

Occupational Health Guideline for 1,1-Dichloro-1-Nitroethane

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: $\text{CH}_2\text{CCl}_2\text{NO}_2$
- Synonyms: None
- Appearance and odor: Colorless liquid with an unpleasant odor that causes tears.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for 1,1-dichloro-1-nitroethane is a ceiling of 10 parts of 1,1-dichloro-1-nitroethane per million parts of air (ppm). This may also be expressed as 60 milligrams of 1,1-dichloro-1-nitroethane per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

• Routes of exposure

1,1-Dichloro-1-nitroethane 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

Exposure of animals has produced severe irritation of the lungs with severe breathing difficulties. These breathing difficulties may be delayed in onset. Liver, heart, kidney, and blood vessel damage were also reported in animals. In addition, eye and skin irritation have been reported in animals.

• 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-dichloro-1-nitroethane.

• Recommended medical surveillance

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

—Chronic respiratory disease: 1,1-Dichloro-1-nitroethane causes respiratory irritation in animals. In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of 1,1-dichloro-1-nitroethane might cause exacerbation of symptoms due to its irritant properties.

—Liver disease: 1,1-Dichloro-1-nitroethane causes liver damage 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: 1,1-Dichloro-1-nitroethane causes kidney damage in animals. The importance of this organ in the elimination of toxic substances justifies special consideration in those with impaired renal function.

—Cardiovascular disease: 1,1-Dichloro-1-nitroethane causes heart damage in animals. In persons with impaired cardiovascular function, the inhalation of 1,1-dichloro-1-nitroethane might cause exacerbation of pre-existing disorders.

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

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

• Summary of toxicology

1,1-Dichloro-1-nitroethane vapor is a pulmonary, skin, and eye irritant in animals. It also causes liver, kidney, and heart damage in animals. At high concentrations animals showed lacrimation, increased nasal secretion,

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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sneezing, coughing, pulmonary rales, and weakness. Exposure of rabbits to levels as low as 52 ppm for 18-½ hours was fatal. Autopsies on animals exposed to more than 170 ppm for over 30 minutes revealed pulmonary edema and hemorrhage, with damage to the heart, liver, and kidneys. Application of the liquid to the skin of rabbits caused irritation and edema. No human experience has been reported.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 144
2. Boiling point (760 mm Hg): 125 C (257 F)
3. Specific gravity (water = 1): 1.42
4. Vapor density (air = 1 at boiling point of 1,1-dichloro-1-nitroethane): 5.0
5. Melting point: Data not available
6. Vapor pressure at 20 C (68 F): 15 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 0.25
8. Evaporation rate (butyl acetate = 1): Data not available

• Reactivity

1. Conditions contributing to instability: Overheating in closed containers may cause explosions.
2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as oxides of nitrogen, hydrogen chloride, and carbon monoxide) may be released in a fire involving 1,1-dichloro-1-nitroethane.
4. Special precautions: Liquid 1,1-dichloro-1-nitroethane will attack some forms of plastics, rubber, and coatings.

• Flammability

1. Flash point: 58 C (136 F) (closed cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Data not available
4. Extinguishant: Dry chemical, foam, carbon dioxide

• Warning properties

1. Odor Threshold: No quantitative information is available concerning the odor threshold of 1,1-dichloro-1-nitroethane.
2. Eye Irritation Level: The *Handbook of Organic Industrial Solvents* states that this substance "may cause irritation of eyes and nose at twice threshold limit and, at higher concentrations, lung injury." Grant points out that it "has an irritant, lacrimogenic effect which gives adequate warning to prevent dangerous exposure."
3. Evaluation of Warning Properties: Although 1,1-dichloro-1-nitroethane produces irritant effects at only twice the permissible exposure limit, it is treated as a substance with poor warning properties, since the permissible exposure limit is a ceiling concentration which was set "to prevent serious injury in man."

MONITORING AND MEASUREMENT PROCEDURES

• Ceiling Evaluation

Measurements to determine employee ceiling exposure are best taken during periods of maximum expected airborne concentrations of 1,1-dichloro-1-nitroethane. Each measurement should consist of a fifteen (15) minute sample or series of consecutive samples totalling fifteen (15) minutes in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). A minimum of three (3) measurements should be taken on one work shift and the highest of all measurements taken is an estimate of the employee's exposure.

• 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-dichloro-1-nitroethane may be used. An analytical method for 1,1-dichloro-1-nitroethane is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 3, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00261-4).

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-dichloro-1-nitroethane.

- Clothing wet with liquid 1,1-dichloro-1-nitroethane should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of 1,1-dichloro-1-nitroethane from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the 1,1-dichloro-1-nitroethane, the person performing the operation should be informed of 1,1-dichloro-1-nitroethane's hazardous properties.
- Non-impervious clothing which becomes contaminated with 1,1-dichloro-1-nitroethane should be removed promptly and not reworn until the 1,1-dichloro-1-nitroethane is removed from the clothing.
- Employees should be provided with and required to use splash-proof safety goggles where liquid 1,1-dichloro-1-nitroethane may contact the eyes.

SANITATION

- Skin that becomes contaminated with 1,1-dichloro-1-nitroethane should be promptly washed or showered with soap or mild detergent and water to remove any 1,1-dichloro-1-nitroethane.
- Employees who handle liquid 1,1-dichloro-1-nitroethane 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 1,1-dichloro-1-nitroethane may occur and control methods which may be effective in each case:

Operation	Controls
Use as an insecticidal fumigant for grain (this product is not in common use at this time)	Material substitution

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 liquid 1,1-dichloro-1-nitroethane gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation persists after washing, get medical attention. Contact lenses should not be worn when working with this chemical.

• Skin Exposure

If liquid 1,1-dichloro-1-nitroethane gets on the skin, immediately wash the contaminated skin using soap or mild detergent and water. If liquid 1,1-dichloro-1-nitroethane soaks through the clothing, remove the clothing immediately 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 1,1-dichloro-1-nitroethane, 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 liquid 1,1-dichloro-1-nitroethane has been swallowed and the person is conscious, give the person large quantities of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. Get medical attention immediately.

• 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 liquid 1,1-dichloro-1-nitroethane 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 collected and atomized in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. 1,1-Dichloro-1-nitroethane should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

- Waste disposal method:

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

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RESPIRATORY PROTECTION FOR 1,1-DICHLORO-1-NITROETHANE

Condition

Minimum Respiratory Protection* Required Above 10 ppm

Vapor Concentration

150 ppm or less

Any supplied-air respirator with a full facepiece, helmet, or hood.
Any self-contained breathing apparatus with a full facepiece.

Greater than 150 ppm or entry and escape from unknown concentrations

Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.

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.

Fire Fighting

Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.

Escape

Any gas mask providing protection against organic vapors.
Any escape self-contained breathing apparatus.

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