

## BIS-CHLOROMETHYL ETHER AWARENESS TRAINING

**Substance:** Bis-Chloromethyl Ether

**CAS Registry Number:** 542-88-1

**Synonyms:** BCME, CCME, Bis-CME, Chloromethyl ether, Dichlorodimethyl ether, Dichloromethyl ether, Oxybis (Chloromethane)

Bis(chloromethyl) ether is a flammable liquid which is clear liquid with a strong unpleasant odor. It does not occur naturally. It dissolves easily in water, but degrades rapidly and readily evaporates into air. Numerous epidemiological studies and case reports from around the world have demonstrated that a worker exposed to BCME has an increased risk for lung cancer. Among heavily exposed workers, the relative risks are ten fold or greater. Risks increase with duration and cumulative exposure. Histological evaluation indicates that exposure results primarily in lung cancer of the small-cell type. Maximal relative risks appear to occur 15 to 20 years after first exposure, and latency is shortened among workers with heavier exposure.

Since BCME has such limited use in the United States, chances for exposure to BCME are low. Some BCME can form as an impurity during the production of other chemicals, so exposure might occur in chemical plants that make or use these chemicals. Also, some BCME may exist in chemical waste sites, although this is not certain. Because BCME evaporates easily, the most likely way to be exposed to BCME in the workplace or around a waste site is by breathing air containing BCME vapors. However, information on levels of BCME, which exist in air, is not available.

Bis(chloromethyl) ether released into the air can be broken down by reactions with other chemicals and sunlight, or it can be removed by rain. In water, it is broken down quickly to formaldehyde and hydrochloric acid. When released to soil, some will evaporate to the air but most of it will be broken down by reacting with soil moisture.

Bis(chloromethyl) ether does not build up in the food chain and does not last long in the environment.

### PROPERTIES

BCME is a flammable, volatile, colorless liquid that is miscible with ethanol and many other organic solvents. In aqueous solutions, it is rapidly hydrolyzed to form hydrochloric acid and formaldehyde. BCME has a suffocating effect and can be formed whenever formaldehyde, water, and hydrogen chloride vapors are mixed at room temperature, even in low concentrations. When heated to decomposition, this chemical emits toxic vapors of hydrochloric acid and other chlorinated compounds. Vapors may form explosive mixtures with air.

### USE

BCME is primarily used as chemical intermediates and alkylating agents. BCME is used as a laboratory reagent, to manufacture plastics, ion-exchange resins, and polymers, and as a monitoring indicator for chloromethyl ether. BCME was once used for crosslinking of cellulose, surface treatment of vulcanized rubber to increase adhesion, and in the manufacture of flame-retardant fabrics.

## **EXPOSURE**

Because BCME is so quickly broken down by water, most BCME that contacts the body is quickly changed into other chemicals (formaldehyde and hydrochloric acid) before it passes through the outermost layer of cells contacted (e.g., the cells that line the nose, windpipe and lungs). Some BCME may enter into the blood or internal tissues, but this has not been studied and the amount may be too small to measure.

Therefore, the primary route of potential human exposure to BCME is inhalation and dermal contact. Because BCME is used very little in this country and because it is rapidly degraded in the environment, the probability of human exposure is very low. It has not been detected in ambient air or water.

Occupational exposure to BCME is minimized because most industrial operations working with the chemical are conducted in closed process vessels. The most likely means of exposure to BCME is inhalation of vapors in the workplace during the production and use of chemicals in which it may occur as a contaminant or may be formed inadvertently. The risk of potential occupational exposure to the chemicals is greatest for workers such as chemical plant workers, ion-exchange resin makers, laboratory workers, and polymer makers.

There are no warning properties of BCME exposure; worker exposure by all routes should be carefully controlled. It is advisable that the laboratory chemist exercise great caution in the use of BCME. BCME is among those carcinogens for which zero tolerance has been proposed.

