

Bis(chloromethyl)ether (BCME)

542-88-1

Hazard Summary

Bis(chloromethyl)ether (BCME) is no longer used commercially in the United States. In humans, acute (short-term) exposure to BCME may cause skin, mucous membrane, and respiratory tract irritation. Chronic bronchitis, chronic cough, and impaired respiratory function have been observed in humans following chronic (long-term) inhalation exposure. Several occupational studies have reported increased incidences of lung cancer among exposed workers. Animal studies indicate that BCME is a potent carcinogen with a short latency period. Increased incidences of respiratory tract tumors have been reported in rodents exposed by inhalation. EPA has classified BCME as a Group A, known human carcinogen.

Please Note: The main sources of information for this fact sheet are EPA's Integrated Risk Information System (IRIS) (4), which contains information on the carcinogenic effects of bis(chloromethyl)ether including the unit cancer risk for inhalation exposure, and the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for Bis(chloromethyl)ether. (1)

Uses

- In the past, BCME was used for chloromethylation and as an alkylating agent in the manufacture of polymers. (1,2,4)
- BCME is no longer used commercially in the United States. It is used as a research chemical and lab reagent. (1,2,4)

Sources and Potential Exposure

- Because BCME is not currently used as an isolated material in the United States, and because it is rapidly degraded in the environment, the probability of human exposure is low. (1)
- The most likely means of exposure to BCME is via inhalation in the workplace during its production and use. (1)

Assessing Personal Exposure

- No information was located regarding the measurement of personal exposure to BCME.

Health Hazard Information

Acute Effects:

- In humans, acute exposure to BCME may cause skin, mucous membrane, and respiratory tract irritation. (2)
- Lung irritation, congestion, edema, and hemorrhage have been observed in rats and hamsters following acute inhalation exposure. (1)
- BCME is irritating to the skin of mice and rabbits. Corneal opacity has been observed in rabbits. (1,2) Acute
- animal tests in rats, mice, hamsters, and rabbits have demonstrated BCME to have **extreme** acute toxicity via inhalation and **high** acute toxicity via oral and dermal exposure. (3)

Chronic Effects (Noncancer):

- Chronic bronchitis, chronic cough, and impaired respiratory function have been observed in humans following chronic inhalation exposure. However, exposure to BCME usually occurs concurrently with exposure to chloromethyl methyl ether, which itself is a lung irritant. (1,2)
- Chronic inhalation exposure of mice to BCME has been reported to cause respiratory distress. (1)
- EPA has not established a Reference Concentration (RfC) or a Reference Dose (RfD) for BCME. (4)
- ATSDR has established an intermediate inhalation minimal risk level (MRL) of 0.0014 milligrams per cubic meter (mg/m³) (0.0003 ppm) based on respiratory effects in rats. The MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects over a specified duration of exposure. It is not a direct estimator of risk but rather a reference point to gauge the potential effects. At exposures increasingly greater than the MRL, the potential for adverse health effects increases. (1)

Reproductive/Developmental Effects:

- No information is available on the reproductive and developmental effects of BCME in humans.
- No effects on the testes were noted in a study of rats exposed by inhalation. (1)

Cancer Risk:

- Several occupational studies have reported increased incidences of lung cancer among exposed workers. (1,2,4,5)
- Animal studies indicate that BCME is a potent carcinogen with a short latency period. A high incidence of respiratory tract tumors has been reported in rats exposed by inhalation. An increased incidence of pulmonary adenomas has been reported in mice exposed by inhalation. In dermally exposed mice, skin papillomas and carcinomas were observed. (1,2,4,5)
- EPA has classified BCME as a Group A, known human carcinogen. (4)
- EPA uses mathematical models, based on human and animal studies, to estimate the probability of a person developing cancer from breathing air containing a specified concentration of a chemical. EPA calculated an inhalation unit risk estimate of 0.062 (µg/m³)⁻¹. EPA estimates that, if an individual were to continuously breathe air containing BCME at an average of 0.000016 µg/m³ (1.6 × 10⁻⁸ mg/m³) over his or her entire lifetime, that person would theoretically have no more than a one-in-a-million increased chance of developing cancer as a direct result of breathing air containing this chemical. Similarly, EPA estimates that breathing air containing 0.00016 µg/m³ (1.6 × 10⁻⁷ mg/m³) would result in not greater than a one-in-a-hundred thousand increased chance of developing cancer, and air containing 0.0016 µg/m³ (1.6 × 10⁻⁶ mg/m³) would result in not greater than a one-in-ten thousand increased chance of developing cancer. For a detailed discussion of confidence in the potency estimates, please see IRIS. (4)
- EPA has calculated an oral cancer slope factor of 220 (mg/kg/d)⁻¹. (4)

