

Occupational Health Guideline for 1,2,3-Trichloropropane

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

- Formula: $\text{CH}_2\text{ClCHClCH}_2\text{Cl}$
- Synonyms: Allyl trichloride; glycerol trichlorohydrin; glycerin trichlorohydrin; trichlorohydrin
- Appearance and odor: Colorless liquid with a strong acid odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for 1,2,3-trichloropropane is 50 parts of 1,2,3-trichloropropane per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 300 milligrams of 1,2,3-trichloropropane per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

• Routes of exposure

1,2,3-Trichloropropane can affect the body if it is inhaled, if it comes in contact with the eyes or skin, or if it is swallowed. It may be absorbed through the skin.

• Effects of overexposure

1. **Short-term Exposure:** 1,2,3-Trichloropropane may cause irritation of the eyes, nose, and throat. It might cause drowsiness and liver damage.
2. **Long-term Exposure:** 1,2,3-Trichloropropane might cause irritation from prolonged or repeated exposure.
3. **Reporting Signs and Symptoms:** A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to 1,2,3-trichloropropane.

• Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to 1,2,3-trichloropropane at potentially hazardous levels:

1. **Initial Medical Screening:** Employees should be screened for history of certain medical conditions (listed below) which might place the employee at increased risk from 1,2,3-trichloropropane exposure.

—Skin disease: 1,2,3-Trichloropropane is a skin irritant. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.

—Liver disease: 1,2,3-Trichloropropane is known as a liver toxin in animals. The importance of this organ in the biotransformation and detoxification of foreign substances should be considered before exposing persons with impaired liver function.

—Kidney disease: Although 1,2,3-trichloropropane is not known as a kidney toxin in humans, the importance of this organ in the elimination of toxic substances justifies special consideration in those with impaired renal function.

—Chronic respiratory disease: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of 1,2,3-trichloropropane might cause exacerbation of symptoms due to its irritant properties.

2. **Periodic Medical Examination:** Any employee developing the above-listed conditions should be referred for further medical examination.

• Summary of toxicology

1,2,3-Trichloropropane vapor is a narcotic, irritates the upper respiratory tract, and is toxic to the liver. Inhalation by mice of 30 mg/liter (5,000 ppm) for 20 minutes was fatal to 8 of 15 exposed; liver damage accounted for four additional deaths 7 to 10 days later; daily 10-minute exposures at 2,500 ppm for 10 days resulted in 7 deaths among 10 mice. In rabbits the liquid was an intense skin irritant and caused erythema, sloughing, and cracking. In an experimental human study, exposure to 100 ppm

These recommendations reflect good industrial hygiene and medical surveillance practices and their implementation will assist in achieving an effective occupational health program. However, they may not be sufficient to achieve compliance with all requirements of OSHA regulations.

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was objectionable because of eye and throat irritation and unpleasant odor.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 147.4
2. Boiling point (760 mm Hg): 156 C (313 F)
3. Specific gravity (water = 1): 1.4
4. Vapor density (air = 1 at boiling point of 1,2,3-trichloropropane): 5
5. Melting point: -14.7 C (5 F)
6. Vapor pressure at 20 C (68 F): 3.4 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F):

Insoluble

8. Evaporation rate (butyl acetate = 1): Data not available

• Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with active metals, strong caustics, or with strong oxidizers may cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as hydrogen chloride, phosgene, and carbon monoxide) may be released in a fire involving 1,2,3-trichloropropane.
4. Special precautions: 1,2,3-Trichloropropane will attack some forms of plastics, rubber, and coatings.

• Flammability

1. Flash point: 73.3 C (164 F) (closed cup)
2. Autoignition temperature: 304 C (579 F)
3. Flammable limits in air, % by volume: Lower: 3.2%; Upper: 12.6%
4. Extinguishant: Foam, carbon dioxide, dry chemical

• Warning properties

The *Documentation of TLV's* reports that "the vapor of 1,2,3-trichloropropane was objectionable to all subjects exposed at a concentration of 100 ppm because of eye irritation, throat irritation, and unpleasant odor." Since this concentration is only twice the permissible exposure limit, this compound is considered to have adequate warning properties.

As mentioned above, the *Documentation of TLV's* states that 100 ppm causes eye irritation. However, this is not reported as a threshold level.

MONITORING AND MEASUREMENT PROCEDURES

• General

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

• Method

Sampling and analyses may be performed by collection of vapors using an adsorption tube with subsequent desorption with carbon disulfide and gas chromatographic analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure 1,2,3-trichloropropane may be used. An analytical method for 1,2,3-trichloropropane is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 2, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00260-6).

