Product Safety Assessment

**Methylene Chloride**

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**Names**

- CAS No. 75-09-2
- Methylene chloride
- Dichloromethane
- AEROTHENE™ MM solvent
- MECTHENE™ solvent

**Product Overview**

- Methylene chloride is a clear, colorless, volatile liquid with a mild “ether-like” odor that is completely miscible with a variety of solvents. See **Product Description**.
- Methylene chloride is used in pharmaceutical products and paint removers. It also is used to produce flexible urethane foams, industrial adhesive formulations, and plastics. Alone, it can be used as a cleaning agent for fabricated metal parts and as an extraction solvent.¹ See **Product Uses**.
- Methylene chloride does not deplete stratospheric ozone and, when handled properly, methylene chloride poses no danger to health or the environment.² However, when used improperly or with inadequate ventilation, methylene chloride vapor concentrations can reach levels that can cause injury, even death. Although it has low toxicity when swallowed, breathing high concentrations of methylene chloride for long periods of time did increase the incidence of cancer in mice. Methylene chloride is listed as a potential carcinogen by IARC (International Agency for Research on Cancer) and NTP (National Toxicology Program).³ See **Health**, **Environmental** or **Physical Hazard Information**.
- The highest and most frequent exposures to methylene chloride occur in workplaces where the chemical is used; exposure can be dangerously high if methylene chloride is used in an enclosed space without adequate ventilation. Because methylene chloride evaporates into the air rapidly, exposure by breathing is the most likely route of exposure. Paint removers and adhesives containing methylene chloride may be used by consumers, so methylene chloride vapors could be present in the home, in addition to the workplace.⁴ See **Exposure Potential**.
- Methylene chloride should not be stored near open flames or excessive heat because of the potential danger of thermal decomposition of the solvent. Solvent decomposition products may be highly corrosive and toxic.⁵ Avoid direct sunlight or ultraviolet sources. **Physical Hazard Information**.

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Manufacture of Product

- **Capacity** – Total global industry capacity is approximately 1.1 billions pounds (520,000 metric tons). Dow produces methylene chloride in Freeport, Texas; Plaquemine, Louisiana; Aratu, Brazil; and Stade, Germany. Dow is the world largest supplier of chlorinated organic products and services.
- **Process** – At Dow, methylene chloride is manufactured primarily by the hydrochlorination of methanol.

\[
\begin{align*}
\text{CH}_3\text{OH} & + \text{HCl} \xrightarrow{\sim 100^\circ \text{C}} \text{CH}_3\text{Cl} + \text{H}_2\text{O} \\
\text{methyl chloride} & + \text{anhydrous hydrogen chloride}
\end{align*}
\]

\[
\begin{align*}
\text{CH}_3\text{Cl} & + \text{Cl}_2 \xrightarrow{\sim 400^\circ \text{C}} \text{CH}_2\text{Cl}_2 + \text{HCl} \\
\text{methyl chloride} & + \text{chlorine}
\end{align*}
\]

Product Description

Methylene chloride is a clear, colorless, volatile liquid with a mild “ether-like” odor that is completely miscible with a variety of solvents. Methylene chloride is nonflammable (under most end use conditions), having no flash point as determined by standard test methods. Methylene chloride does not deplete stratospheric ozone and is not being phased out under the Montreal Protocol.

Product Uses

Methylene chloride is a type of chlorinated solvent. Chlorinated solvents have been widely used for more than 50 years. While regulations in specific regions or countries may restrict or ban it use on some applications, depending on regulations, methylene chloride may be used in:

- Chemical processing
- Pharmaceutical products
- Metal cleaning and degreasing agents
- Paint removers and paint formulations
- Industrial adhesive and coatings formulations
- Flexible urethane foam production
- Manufacture of fluorocarbons
- Plastics
- Solvents for extraction, like the decaffeination of coffee
- Lubricants for leathers, plastics, pharmaceuticals and the food industry
- Cleaners for circuit board components
- Aerosol product formulations

