

# Occupational Health Guideline for Dichlorodifluoromethane

## 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:  $\text{CCl}_2\text{F}_2$
- Synonyms: Refrigerant 12; Freon 12; propellant 12; Halon 122
- Appearance and odor: Colorless gas with a characteristic ether-like odor that is detectable only in concentrations well above the permissible exposure (above 20% by volume).

## PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for dichlorodifluoromethane is 1000 parts of dichlorodifluoromethane per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 4950 milligrams of dichlorodifluoromethane per cubic meter of air ( $\text{mg}/\text{m}^3$ ).

## HEALTH HAZARD INFORMATION

### • Routes of exposure

Dichlorodifluoromethane can affect the body if it is inhaled or if it comes in contact with the eyes or skin.

### • Effects of overexposure

1. *Short-term Exposure:* Exposure to dichlorodifluoromethane may cause dizziness, involuntary trembling, unconsciousness, and death. It may also cause irregular heartbeat. If the liquid gets on the skin or in the eyes, it may cause frostbite.

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 dichlorodifluoromethane.

### • Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to dichlorodifluoromethane 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 dichlorodifluoromethane exposure.

—*Cardiovascular disease:* In persons with impaired cardiovascular function, especially those with a history of cardiac arrhythmias, the inhalation of dichlorodifluoromethane might cause exacerbation of disorders of the conduction mechanism due to its sensitizing effects on the myocardium.

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

### • Summary of toxicology

Dichlorodifluoromethane vapor is a narcotic and can cause asphyxia at very high concentrations. At 800,000 ppm rats were deeply anesthetized, but 4 to 6 hours' exposure produced no permanent effects. At 200,000 ppm dogs and monkeys showed only tremors, salivation, and lacrimation. Inhalation by man at 150,000 ppm produces unconsciousness, while dizziness occurs at 50,000 ppm. Sniffing aerosols of fluorochlorinated hydrocarbons has caused sudden death by cardiac arrest, probably due to sensitization of the myocardium. In liquid form this substance may cause frostbite.

## CHEMICAL AND PHYSICAL PROPERTIES

### • Physical data

1. Molecular weight: 120.9
2. Boiling point (760 mm Hg):  $-29.8\text{ C}$  ( $-21.6\text{ F}$ )
3. Specific gravity (water = 1): 1.49 (at boiling)

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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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point)

4. Vapor density (air = 1 at boiling point of dichlorodifluoromethane): 4.2

5. Melting point: -157.7 C (-252 F)

6. Vapor pressure at 20 C (68 F): 5.7 atm.

7. Solubility in water, g/100 g water at 20 C (68 F): 0.008

8. Evaporation rate (butyl acetate = 1): 380

• **Reactivity**

1. Conditions contributing to instability: Heat

2. Incompatibilities: Dichlorodifluoromethane reacts with chemically active metals such as sodium, potassium, calcium, powdered aluminum, zinc, and magnesium.

3. Hazardous decomposition products: Toxic gases and vapors (such as hydrogen chloride, phosgene, and hydrogen fluoride) may be released when dichlorodifluoromethane decomposes.

4. Special precautions: Liquid dichlorodifluoromethane will attack some forms of plastics, rubber, and coatings.

• **Flammability**

1. Not combustible

• **Warning properties**

Since dichlorodifluoromethane is practically odorless and is not an irritant, it is treated as a material with poor warning properties.

Grant states that "in ordinary occupational or domestic exposure to the gas, there is neither ocular nor respiratory irritation. Dogs, monkeys, and guinea pigs exposed to 20% of the gas in air for several hours a day for several days showed temporary intoxication with tremors, ataxia, and associated tendency to stare, salivate, and lacrimate, but no cumulative toxic effect and no specific ocular disturbance. The speed of reflex closure of the eyes is such that it seems extremely unlikely that any serious injury would result from an accidental spray of this substance in the eyes of human beings."

## 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**

An analytical method for dichlorodifluoromethane 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).

• Gleason, M. N., Gosselin, R. E., Hodge, H. C., and Smith, R. P.: *Clinical Toxicology of Commercial Products* (3rd ed.), Williams and Wilkins, Baltimore, 1969.

## 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 the skin from becoming wet with liquid dichlorodifluoromethane or from becoming frozen from contact with vessels containing dichlorodifluoromethane.

• Any clothing which becomes wet with liquid dichlorodifluoromethane should be removed immediately and not reworn until the dichlorodifluoromethane has evaporated from the clothing.

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

## COMMON OPERATIONS AND CONTROLS

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

| Operation                                     | Controls                               |
|---|--|
| Use in manufacture of aerosols for cosmetics, | General dilution ventilation; personal |

pharmaceuticals, insecticides, paints, adhesives, and cleaners; use in manufacture and extensive use as a refrigerant in home and commercial applications

Use as a blowing agent for cellular polymers; use as a solvent or diluent in fumigants for food sterilization; in paints and varnish removers, and in polymerization processes

Use as a foaming agent in fire extinguishing, aerosols, for surfactants; use in Immersion Quick Freezing of food products

Use in water purification; copper and aluminum purification, petroleum recovery, and in manufacture of glass bottles

Use in regulating devices for leak detection; in thermal expansion valves; use in manufacture of materials for electrical applications as insulators and generator windings

Use in organic synthesis of Freons, and a polymerization catalysts; use as a working fluid for heat pumps and in hydraulic fluids

protective equipment

General dilution ventilation; personal protective equipment

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## 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 dichlorodifluoromethane 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 liquid dichlorodifluoromethane gets on the skin, immediately flush the skin with water if the dichlorodifluoromethane has not already evaporated. If liquid dichlorodifluoromethane soaks through the clothing, remove the clothing immediately and flush the skin with water. Do not use hot water for flushing. If irritation is present after washing, get medical attention.

### • Breathing

If a person breathes in large amounts of dichlorodifluoromethane, 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.

### • 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 AND LEAK PROCEDURES

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

• If dichlorodifluoromethane is leaked, the following steps should be taken:

1. Ventilate area of spill or leak to disperse gas.
2. Stop flow of gas.

## REFERENCES

- American Conference of Governmental Industrial Hygienists: "Dichlorodifluoromethane," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.
- American Industrial Hygiene Association: "Dichlorodifluoromethane," *Hygienic Guide Series*, Detroit, Michigan, 1968.
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- Reinhardt, C. F., et al.: "Cardiac Arrhythmias and Aerosol 'Sniffing'," *Archives of Environmental Health*, 22:265-279, 1971.

- Stecher, P. G. (ed.): *The Merck Index* (8th ed.), Merck Co., Inc., Rahway, New Jersey, 1968.
- Union Carbide Corporation, Industrial Medicine and Toxicology Department: *Material Safety Data Sheet - Dichlorodifluoromethane*, New York, 1972.

## RESPIRATORY PROTECTION FOR DICHLORODIFLUOROMETHANE

| Condition   | Minimum Respiratory Protection*<br>Required Above 1000 ppm  |
|---|---|
| Gas Concentration<br><br>10,000 ppm or less                             | Any supplied-air respirator.<br><br>Any self-contained breathing apparatus.   |
| 50,000 ppm or less  | Any supplied-air respirator with a full facepiece, helmet, or hood.<br><br>Any self-contained breathing apparatus with a full facepiece.<br><br>A Type C supplied-air respirator with a half facepiece operated in pressure-demand or other positive pressure or continuous-flow mode.  |
| Greater than 50,000 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.<br><br>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.<br><br>Any escape self-contained breathing apparatus.   |

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