RESPIRATORS

- Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.
- In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

- Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with liquid 1,2,3-trichloropropane.
- Clothing contaminated with liquid 1,2,3-trichloropropane should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of 1,2,3-trichloropropane from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the 1,2,3-trichloropropane, the person performing the operation should be informed of 1,2,3-trichloropropane's hazardous properties.
- Where exposure of an employee's body to liquid 1,2,3-trichloropropane may occur, facilities for quick drenching of the body should be provided within the immediate work area for emergency use.
- Non-impervious clothing which becomes contaminated with liquid 1,2,3-trichloropropane should be re-

moved immediately and not reworn until the 1,2,3-trichloropropane is removed from the clothing.

- Employees should be provided with and required to use splash-proof safety goggles where there is any possibility of liquid 1,2,3-trichloropropane contacting the eyes.
- Where there is any possibility that employees' eyes may be exposed to liquid 1,2,3-trichloropropane, an eye-wash fountain should be provided within the immediate work area for emergency use.

SANITATION

- Skin that becomes contaminated with liquid 1,2,3-trichloropropane should be immediately washed or showered with soap or mild detergent and water to remove any 1,2,3-trichloropropane.
- Eating and smoking should not be permitted in areas where liquid 1,2,3-trichloropropane is handled, processed, or stored.
- Employees who handle liquid 1,2,3-trichloropropane should wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to 1,2,3-trichloropropane may occur and control methods which may be effective in each case:

Operation	Controls
Use as a solvent and extractant for resins, oils, fats, waxes, and chlorinated rubber; as a commercial solvent for degreasing metal parts	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Use in organic synthesis for the manufacture of other chemicals; use as a copolymer or telomer or cross-linking agent for sealing compounds	Process enclosure; local exhaust ventilation; general dilution ventilation

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

• Eye Exposure

If 1,2,3-trichloropropane gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

• Skin Exposure

If 1,2,3-trichloropropane gets on the skin, promptly wash the contaminated skin using soap or mild detergent and water. If 1,2,3-trichloropropane soaks through the clothing, remove the clothing promptly and wash the skin using soap or mild detergent and water. If irritation persists after washing, get medical attention.

• Breathing

If a person breathes in large amounts of 1,2,3-trichloropropane, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

• Swallowing

When 1,2,3-trichloropropane has been swallowed, get medical attention immediately. If medical attention is not immediately available, get the afflicted person to vomit by having him touch the back of his throat with his finger or by giving him syrup of ipecac as directed on the package. This non-prescription drug is available at most drug stores and drug counters and should be kept with emergency medical supplies in the workplace. Do not make an unconscious person vomit.

• Rescue

Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL, LEAK, AND DISPOSAL PROCEDURES

- Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed.

- If 1,2,3-trichloropropane is spilled or leaked, the following steps should be taken:

1. Remove all ignition sources.
2. Ventilate area of spill or leak.
3. For small quantities, absorb on paper towels. Evaporate in a safe place (such as a fume hood). Allow sufficient time for evaporating vapors to completely clear the hood ductwork. Burn the paper in a suitable location away from combustible materials. Large quantities can be reclaimed or collected and atomized in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

- Waste disposal methods:

1,2,3-Trichloropropane may be disposed of:

1. By absorbing it in vermiculite, dry sand, earth or a similar material and disposing in a secured sanitary landfill.
2. By atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

REFERENCES

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RESPIRATORY PROTECTION FOR 1,2,3-TRICHLOROPROPANE

Condition	Minimum Respiratory Protection* Required Above 50 ppm
Vapor Concentration	
1000 ppm or less	<p>A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s).</p> <p>A gas mask with a chin-style or a front- or back-mounted organic vapor canister.</p> <p>Any supplied-air respirator with a full facepiece, helmet, or hood.</p> <p>Any self-contained breathing apparatus with a full facepiece.</p>
Greater than 1000 ppm** or entry and escape from unknown concentrations	<p>Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.</p> <p>A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.</p>
Fire Fighting	<p>Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.</p>
Escape	<p>Any gas mask providing protection against organic vapors.</p> <p>Any escape self-contained breathing apparatus.</p>

*Only NIOSH-approved or MSHA-approved equipment should be used.

**Use of supplied-air suits may be necessary to prevent skin contact while providing respiratory protection from airborne concentrations of 1,2,3-trichloropropane; however, this equipment should be selected, used, and maintained under the immediate supervision of trained personnel. Where supplied-air suits are used above a concentration of 1000 ppm, an auxiliary self-contained breathing apparatus operated in positive pressure mode should also be worn.