
ENVIRONMENTAL Fact Sheet



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ARD-EHP-28

2009

Methylene Chloride (Dichloromethane): Health Information Summary

Methylene chloride is a synthetic, colorless, liquid with a sweet odor. It is used primarily in industry for its solvent properties. It is used as a solvent in paints, varnish, paint removers, as a cleaning agent for metal parts and electronics, as an aerosol propellant, and, formerly, as an insecticide and to decaffeinate coffee.

The major environmental releases of methylene chloride are from its industrial uses. Because of its volatility, it will mainly be released into the atmosphere by evaporation. Methylene chloride that is released to air is degraded within about four months. When released to surface waters, it vaporizes into the atmosphere within a few days. Methylene chloride is very mobile in the soil so that it easily migrates down into groundwater, where it is expected to remain for several months to years.

The odor threshold for methylene chloride in air is reported as ranging from 160 parts per million to 620 ppm; its odor threshold in water is 9.1 ppm.

Health Effects

Absorption

In a study of humans exposed to methylene chloride in air, 70 percent to 75 percent was absorbed when inhaled. In a study with mice, 75 percent to 98 percent was absorbed after ingestion exposure. Methylene chloride can also be dermally absorbed; however, there is no information on the percentage absorbed via this route. The body eliminates absorbed methylene chloride within two days following exposure.

Methylene chloride is broken down to carbon monoxide (CO) in the body. Hemoglobin (Hb) in the blood normally carries oxygen to cells and tissues. CO binds with Hb to form carboxyhemoglobin (COHb), which cannot transport oxygen. However, exposure to environmental levels of methylene chloride is unlikely to raise COHb concentrations in the body to greater than 10 percent, the level at which initial symptoms of CO poisoning, such as headache, fatigue, or dizziness, normally first occur.

Short-term (acute) Effects

Inhalation exposure at 300 ppm of methylene chloride decreased visual and hearing capabilities in humans. At an exposure level of 800 ppm, reaction times and hand steadiness were affected. These are sensitive indicators of central nervous system (CNS) depression. Inhalation of still higher concentrations of 10,000 ppm of methylene chloride in animal studies caused CNS-related behavioral effects of incoordination, reduced activity, and sleepiness. At the highest concentrations of greater than 16,000 ppm in animal studies, exposure leads to unconsciousness and death.

Long-term (chronic) Effects

Chronic occupational inhalation exposure to methylene chloride increased the reporting of neurological system complaints in workers exposed to an average of 68 ppm. Reported effects were dizziness, memory loss, personality changes, and depression.

Exposure durations of both three months and two years to methylene chloride in drinking water resulted in liver toxicity to rats.

In an animal inhalation study, exposure to 2,000 ppm methylene chloride for two years increased the incidence of kidney degeneration.

Carcinogenic (cancer producing) Effects

Occupational studies have not produced any clear evidence that methylene chloride exposure is associated with an increase in cancer rates.

In animal studies with inhalation exposure to methylene chloride, there were increased incidences of tumors of the liver, lung, salivary gland, breast, and of leukemia. In an animal study in which exposure was from drinking water, rats had an increased incidence of liver tumors. Under the old cancer classification system, the Environmental Protection Agency classified methylene chloride as a Group B2 or “probable human carcinogen” because of sufficient evidence in animal studies. It has not yet been reevaluated under the current cancer guidelines.

Reproductive/Developmental Effects

Based on the results of animal studies, developmental toxicity resulting from methylene chloride exposure is not a major concern. However, in one animal inhalation study, minor skeletal variations were observed in offspring whose mothers were exposed to 1,250 ppm of methylene chloride during pregnancy.

Health Standards and Criteria

The EPA has established a maximum contaminant level goal (MCLG) of 0 parts per billion (ppb = micrograms per liter or ug/l) for methylene chloride in public drinking water systems. MCLGs are health-based non-enforceable guidelines and have traditionally been set at zero for "known" and "probable" human carcinogens. The EPA has also established a maximum contaminant level (MCL) for methylene chloride. MCLs are enforceable drinking water standards determined by balancing the adverse health effects of a particular chemical against the feasibility and costs of treating contaminated water. The MCL for methylene chloride is 5 ppb.

Because methylene chloride is considered a probable human carcinogen, there may be some degree of carcinogenic risk even below the MCL. Based upon EPA calculations, the EHP estimates that drinking water containing 5 ppb of methylene chloride would be associated with an increased lifetime risk of cancer of one in one million (one excess cancer case in 1,000,000 people exposed). This estimate is based on a daily intake of two liters of water per day for 70 years.

The EPA has also developed a toxicity value, called a "reference dose" or RfD, for non-cancer effects based on an animal study in which exposure to methylene chloride was from drinking water. Toxicity to the liver was the most sensitive non-cancer effect. The adult drinking water equivalent level for this RfD is a methylene chloride concentration in water of approximately 2,100 ppb.

The Occupational Safety and Health Administration enforceable standard (permissible exposure limit or PEL) for methylene chloride in workplace air is 25 ppm averaged over eight hours.

Suggested Reading and References

Casarett and Doull's Toxicology: The Basic Science of Poisons, Sixth Edition. Klaassen, C.D., ed. McGraw-Hill Publishing Co., Inc., New York, 2001.

Toxicological information on methylene chloride. Integrated Risk Information System (IRIS). U.S. EPA, Office of Health and Environmental Assessment. Last significant revision: 1991.

Toxicological Profile for Methylene chloride (Update). Agency for Toxic Substances and Disease Registry (ATSDR). Atlanta, Ga. September, 2000.