

# Occupational Health Guideline for 1,1-Dichloroethane

## 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:  $\text{CH}_3\text{CHCl}_2$
- Synonyms: Asymmetrical dichloroethane; ethylidene chloride; 1,1-ethylidene dichloride
- Appearance and odor: Colorless liquid with a chloroform-like odor.

## PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for 1,1-dichloroethane is 100 parts of 1,1-dichloroethane per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 400 milligrams of 1,1-dichloroethane per cubic meter of air ( $\text{mg}/\text{m}^3$ ). The American Conference of Governmental Industrial Hygienists has recommended for 1,1-dichloroethane a Threshold Limit Value of 200 ppm.

## HEALTH HAZARD INFORMATION

### • Routes of exposure

1,1-Dichloroethane can affect the body if it is inhaled or if it comes in contact with the eyes or skin. It can also affect the body if it is swallowed.

### • Effects of overexposure

**1. Short-term Exposure:** Breathing 1,1-dichloroethane vapor may cause drowsiness and unconsciousness. It might also cause damage to the liver, kidneys, and lungs. Splashing the liquid in the eyes may cause irritation.

**2. Long-term Exposure:** Prolonged, confined, or repeated skin contact with 1,1-dichloroethane can produce a slight burn.

**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 1,1-dichloroethane.

### • Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to 1,1-dichloroethane 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 1,1-dichloroethane exposure.

—Skin disease: 1,1-Dichloroethane can cause dermatitis on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.

—Liver disease: Although 1,1-dichloroethane is not known as a liver toxin in humans, 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 1,1-dichloroethane 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 1,1-dichloroethane 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

1,1-Dichloroethane vapor is a narcotic. Rats exposed to 32,000 ppm for 30 minutes did not survive. The most consistent findings in animals exposed to concentrations

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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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of above 8,000 ppm for up to 7 hours were pathologic changes in the kidney and liver, and at much higher concentrations, near 64,000 ppm, damage to the lungs as well. Repeated daily exposure of several species of animals to 1,000 ppm resulted in no pathologic or hematologic changes. The liquid applied to the intact or abraded skin of rabbits produced slight edema and very slight necrosis after six daily applications. Instilled in the eyes of rabbits there was immediate, moderate conjunctival irritation and swelling which subsided within a week. There have been no reported cases of human overexposure by inhalation; prolonged, confined, or repeated skin contact can produce a slight burn.

## CHEMICAL AND PHYSICAL PROPERTIES

### • Physical data

1. Molecular weight: 99
2. Boiling point (760 mm Hg): 57.3 C (135 F)
3. Specific gravity (water = 1): 1.2
4. Vapor density (air = 1 at boiling point of 1,1-dichloroethane): 3.4
5. Melting point: -96.7 C (-142 F)
6. Vapor pressure at 20 C (68 F): 182 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Less than 0.1
8. Evaporation rate (butyl acetate = 1): 11.6

### • Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions. Contact with strong caustics will cause formation of flammable and toxic acetaldehyde gas.

3. Hazardous decomposition products: Toxic gases and vapors (such as vinyl chloride, hydrogen chloride, phosgene, and carbon monoxide) may be released in a fire involving 1,1-dichloroethane.

4. Special precautions: 1,1-Dichloroethane will attack some forms of plastics, rubber, and coatings.

### • Flammability

1. Flash point: -8.5 C (17 F) (closed cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Lower: 5.9; Upper: 15.9
4. Extinguishant: Foam, dry chemical, carbon dioxide

### • Warning properties

The AIHA *Hygienic Guide* reports that 1,1-dichloroethane has a distinctive, easily recognizable odor at the TLV.

1,1-Dichloroethane is not known to be an eye irritant.

## 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 1,1-dichloroethane may be used. An analytical method for 1,1-dichloroethane 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 1,1-dichloroethane.

• Clothing wet with liquid 1,1-dichloroethane should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of 1,1-dichloroethane from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the 1,1-dichloroethane, the person performing the operation should be informed of 1,1-dichloroethane's hazardous properties.

• Any clothing which becomes wet with liquid 1,1-dichloroethane should be removed immediately and not

reworn until the 1,1-dichloroethane is removed from the clothing.

- Employees should be provided with and required to use splash-proof safety goggles where liquid 1,1-dichloroethane may contact the eyes.

## SANITATION

- Skin that becomes wet with liquid 1,1-dichloroethane should be immediately washed or showered with soap or mild detergent and water to remove any 1,1-dichloroethane.

## COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Use as dewaxer of mineral oils; extractant for heat-sensitive substances	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use as a fumigant	General dilution ventilation of work area; personal protective equipment
Use in manufacture of vinyl chloride by vapor phase cracking; use in manufacture of high vacuum rubber and silicon grease; use as a chemical intermediate	General dilution ventilation; local exhaust ventilation; personal protective equipment

## 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 1,1-dichloroethane 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 1,1-dichloroethane gets on the skin, promptly flush the contaminated skin using soap or mild detergent and water. If 1,1-dichloroethane soaks through the clothing, remove the clothing immediately and flush 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 1,1-dichloroethane, 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 1,1-dichloroethane 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 1,1-dichloroethane 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. 1,1-Dichloroethane should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion. Sewers designed to preclude the formation of explosive concentrations of 1,1-dichloroethane vapors are permitted.

- Waste disposal method:

1,1-Dichloroethane may be disposed of by atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

## REFERENCES

- American Conference of Governmental Industrial Hygienists: "1,1-Dichloroethane (Ethylidene Chloride)," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.
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## RESPIRATORY PROTECTION FOR 1,1-DICHLOROETHANE

Condition	Minimum Respiratory Protection* Required Above 100 ppm
Vapor Concentration	
1000 ppm or less	<p>Any chemical cartridge respirator with an organic vapor cartridge(s).</p> <p>Any supplied-air respirator.</p> <p>Any self-contained breathing apparatus.</p>
4000 ppm or less	<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> <p>A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.</p>
Greater than 4000 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.