Methyl Chloride (Chloromethane)

METHYL CHLORIDE (CHLOROMETHANE)

74-87-3

Hazard Summary

Low levels of methyl chloride occur naturally in the environment. Higher levels may occur at chemical plants where it is made or used. Acute (short-term) exposure to high concentrations of methyl chloride in humans has caused severe neurological effects. Methyl chloride has also caused effects on the heart rate, blood pressure, liver, and kidneys in humans. Chronic (long-term) animal studies have shown liver, kidney, spleen, and central nervous system (CNS) effects. Inhalation studies have demonstrated that methyl chloride causes reproductive effects in male rats, with effects such as testicular lesions and decreased sperm production. Human cancer data are limited. EPA has classified methyl chloride as a Group D carcinogen (not classifiable as to human carcinogenicity).

Please Note: The main source of information for this fact sheet is the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for Chloromethane. (1) Other secondary sources include the Hazardous Substances Data Bank (HSDB) (2), a database of summaries of peer-reviewed literature, and the Registry of Toxic Effects of Chemical Substances (RTECS) (3), a database of toxic effects that are not peer reviewed.

Uses

- Methyl chloride is used mainly in the production of silicones where it is used to make methylate silicon. It is also used in the production of agricultural chemicals, methyl cellulose, quaternary amines, and butyl rubber and for miscellaneous uses including tetramethyl lead. (1)
- Methyl chloride was used widely in refrigerators in the past, but generally this use has been taken over by newer chemicals such as Freon. (1,8)

Sources and Potential Exposure

- Methyl chloride is formed in the oceans by natural processes (e.g., marine phytoplankton) and from biomass burning in grasslands and forested areas (e.g., forest fires); it has been detected at low levels in air all over the world. (1)
- Other sources of exposure to methyl chloride include cigarette smoke, polystyrene insulation, and aerosol propellants; home burning of wood, coal, or certain plastics; and chlorinated swimming pools. (1)
- Methyl chloride is also present in some lakes and streams and has been found in drinking water at very low levels. (1)
- Occupations that present a higher risk of exposure include building contracting, metal industries, transportation, car dealers, and service-station attendants. (1)

Assessing Personal Exposure

- There is no known reliable medical test to determine exposure to methyl chloride. (1)

Health Hazard Information

Acute Effe cts:

- In humans, brief exposures to high levels of methyl chloride can have serious effects on the nervous system, including convulsions, and coma. Other effects include dizziness, blurred or double vision, fatigue, personality changes, confusion, tremors, uncoordinated movements, slurred speech, nausea, and vomiting. These symptoms develop within a few hours after exposure and may persist for several months.(1)
- Effects on heart rate, the liver, and kidneys have also been reported in humans following acute inhalation exposures to methyl chloride. (1)
- Numerous acute inhalation exposure studies have identified the liver and kidney as target organs in rats and mice; the central nervous system (CNS) as a target system in rats, mice, and dogs; spleen effects in mice; and endocrine effects in rats. (1,2)
- Tests involving acute exposure of rats and mice have shown methyl chloride to have moderate acute toxicity. (3)

Chronic Effects (Nonca ncer):

- No information is available regarding the chronic effects of methyl chloride in humans. (1)
- Chronic animal studies have shown that the liver, kidney, spleen, and CNS were the target of methyl chloride toxicity. Animals that breathed air containing methyl chloride gained weight more slowly than animals exposed to air. (1)
- EPA's Reference Concentration (RfC) for methyl chloride is 0.09 milligrams per cubic meter (mg/m^3). EPA has not established a Reference Dose (RfD) for methyl chloride. (4)

Reproductive/Developmental Effects:

- No studies were located concerning developmental or reproductive effects of methyl chloride in humans.(1) Several inhalation studies have demonstrated that methyl chloride causes reproductive effects in animals,
- with effects such as testicular lesions, disrupted spermatogenesis, and decreased sperm production in male rats. Delayed fetal development was noted in rats exposed to the same concentration of methyl chloride that resulted in maternal toxicity. (1)

Cancer Risk:

