

Occupational Health Guideline for Chlorobromomethane

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: CH_2BrCl
- Synonyms: Bromochloromethane; methylene chlorobromide; CB; CBM; Halon 1011
- Appearance and odor: Colorless to pale yellow liquid with a characteristic, sweet odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for chlorobromomethane is 200 parts of chlorobromomethane per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 1050 milligrams of chlorobromomethane per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

• Routes of exposure

Chlorobromomethane 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:* Chlorobromomethane may cause irritation of the eyes and throat. It may also cause mental confusion, dizziness, and unconsciousness.

2. *Long-term Exposure:* Prolonged or repeated skin exposure may cause skin irritation.

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 chlorobromomethane.

• Recommended medical surveillance

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

—Skin disease: Chlorobromomethane 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 chlorobromomethane 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 chlorobromomethane 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 chlorobromomethane 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

Chlorobromomethane vapor is a narcotic and a respiratory irritant. Concentrations near 30,000 ppm were fatal to mice and rats within 15 minutes; this level of exposure produced pulmonary edema and, in delayed deaths, interstitial pneumonitis. The LC50 for mice on 8-hour exposure was 3000 ppm; the predominant observation was narcosis. No toxic effects were observed in several species after repeated inhalation exposures at 1000 ppm for 14 weeks. The substance is a mild skin

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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irritant in animals. A reported exposure of three firefighters to unknown but very high vapor concentrations was characterized by disorientation, headache, nausea, and irritation of the eyes and throat; two of the three became comatose; of these, one had convulsive seizures and the other had respiratory arrest, from which he was resuscitated. Recovery was slow but complete. Some effects may have been due to the inhalation of thermal decomposition products.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 129.4
2. Boiling point (760 mm Hg): 67.8 C (154 F)
3. Specific gravity (water = 1): 1.93
4. Vapor density (air = 1 at boiling point of chlorobromomethane): 4.5
5. Melting point: -88 C (-126 F)
6. Vapor pressure at 20 C (68 F): 117 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 0.9
8. Evaporation rate (butyl acetate = 1): Data not available

• Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Chlorobromomethane reacts with chemically active metals such as calcium, powdered aluminum, zinc, and magnesium.
3. Hazardous decomposition products: Toxic gases and vapors (such as hydrogen chloride, phosgene, carbon monoxide, and hydrogen bromide) may be released when chlorobromomethane decomposes.
4. Special precautions: Liquid chlorobromomethane will attack some forms of plastics, rubber, and coatings.

• Flammability

1. Not combustible

• Warning properties

Patty states that "chlorobromomethane has a distinctive odor at 400 ppm. It is a good warning at well before acutely hazardous concentration. The odor is distinctive at the acceptable concentration and so gives some warning, but it is not disagreeable enough to drive anyone from the area, and workmen may well tolerate a level well above the acceptable level for chronic exposure."

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 chlorobromomethane 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 chlorobromomethane may be used. An analytical method for chlorobromomethane 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 chlorobromomethane.
- Non-impervious clothing which becomes wet with liquid chlorobromomethane should be removed promptly and not reworn until the chlorobromomethane is removed from the clothing.
- Employees should be provided with and required to use splash-proof safety goggles where liquid chlorobromomethane may contact the eyes.

SANITATION

- Skin that becomes wet with liquid chlorobromomethane should be promptly washed or showered with soap or mild detergent and water to remove any chlorobromomethane.

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Use as a fire extinguishing fluid in vaporizing fire extinguishers; use in manufacture of vaporizing liquid fire extinguishers	Material substitution
Use in mineral and salt separations for flotation	General dilution ventilation; personal protective equipment
Use as a grain fumigant	General dilution 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 chlorobromomethane 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 chlorobromomethane gets on the skin, promptly wash the contaminated skin using soap or mild detergent and water. If chlorobromomethane 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.

• Breathing

If a person breathes in large amounts of chlorobromomethane, 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 chlorobromomethane 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 some-

one 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 chlorobromomethane is spilled or leaked, the following steps should be taken:

1. Ventilate area of spill or leak.

2. Collect for reclamation or absorb in vermiculite, dry sand, earth, or a similar material.

• Waste disposal method:

Chlorobromomethane may be disposed of by absorbing it in vermiculite, dry sand, earth, or a similar material, and disposing in a secured sanitary landfill.

REFERENCES

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RESPIRATORY PROTECTION FOR CHLOROBROMOMETHANE

Condition	Minimum Respiratory Protection* Required Above 200 ppm
Vapor Concentration	
1000 ppm or less	Any chemical cartridge respirator with an organic vapor cartridge(s).
2000 ppm or less	Any supplied-air respirator. Any self-contained breathing apparatus.
5000 ppm or less	A gas mask with a chin-style or a front- or back-mounted organic vapor canister.
Greater than 5000 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.