Physical Properties

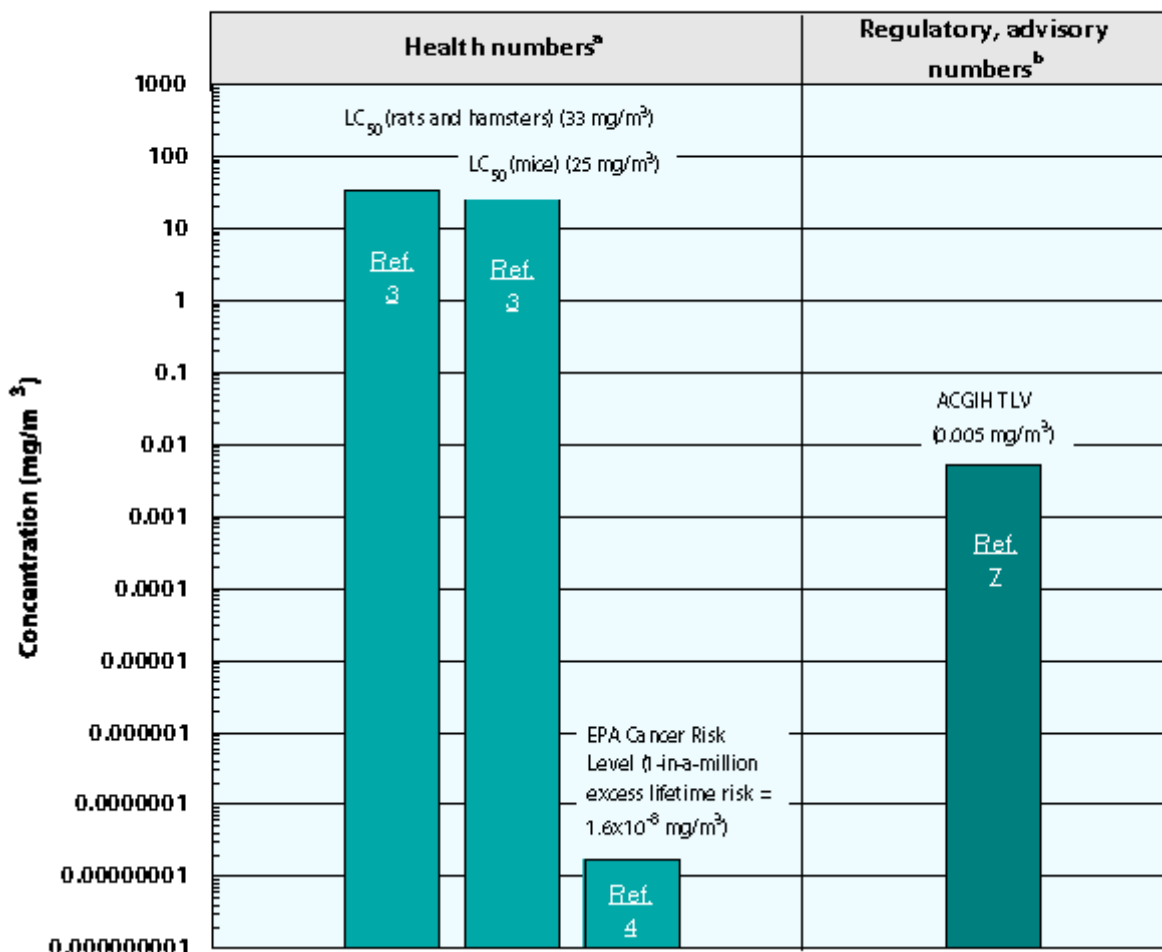
- The chemical formula for BCME is C₂H₄Cl₂O, and its molecular weight is 114.97 g/mol. (6)
- BCME occurs as a colorless liquid. (1,2,4,6)
- BCME has a suffocating odor; the odor threshold has not been established. (2,6)
- The vapor pressure for BCME is 30 mm Hg at 22 °C, and its log octanol/water partition coefficient (log K_{ow}) is -0.38. (1,2,4)

Conversion Factors:

To convert concentrations in air (at 25 °C) from ppm to mg/m³: $\text{mg/m}^3 = (\text{ppm}) \times (\text{molecular weight of the compound}) / (24.45)$. For bis(chloromethyl)ether: 1 ppm = 4.7 mg/m³. To convert concentrations in air from µg/m³ to mg/m³: $\text{mg/m}^3 = (\mu\text{g/m}^3) \times (1 \text{ mg} / 1,000 \mu\text{g})$.

Health Data from Inhalation Exposure

Bis(chloromethyl)Ether



ACGIH TLV --American Conference of Governmental and Industrial Hygienists' threshold limit value expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effects.

LC₅₀ (Lethal Concentration₅₀)--A calculated concentration of a chemical in air to which exposure for a specific length of time is expected to cause death in 50% of a defined experimental animal population.

The health and regulatory values cited in this fact sheet were obtained in December 1999.

^a Health numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.

^b Regulatory numbers are values that have been incorporated in Government regulations, while advisory numbers are nonregulatory values provided by the Government or other groups as advice. ACGIH numbers are advisory.

Summary created in April 1992, updated in January 2000

References

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4. U.S. Environmental Protection Agency. Integrated Risk Information System (IRIS) on Bis(chloromethyl)ether. National Center for Environmental Assessment, Office of Research and Development, Washington, DC. 1999.
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7. American Conference of Governmental Industrial Hygienists (ACGIH). 1999 TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents. Biological Exposure Indices. Cincinnati, OH. 1999.