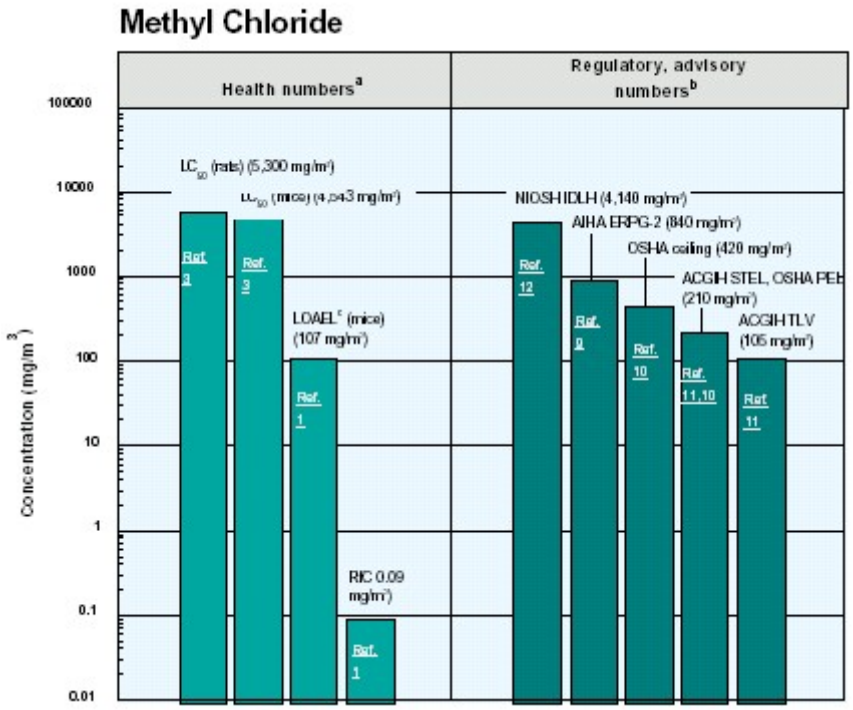
- Information regarding carcinogenicity in humans after exposure to methyl chloride is limited. An epidemiological study of butyl rubber workers showed no statistically significant increase in the rate of death due to cancer in this population. An elevated mortality from all cancers and for lung cancer was reported among a group of Icelandic fishermen who had been exposed to methyl chloride for two days in 1963. (1)
- In animal studies, kidney tumors were reported in one study of male mice. (1)
- EPA has classified methyl chloride as a Group D carcinogen (not classifiable as to human carcinogenicity). (5)

Physical Properties

- Methyl chloride is a colorless gas with a faint sweet smell and an odor threshold of 10 ppm. (1)
- Methyl chloride is soluble in water. (6)
- The chemical formula for methyl chloride is CH_3Cl, and it has a molecular weight of 50.49 g/mol. (1)
- The vapor pressure for methyl chloride is 4,310 mm Hg at 25 °C, and the log octanol/water partition coefficient (log K_{ow}) is 0.91. (1,7)

Conversion Factors:
To convert concentrations in air (at 25 °C) from ppm to mg/m^3: mg/m^3 = (ppm) × (molecular weight of the compound)/(24.45). For methyl chloride: 1 ppm = 2.1 mg/m^3. To convert concentrations in air from $\mu g/m^3$ to mg/m^3: mg/m^3 = ($\mu g/m^3$) × (1 mg/1,000 µg).

Health Data from Inhalation Exposure\



ACGIH STEL --American Conference of Governmental and Industrial Hygienists' short-term exposure limit; 15-min time-weighted-average exposure that should not be exceeded at any time during a workday even if the 8-h time-weighted-average is within the threshold limit value.
ACGIH TLV --ACGIH's threshold limit value expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effects.
AIHA ERPG --American Industrial Hygiene Association's emergency response planning guidelines. ERPG 2 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed up to one hour without experiencing or developing irreversible or other serious health effects that could impair their abilities to take protective action.
LC_{50} (Lethal Concentration $_{50}$)--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.
LOAEL--lowest observed adverse effect level.
NIOSH IDLH -- National Institute of Occupational Safety and Health's immediately dangerous to life or health concentration; NIOSH recommended exposure limit to ensure that a worker can escape from an exposure condition that is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from the environment.
OSHA PEL --Occupational Safety and Health Administration's permissible exposure limit expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effect averaged over a normal 8-h workday or a 40-h workweek.
OSHA ceiling value --OSHA's permissible exposure limit ceiling value; the concentration of a substance that should not be exceeded at any time.

The health and regulatory values cited in this factsheet 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. OSHA numbers are regulatory, whereas NIOSH, ACGIH, and AIHA numbers are advisory.

[c] The LOAEL is from the critical study used as the basis for the ATSDR chronic MRL.

References

Summary created in April 1992, updated January 2000

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