## **REGULATIONS**

Any release to the environment greater than 10 pounds of bis(chloromethyl) ether must be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has not set any exposure limits for Bis (2-Chloromethyl) ether. OSHA issued an emergency temporary standard covering this chemical in 1973, and a final standard in 1974. The standard prohibits operations in open vessels and requires exhaust fans, protective clothing and devices, warning signs and labels. OSHA also regulates occupational exposure to bis(chloromethyl) ether as potential carcinogen and it is regulated under the Hazard Communication Standard and as chemical hazards in laboratories.

NIOSH: Recommends that exposure to occupational carcinogens be limited to the lowest feasible concentration.

ACGIH TLV: The recommended airborne exposure limit is 0.001 ppm, 0.0047 mg/m<sup>3</sup> TWA - (Confirmed Human Carcinogen) averaged over an 8-hour workshift.

## **HEALTH EFFECTS**

### **Acute Health Effects**

Immediately or shortly after exposure to Bis (2-Chloromethyl) Ether, the exposed individual may experience the following:

- Skin and eye irritation along with a burning sensation.

- Breathing can irritate the lungs causing coughing and/or shortness of breath.
- Higher exposures can cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.
- loss of appetite, nausea and fatigue
- irritability, anxiety and weakness.
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### **Chronic Health Effects**

The following chronic (long-term) health effects can occur at some time after exposure to Bis (2-Chloromethyl) Ether and can last for months or years:

- Found to cause cancer
- Not tested for its ability to affect reproduction.
- Not tested for other chronic (long-term) health effects.

### **Medical Testing**

OSHA requires pre-assignment physical, personal history, family and occupational background, inclusive of genetic and environmental factors (at least annually). Before beginning employment and at regular times after that, a chest x-ray is recommended. A chest x-ray is also recommended after acute overexposure.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Because BCME is broken down so rapidly in the body, there are no specific tests to determine if a human has been exposed to this compound. The only available medical tests are physical examination of the nose and throat, chest X-ray, and examination of the sputum for abnormal cell types. Unfortunately, these tests are not specific for this compound, and would reveal effects of the compound only after damage to the tissues had already occurred

### **WORKPLACE CONTROLS AND PRACTICES**

Unless a less toxic chemical can be substituted for a hazardous substance, Engineering controls are the most effective way of reducing exposure.

### **ENGINEERING CONTROLS**

The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

Good work practices can help to reduce hazardous exposures. The following work practices are recommended:

- Workers whose clothing has been contaminated by Bis (2-Chloromethyl) Ether should change into clean clothing promptly.
- Do not take contaminated work clothes home. Family members could be exposed.
- Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to Bis (2-Chloromethyl) Ether.

## WAYS OF REDUCING EXPOSURE

- Enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, appropriate respirators should be worn. If you wear a respirator, you must be part of our Respiratory Protection Program.
- A regulated, marked area should be established where Bis (2-Chloromethyl) Ether is handled, used, or stored as required by the OSHA Standard 1910.1008.
- Wear protective work clothing.
- Wash thoroughly immediately after exposure to Bis(2 Chloromethyl) Ether and at the end of the work shift.
- To alert your employees, post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of Bis (2-Chloromethyl) Ether to potentially exposed workers.

**Emergency Procedures:** In a medical emergency, call 911, then 4111.

**Inhalation:** Take proper precautions to ensure your own safety before attempting rescue (e.g. wear appropriate protective equipment, use the buddy system). Remove source of contamination or move victim to fresh air. Obtain medical attention immediately.

**Skin contact:** Under running water remove contaminated clothing, shoes and leather goods (e.g. watchbands, belts). Obtain medical attention immediately. Completely decontaminate clothing, shoes and leather goods before re-use or discard.

**Contact with eyes:** Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for 15 minutes or until the chemical is removed, while holding eyelid(s) open. Take care not to rinse contaminated water into the unaffected eye or onto the face. Obtain attention immediately.

**Ingestion:** Rinse mouth and don't give anything to the victim to drink. Obtain medical attention immediately.

Before working with any chemical, review the Material Safety Data Sheet.