http://www.epa.gov/ttn/atw/hlthef/methylen.html

Methylene Chloride (Dichloromethane)

75-09-2

Hazard Summary-Created in April 1992; Revised in January 2000

Methylene chloride is predominantly used as a solvent. The acute (short-term) effects of methylene chloride inhalation in humans consist mainly of nervous system effects including decreased visual, auditory, and motor functions, but these effects are reversible once exposure ceases. The effects of chronic (long-term) exposure to methylene chloride suggest that the central nervous system (CNS) is a potential target in humans and animals. Human data are inconclusive regarding methylene chloride and cancer. Animal studies have shown increases in liver and lung cancer and benign mammary gland tumors following the inhalation of methylene chloride.

Please Note: The main sources of information for this fact sheet are the Agency for Toxic Substances and Disease Registry's (ATSDR's) *Toxicological Profile for Methylene Chloride* and EPA's Integrated Risk Information System (IRIS), which contains information on oral chronic toxicity and the RfD, and the carcinogenic effects of methylene chloride including the unit cancer risk for inhalation exposure.

Uses

- Methylene chloride is predominantly used as a solvent in paint strippers and removers; as a process solvent in the manufacture of drugs, pharmaceuticals, and film coatings; as a metal cleaning and finishing solvent in electronics manufacturing; and as an agent in urethane foam blowing. (1)
- Methylene chloride is also used as a propellant in aerosols for products such as paints, automotive products, and insect sprays. (1)
- It is used as an extraction solvent for spice oleoresins, hops, and for the removal of caffeine from coffee. However, due to concern over residual solvent, most decaffeinators no longer use methylene chloride. (1)
- Methylene chloride is also approved for use as a postharvest fumigant for grains and strawberries and as a degreening agent for citrus fruit. (1)

Sources and Potential Exposure

- The principal route of human exposure to methylene chloride is inhalation of ambient air. (1)
- Occupational and consumer exposure to methylene chloride in indoor air may be much higher, especially from spray painting or other aerosol uses. People who work in these places can breathe in the chemical or it may come in contact with the skin. (1)
- Methylene chloride has been detected in both surface water and groundwater samples taken at hazardous waste sites and in drinking water at very low concentrations. (1)

Assessing Personal Exposure

- Several tests exist for determining exposure to methylene chloride. These tests include measurement of methylene chloride in the breath, blood, and urine. It is noted that smoking and exposure to other chemicals may affect the results of these tests. (1)

Health Hazard Information

Acute Effects:

- Case studies of methylene chloride poisoning during paint stripping operations have demonstrated that inhalation exposure to extremely high levels can be fatal to humans. (1,2)
- Acute inhalation exposure to high levels of methylene chloride in humans has resulted in effects on the central nervous system (CNS) including decreased visual, auditory, and psychomotor functions, but these effects are reversible once exposure ceases. Methylene chloride also irritates the nose and throat at high concentrations. (1,2)
- Tests involving acute exposure of animals have shown methylene chloride to have moderate acute toxicity from oral and inhalation exposure. (3)

Chronic Effects (Noncancer):

- The major effects from chronic inhalation exposure to methylene chloride in humans are effects on the CNS, such as headaches, dizziness, nausea, and memory loss. (1,2)
- Animal studies indicate that the inhalation of methylene chloride causes effects on the liver, kidney, CNS, and cardiovascular system. (1,2)
- EPA has calculated a provisional Reference Concentration (RfC) of 3 milligrams per cubic meter (mg/m^3) based on liver effects in rats. The RfC is an estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious noncancer effects during a lifetime. It is not a direct estimator of risk but rather a reference point to gauge the potential effects. At exposures increasingly greater than the RfC, the potential for adverse health effects increases. Lifetime exposure above the RfC does not imply that an adverse health effect would necessarily occur. (5)
- The Reference Dose (RfD) for methylene chloride is 0.06 milligrams per kilogram body weight per day (mg/kg/d) based on liver toxicity in rats. (4)
- EPA has medium confidence in the RfD based on: high confidence in the study on which the RfD is based because a large number of animals of both sexes were tested in four dose groups, with a large number of controls, many effects were monitored, and a dose-related increase in severity was observed; and medium to low confidence in the database because only a few studies support the no-observed-adverse-effect level (NOAEL). (4)

Reproductive/Developmental Effects:

- No studies were located regarding developmental or reproductive effects in humans from inhalation or oral exposure. (1,2)
- Animal studies have demonstrated that methylene chloride crosses the placental barrier, and minor skeletal variations and lowered fetal body weights have been noted. (1,2)

Cancer Risk:

- Several studies did not report a statistically significant increase in deaths from cancer among workers exposed to methylene chloride. (1,2)
- Animal studies have shown an increase in liver and lung cancer and benign mammary gland tumors following inhalation exposure to methylene chloride. (1,2,4)
- EPA considers methylene chloride to be a probable human carcinogen and has ranked it in EPA's Group B2. (4)
- EPA uses mathematical models, based on 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 4.7×10^{-7} $(\mu g/m^3)^{-1}$. EPA estimates that, if an individual were to continuously breathe air containing methylene chloride at an average of 2.0 $\mu g/m^3$ (0.002 mg/m^3) 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 20 $\mu g/m^3$ (0.02 mg/m^3) would result in not greater than a one-in-a-hundred thousand increased chance of developing cancer, and air containing 200 $\mu g/m^3$ (0.2 mg/m^3) 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 calculated an oral cancer slope factor of 7.5×10^{-3} $(mg/kg/d)^{-1}$. (4)