Exposure Potential

Methylene chloride is primarily used in industrial settings. It is also used to formulate industrial, professional and consumer products. Special attention must be given to controlling methylene
chloride vapor within recommended exposure guidelines. Based on the uses for methylene chloride, people could be exposed through:

- **Workplace exposure** – Exposure can occur either in a methylene chloride manufacturing facility or in the various industrial, professional or manufacturing settings that use methylene chloride or methylene chloride-containing products. It is produced, distributed, stored and consumed primarily in closed systems. Those working with methylene chloride in manufacturing operations could be exposed during maintenance, sampling, testing or other procedures. Only use positive-pressure, self-contained breathing equipment when entering tanks or other confined spaces. An industrial cartridge respirator will not be sufficient for confined spaces. Facilities that manufacture or use methylene chloride should have a thorough training program for employees, appropriate work processes and safety equipment in place to limit unnecessary methylene chloride exposure. Professionals that use methylene chloride-containing products, like paint strippers, must take particular care to minimize exposure and ensure adequate ventilation. Carefully follow instructions given on the package label. See Health Information.

- **Consumer exposure to products containing methylene chloride** – Dow does not sell methylene chloride for direct consumer use, but it is used in formulations for products that are used by consumers. Caution should be used when using methylene chloride-containing products in the home or enclosed areas. Carefully follow instructions given on the package label for the proper ventilation conditions for using these products. See Health Information.

- **Environmental releases** – In the event of a spill, the focus is on containing the spill to prevent contamination of soil, surface or ground water. Respiratory protection is necessary for cleaning up spills and leaks. For small spills, methylene chloride should be absorbed with materials such as sawdust. The high vapor pressure and insolubility in water make methylene chloride tend to accumulate (partition) into the air, which creates an inhalation risk. Provide adequate ventilation. Consult the relevant Safety Data Sheet (SDS) for more information about protective equipment and procedures. See Environmental, Health and Physical Hazard Information.

- **Large release** – Industrial spills or releases are infrequent and are generally contained. If a large spill does occur, the material should be captured, collected and re-processed, or disposed of according to applicable governmental requirements. Methylene chloride will sink in water. Every attempt should be made to prevent it from entering into soil, ditches, sewers, waterways and/or groundwater. A positive pressure, self-contained breathing apparatus (SCBA) with a full-face mask is recommended for emergency work. Ventilate the area. In case of fire, deny any unnecessary entry into the area. Although this material does not have a flash point, it can burn at room temperature. During a fire, smoke may contain the original material in addition to combustion products, including, but not limited to: hydrogen chloride, carbon monoxide, carbon dioxide, and trace amounts of phosgene and chlorine. Vapors are heavier than air and may travel a long distance and accumulate in low lying areas. Keep vapors out of sewers. Follow emergency procedures carefully. See Environmental, Health and Physical Hazard Information.

**Health Information**

**Cancer**

There is not clear evidence that methylene chloride causes cancer in humans exposed to vapors in the workplace. However, breathing high concentrations of methylene chloride for long periods of time did increase the incidence of cancer in mice. Based on the evidence of carcinogenicity in mice, methylene chloride is classified as probably carcinogenic to humans by U.S. Environmental Protection Agency (EPA) guidelines and considered as “possibly” carcinogenic to humans by the IARC (International Agency for Research on Cancer). It is also classified as a “possible carcinogen” by the European Union.
Epidemiological studies on more than 6,000 people exposed to methylene chloride in their workplace using over 35 years of observations showed no increase in deaths from cancer or any other disease. Although repeated exposure to high levels of methylene chloride is known to cause transient central nervous system disturbance, neurological studies have shown that there is virtually no chance of permanent damage. A long-term inhalation study in mice, exposed to high doses of methylene chloride, showed an increased incidence of lung and liver tumors (NTP, 1986). However, similar studies in rats and hamsters did not show an increased incidence of these tumors. The results of recent research on methylene chloride indicate that the mouse may not be a representative model for humans.  

