

# Occupational Health Guideline for Difluorodibromomethane (Freon 12B2)

## 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:  $\text{CBr}_2\text{F}_2$
- Synonyms: Dibromodifluoromethane; Freon 12B2
- Appearance and odor: Colorless liquid or gas with a characteristic odor.

## PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for Freon 12B2 is 100 parts of Freon 12B2 per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 860 milligrams of Freon 12B2 per cubic meter of air ( $\text{mg}/\text{m}^3$ ).

## HEALTH HAZARD INFORMATION

### • Routes of exposure

Freon 12B2 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 to Freon 12B2 may cause irritation of the nose and throat, drowsiness, unconsciousness, and death. Exposure may also cause liver damage. If the liquid gets on the skin or in the eyes, it may cause frostbite.

### • 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 Freon 12B2.

### • Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to Freon 12B2 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 Freon 12B2 exposure.

—Liver disease: Although Freon 12B2 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.

—Chronic respiratory disease: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of Freon 12B2 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

Freon 12B2 vapor is a respiratory irritant and a narcotic. Rats exposed to 4000 ppm for 15 minutes showed pulmonary edema, while 2300 ppm daily for 6 weeks resulted in the death of more than half the animals. At 2300 ppm dogs showed rapid and progressive signs of intoxication, with weakness and loss of balance after a few days' exposure, followed by convulsions. These dogs at autopsy had pulmonary congestion, centrolobular necrosis of the liver, and some evidence of central nervous system damage. However, other dogs tolerated daily exposures of 350 ppm for 7 months without signs of intoxication. No systemic effects have been reported from industrial exposures. In liquid form, this substance may cause frostbite.

## CHEMICAL AND PHYSICAL PROPERTIES

### • Physical data

1. Molecular weight: 209.8

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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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2. Boiling point (760 mm Hg): 24.5 C (76.1 F)
3. Specific gravity (water = 1): 2.46
4. Vapor density (air = 1 at boiling point of Freon 12B2): 7.2
5. Melting point: -141.6 C (-223 F)
6. Vapor pressure at 20 C (68 F): 620 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F):

Insoluble

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

• **Reactivity**

1. Conditions contributing to instability: Heat
2. Incompatibilities: Freon 12B2 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 bromide and hydrogen fluoride) may be released when Freon 12B2 decomposes.

4. Special precautions: Liquid Freon 12B2 will attack some forms of plastics, rubber, and coatings.

• **Flammability**

1. Not combustible

• **Warning properties**

Freon 12B2 does not have adequate warning properties. Freon 12B2 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 Freon 12B2 vapors using an adsorption tube with subsequent desorption with isopropyl alcohol and gas chromatographic analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure Freon 12B2 may be used. An analytical method for Freon 12B2 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 Freon 12B2.

• Non-impervious clothing which becomes wet with liquid Freon 12B2 should be removed promptly and not reworn until the Freon 12B2 has evaporated.

• Employees should be provided with and required to use splash-proof safety goggles where liquid Freon 12B2 may contact the eyes.

## COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to Freon 12B2 may occur and control methods which may be effective in each case:

Operation	Controls
Use as a fire extinguishing agent; use in organic synthesis	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use in processing cutting tools as razor blades, hypodermic needles, scalpels, culinary knives, and garden tools	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use as a special solvent for preparation of explosive mixtures	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 liquid Freon 12B2 gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation is present after washing, get medical attention. Contact lenses should not be worn when working with this chemical.

- **Skin Exposure**

If liquid Freon 12B2 gets on the skin, immediately flush the contaminated skin with water if the liquid Freon 12B2 has not already evaporated. If liquid Freon 12B2 soaks through the clothing, remove the clothing immediately and flush the skin with water. Do not use hot water for skin flushing. If irritation persists after washing, get medical attention.

- **Breathing**

If a person breathes in large amounts of Freon 12B2, 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 Freon 12B2 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 AND LEAK PROCEDURES

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

- If Freon 12B2 is spilled or leaked, the following steps should be taken:

1. Ventilate area of spill or leak.

2. If the gas is leaking, stop the flow.

3. If the liquid is spilled or leaked, allow to vaporize.

## REFERENCES

- American Conference of Governmental Industrial Hygienists: "Difluorodibromomethane," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.
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## RESPIRATORY PROTECTION FOR FREON 12B2

Condition	Minimum Respiratory Protection* Required Above 100 ppm
Vapor Concentration	
1000 ppm or less	Any supplied-air respirator. Any self-contained breathing apparatus.
2500 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 2500 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.