | Yes  |

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

**Australian Hazchem Code:** 2Y  
**Poison Schedule:** None allocated.  
**WHMIS:**

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

## 16. Other Information

**NFPA Ratings:** Health: 2 Flammability: 3 Reactivity: 0

**Label Hazard Warning:**

WARNING! FLAMMABLE LIQUID AND VAPOR. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM AND LIVER.

**Label Precautions:**

Keep away from heat, sparks and flame.

Avoid breathing vapor.  
Keep container closed.  
Wash thoroughly after handling.  
Avoid contact with eyes, skin and clothing.  
Use only with adequate ventilation.

**Label First Aid:**

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, give large amounts of water to drink. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

**Product Use:**

Laboratory Reagent.

**Revision Information:**

MSDS Section(s) changed since last revision of document include: 3.

**Disclaimer:**

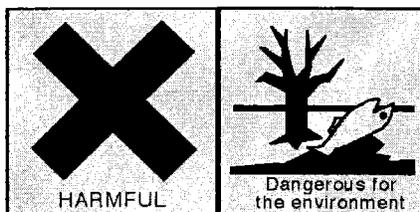
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\*\*\*\*\*

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\*\*\*\*\*

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

# Safety data for 1,2-dichlorobenzene



[Glossary](#) of terms on this data sheet.

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

## General

Synonyms: o-dichlorobenzene, DCB, ODB, ODCB, chloroben, chloroden, cloroben, dilantin DB, dilatin DB, dizene, orth dichlorobenzene, termitkil

Use: solvent, insecticide and ingredient in a varied range of industrial products

Molecular formula:  $C_6H_4Cl_2$

CAS No: 95-50-1

EC No: 202-425-9

Annex I Index No: 602-034-00-7

## Physical data

Appearance: colourless liquid

Melting point: -17 C

Boiling point: 179 C

Vapour density: 5.1

Vapour pressure: 1.2 mm Hg at 20 C

Specific gravity: 1.306

Flash point: 65 C

Explosion limits: 2.2 % - 9.2%

Autoignition temperature: 647 C

## Stability

Stable, but possibly light sensitive. Combustible. Incompatible with oxidizing agents, aluminium, aluminium alloys. Attacks some rubbers and plastics.

## Toxicology

Harmful if swallowed. May be harmful if inhaled or absorbed through the skin. Eye, skin and respiratory tract irritant. May cause sensitization. Typical PEL 50 ppm.

### Toxicity data

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

ORL-RAT LD50 500 mg kg<sup>-1</sup>  
ORL-MUS LD50 4386 mg kg<sup>-1</sup>  
IPR-RAT LD50 840 mg kg<sup>-1</sup>  
IHL-GPG LCLO 800 ppm/24h

### Risk phrases

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

R22 R36 R37 R38 R50 R53.

## Environmental information

Extremely harmful to the aquatic environment; may cause long-term damage.

## Transport information

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

UN No 1591. Hazard class 6.1. Packing group III.

## Personal protection

Safety glasses, good ventilation.

## **Safety phrases**

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

S23 S60 S61.

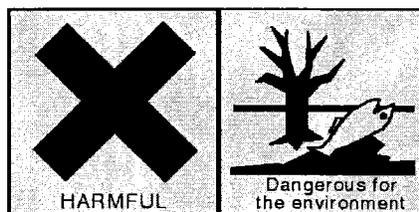
[Return to [Physical & Theoretical Chemistry Lab. Safety home page](#).]

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This information was last updated on September 28, 2005. We have tried to make it as accurate and useful as possible, but can take no responsibility for its use, misuse, or accuracy. We have not verified this information, and cannot guarantee that it is up-to-date.

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# Safety data for 1,3-dichlorobenzene



[Glossary](#) of terms on this data sheet.

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

## General

Synonyms: m-dichlorobenzene, m-dichlorobenzol, meta-dichlorobenzene, m-phenylenedichloride

Molecular formula:  $C_6H_4Cl_2$

CAS No: 541-73-1

EC No: 208-792-1

Annex I Index No: 602-067-00-7

## Physical data

Appearance: colourless liquid

Melting point: -24.8 C

Boiling point: 173 C

Vapour density:

Vapour pressure: 5 mm Hg at 39 C

Density ( $g\ cm^{-3}$ ): 1.29

Flash point: 63 C (closed cup)

Explosion limits:

Autoignition temperature: 648 C

Water solubility: negligible

## Stability

Combustible. Incompatible with strong oxidizing agents, aluminium, aluminium alloys. Moisture-sensitive.

## Toxicology

Harmful if swallowed. May be harmful if inhaled or absorbed through the skin. May act as a mutagen.

### Toxicity data

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

IPR-MUS LD50 1062 mg kg<sup>-1</sup>

### Risk phrases

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

R22 R51 R53.

## Environmental information

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

## Transport information

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

UN No 3082. Hazard class 9. Packing group III.

## Personal protection

Safety glasses, good ventilation.

### Safety phrases

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

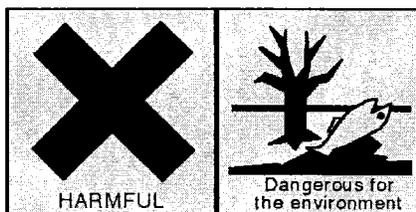
S61.

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

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# Safety data for 1,4-dichlorobenzene



[Glossary](#) of terms on this data sheet.

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

## General

Synonyms: p-dichlorobenzene, para-dichlorobenzene, p-chlorophenyl chloride, p-dichlorobenzol, di-chloride, evola, globol, NCI-C54955, paracide, para crystals, paradi, paradow, paramoth, paranuggets, parazene, pdcB, persia-perazol, santochlor, various other non-systematic names

Use: Moth repellent and general insecticide, deodorant and disinfectant.

Molecular formula:  $C_6H_4Cl_2$

CAS No: 106-46-7

EINECS No:

## Physical data

Appearance: colourless or white crystals

Melting point: 53 C

Boiling point: 174 C

Vapour density: 5.1 (air = 1)

Vapour pressure: 0.6 mm Hg at 20 C

Density ( $g\ cm^{-3}$ ): 1.25

Flash point: 65 C (closed cup)

Explosion limits:

Autoignition temperature:

Water solubility: negligible

## Stability

Stable. Combustible. Incompatible with strong oxidizing agents, aluminium and its alloys, some plastics.

## Toxicology

Harmful if swallowed or inhaled; may be harmful if absorbed through the skin. Experimental mutagen, carcinogen and teratogen. Possible human carcinogen. May act as a systemic poison if swallowed. Typical TLV/TWA 75 ppm. Typical STEL 110 ppm. Typical PEL 75 ppm.

### Toxicity data

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

ORL-HMN TDLO 300 mg kg<sup>-1</sup>

ORL-MUS LD50 2950 mg kg<sup>-1</sup>

IPR-MUS LD50 2000 mg kg<sup>-1</sup>

IPR-RAT LD50 2562 mg kg<sup>-1</sup>

ORL-RAT LD50 500 mg kg<sup>-1</sup>

### Risk phrases

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

R20 R22 R36 R50 R53.

## Environmental information

Very harmful in the environment. Expected to biodegrade very slowly.

## Transport information

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

UN No 1592. Packing group III. Hazard class 6.1.

## Personal protection

Safety glasses, gloves, adequate ventilation.

## **Safety phrases**

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

S24 S25 S46 S60 S61.

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

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