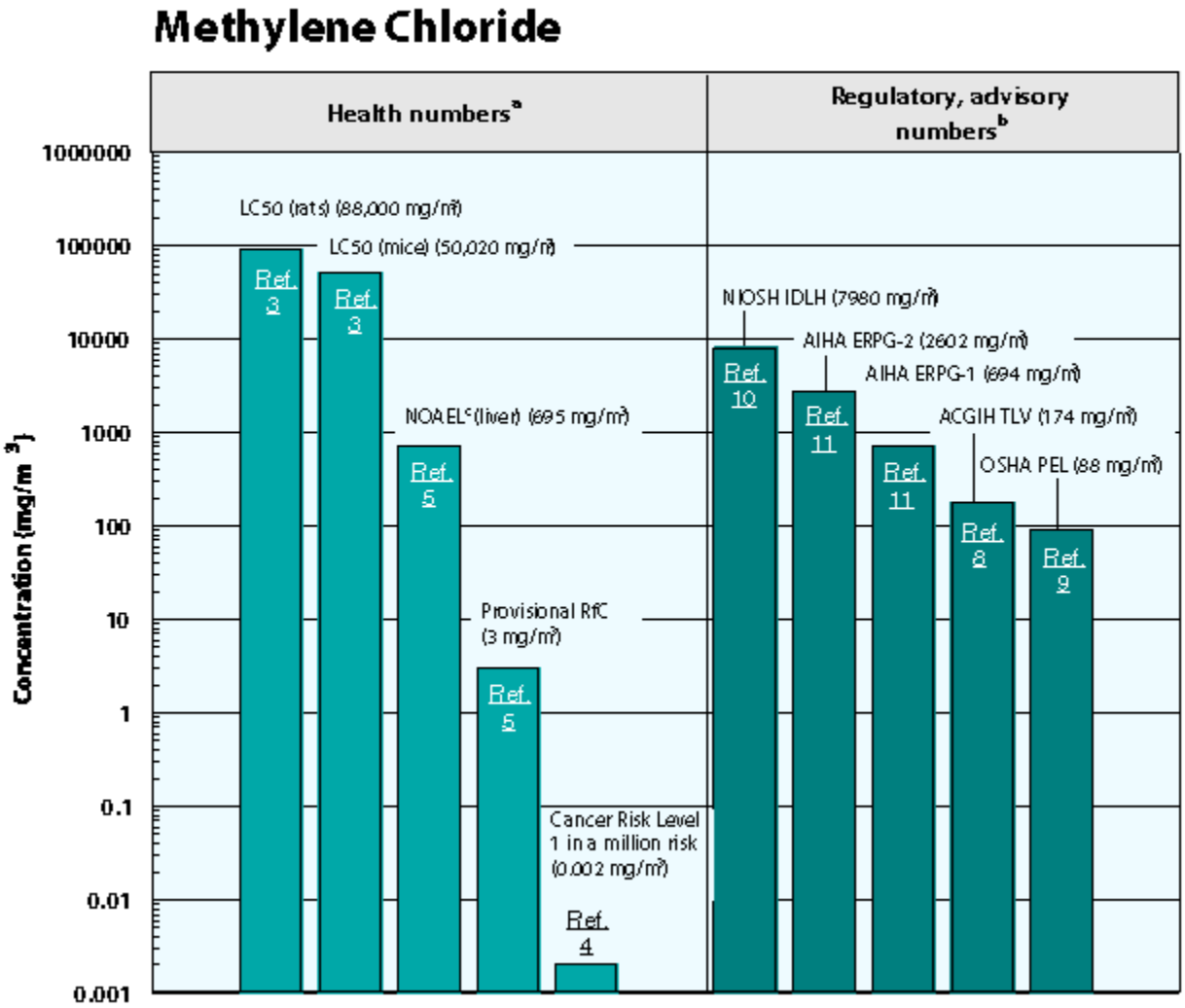
Physical Properties

- A common synonym for methylene chloride is dichloromethane. (1,4)

- Methylene chloride is a colorless liquid with a sweetish odor. (1,6)
- The chemical formula for methylene chloride is CH_2Cl_2, and the molecular weight is 84.93 g/mol. (1)
- The vapor pressure for methylene chloride is 349 mm Hg at 20 °C, and it has an octanol/water coefficient (log K_{ow}) of 1.30. (1)
- Methylene chloride has an odor threshold of 250 parts per million (ppm). (7)
- Methylene chloride is slightly soluble in water and is nonflammable. (1,6)

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 methylene chloride: 1 ppm = 3.5 mg/m^3. To convert concentrations in air from µg/m^3 to mg/m^3: mg/m^3 = (µg/m^3) × (1 mg/1,000 µg).

Health Data from Inhalation Exposure



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.
AIHA ERPG--American Industrial Hygiene Association's emergency response planning guidelines. ERPG 1 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor; 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.
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.

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 NOAEL is from the critical study used as the basis for the provisional RfC.

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