

# Occupational Health Guideline for 1,1,1,2-Tetrachloro-2,2-Difluoroethane

## 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:  $\text{CCl}_3\text{-CClF}_2$
- Synonyms: Halocarbon 112a; refrigerant 112a; 2,2-difluoro-1,1,1,2-tetrachloroethane
- Appearance and odor: Colorless liquid or solid with a slight ether-like odor.

## PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for 1,1,1,2-tetrachloro-2,2-difluoroethane is 500 parts of 1,1,1,2-tetrachloro-2,2-difluoroethane per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 4170 milligrams of 1,1,1,2-tetrachloro-2,2-difluoroethane per cubic meter of air ( $\text{mg}/\text{m}^3$ ).

## HEALTH HAZARD INFORMATION

- **Routes of exposure**  
1,1,1,2-Tetrachloro-2,2-difluoroethane 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:** 1,1,1,2-Tetrachloro-2,2-difluoroethane might cause irritation of the skin and eyes. It might also cause drowsiness and difficulty in breathing.
  2. **Long-term Exposure:** None known.
  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 1,1,1,2-tetrachloro-2,2-difluoroethane.

- **Recommended medical surveillance**

The following medical procedures should be made available to each employee who is exposed to 1,1,1,2-tetrachloro-2,2-difluoroethane 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 1,1,1,2-tetrachloro-2,2-difluoroethane exposure.

—Chronic respiratory disease: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of 1,1,1,2-tetrachloro-2,2-difluoroethane 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**

1,1,1,2-Tetrachloro-2,2-difluoroethane vapor is a narcotic. Rats exposed to 10,000 ppm for 1-½ to 2 hours showed signs of intoxication, and concentrations of 20,000 to 30,000 ppm were fatal. Rats succumbing to 15,000 ppm for 4 hours evidenced pulmonary congestion and edema with some hemorrhage. Application in alcohol to the skin of rabbits produced severe irritation, while no irritation was reported when applied with dimethylphthalate. There are no reports of systemic effects in workers from industrial exposure.

## CHEMICAL AND PHYSICAL PROPERTIES

- **Physical data**
  1. Molecular weight: 203.8
  2. Boiling point (760 mm Hg): 92 C (197 F)
  3. Specific gravity (water = 1): 1.65
  4. Vapor density (air = 1 at boiling point of 1,1,1,2-tetrachloro-2,2-difluoroethane): 7
  5. Melting point: 40.6 C (105 F)
  6. Vapor pressure at 20 C (68 F): 40 mm Hg (approximately)

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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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Public Health Service    Centers for Disease Control  
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Occupational Safety and Health Administration

7. Solubility in water, g/100 g water at 20 C (68 F): 0.012

8. Evaporation rate (butyl acetate = 1): Greater than 1

• **Reactivity**

1. Conditions contributing to instability: Heat  
2. Incompatibilities: Reacts with chemically active metals such as sodium, potassium, and beryllium, or with powdered magnesium, aluminum, and zinc.

3. Hazardous decomposition products: Toxic gases and vapors (such as hydrogen chloride, hydrogen fluoride, and carbon monoxide) may be released when 1,1,1,2-tetrachloro-2,2-difluoroethane decomposes.

4. Special precautions: 1,1,1,2-Tetrachloro-2,2-difluoroethane will attack some forms of plastics, rubber, and coatings.

• **Flammability**

1. Not combustible

• **Warning properties**

No quantitative data are available relating warning properties to air concentrations of this compound. Therefore, for the purposes of this guideline, it is treated as a material with poor warning properties.

1,1,1,2-Tetrachloro-2,2-difluoroethane is not a known 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 1,1,1,2-tetrachloro-2,2-difluoroethane may be used. An analytical method for 1,1,1,2-tetrachloro-2,2-difluoroethane 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 or solid 1,1,1,2-tetrachloro-2,2-difluoroethane.

• Non-impervious clothing which becomes contaminated with liquid or solid 1,1,1,2-tetrachloro-2,2-difluoroethane should be removed promptly and not reworn until the 1,1,1,2-tetrachloro-2,2-difluoroethane is removed from the clothing.

• Employees should be provided with and required to use dust- and splash-proof safety goggles where liquid or solid 1,1,1,2-tetrachloro-2,2-difluoroethane may contact the eyes.

## SANITATION

• Skin that becomes contaminated with liquid or solid 1,1,1,2-tetrachloro-2,2-difluoroethane should be promptly washed or showered with soap or mild detergent and water to remove any 1,1,1,2-tetrachloro-2,2-difluoroethane.

## COMMON OPERATIONS AND CONTROLS

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

## Operation

Use in dry cleaning industry for wool, cotton, dacron, and leather materials in combination with other solvents as azeotropic mixture; use in electric or electronic industries for cleaning rosin fluxes from circuit boards, and cleaning solvent for complex electronic parts and magnetic tapes

Use in polymer and plastics industry as blowing or foaming agent for cellular and microporous materials

Use as solvent extractant for separation and purification of biological material; use as a dye solvent to give brighter colors, and to detect surface cracks or defects in metals

Use as corrosion inhibitors in brake fluid, surface coatings on electrical equipment, heat control of reactions, and propellants

## 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 1,1,1,2-tetrachloro-2,2-difluoroethane 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 1,1,1,2-tetrachloro-2,2-difluoroethane gets on the skin, promptly wash the contaminated skin using soap or mild detergent and water. If 1,1,1,2-tetrachloro-2,2-difluoroethane 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.

## Controls

Local exhaust ventilation; general dilution ventilation; personal protective equipment

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## • Breathing

If a person breathes in large amounts of 1,1,1,2-tetrachloro-2,2-difluoroethane, 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 1,1,1,2-tetrachloro-2,2-difluoroethane 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 1,1,1,2-tetrachloro-2,2-difluoroethane is spilled or leaked, the following steps should be taken:

1. Ventilate area of spill or leak.
2. If in the liquid form, collect for reclamation or absorb in vermiculite, dry sand, earth, or a similar material.
3. If in the solid form, collect spilled material in the most convenient and safe manner for reclamation.

• Waste disposal methods:

1,1,1,2-Tetrachloro-2,2-difluoroethane may be disposed of:

1. If in the liquid form, by absorbing it in vermiculite, dry sand, earth or a similar material
2. If in the solid form, by disposing in a secured sanitary landfill.

## REFERENCES

• American Conference of Governmental Industrial Hygienists: "1,1,1,2-Tetrachloro-2,2-Difluoroethane," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.

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## RESPIRATORY PROTECTION FOR 1,1,1,2-TETRACHLORO-2,2-DIFLUOROETHANE

Condition	Minimum Respiratory Protection* Required Above 500 ppm
Vapor Concentration	
5000 ppm or less	Any supplied-air respirator. Any self-contained breathing apparatus.
15,000 ppm or less	Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece. A Type C supplied-air respirator with a half facepiece operated in pressure-demand or other positive pressure or continuous-flow mode.
Greater than 15,000 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.