Sophisticated studies of enzyme distribution in mouse, rat, and human liver and lung indicate that the increases in lung and liver tumors seem in mice exposed to high levels of methylene chloride might be unique to that species.  

**Contact**

Methylene chloride is painful and irritating if splashed into the eyes or held in contact with the skin. Eye contact may cause pain greater than expected from the level of irritation to the eye tissue. Extensive contact with the skin may cause an intense burning sensation followed by a cold numb feeling that will subside after contact.

**Ingestion and Inhalation**

If ingestion of methylene chloride occurs, do not induce vomiting. If the solvent liquid enters the lungs, it may be rapidly absorbed by the lung tissue, leading to injury of other body systems. There have not been any reports of a connection between methylene chloride exposure during pregnancy and birth defects in humans. If a pregnant woman is exposed to methylene chloride, a small amount may cross the placenta, but not enough to harm the fetus. Studies in animals show that breathing methylene chloride at high levels (1250 ppm) during pregnancy may lead to minor bone variations, none of which are serious and some of which may be outgrown, in newborn pups. Methylene chloride has been shown to cross the placenta in rats. Methylene chloride has not been accurately measured in human milk and there are no animal studies testing to determine what extent it passes into milk.

When methylene chloride is inhaled, the body converts a portion of it to carbon monoxide, which results in increased carboxyhemoglobin levels in the blood. High levels of carboxyhemoglobin can result in a reduced ability of the blood to carry oxygen and can contribute to central nervous system effects.

If large amounts (800 ppm) of methylene chloride are inhaled, a person may not be able to react fast, remain steady, or perform tasks requiring precise hand movements. The individual may experience dizziness, nausea, tingling or numbness of the fingers and toes, and drunkenness if methylene chloride is breathed for a sufficiently long period of time. In most cases, effects disappear shortly after the exposure ends.

Breathing methylene chloride may cause changes in the liver and kidney in animals, but similar effects have not been observed in humans.

For specific health information, review the relevant Safety Data Sheet (SDS).

**Environmental Information**

The potential for environmental releases of methylene chloride is primarily to the air, and to a lesser extent in water and soil, due to how it is used in industry and by consumers and because methylene chloride evaporates readily. It is broken down by sunlight and by reaction with other chemicals present in the air. About half of the methylene chloride disappears from air in 53 to 127 days. Even though methylene chloride does not dissolve easily in water, small amounts may be found in some drinking water.
Methylene chloride is practically non-toxic to aquatic organisms on an acute basis. However, methylene chloride is heavier than water. So, a large spill of methylene chloride into water will tend to collect at low points, creating a concentrated source for continuing contamination. That is why dikes are recommended for large methylene chloride storage tanks and transfer operations.

The bioconcentration potential of methylene chloride is low. Based on stringent Organization for Economic Cooperation and Development (OECD) test guidelines, methylene chloride cannot be considered as readily biodegradable; however, these results do not necessarily mean that the material is not biodegradable under environmental conditions. Biodegradation rate may increase in soil and/or water depending on its make up. In the atmosphere (air), half of the methylene chloride is estimated to degrade within 79-110 days.

For specific environmental information, review the relevant Safety Data Sheet (SDS).

Physical Hazard Information

Methylene chloride is stable under normal storage conditions. However, methylene chloride should not be stored or used near open flames or excessive heat because of the potential danger of thermal decomposition. Avoid direct sunlight or ultraviolet sources. Solvent decomposition products may be highly corrosive and toxic. During a fire, smoke may contain the original material in addition to combustion products of varying compositions which may be toxic and/or irritating compounds. Hazardous combustion products may include and are not limited to hydrogen chloride, carbon monoxide, and carbon dioxide. Hazardous combustion products may include trace amounts of phosgene, or chlorine.

Water contamination of methylene chloride may cause corrosion of metals due to formation of hydrochloric acid. Avoid contact with oxidizing materials. Avoid contact with strong bases and unintended contact with amines and metals.

Additional physical property information for methylene chloride is available on the Safety Data Sheet (SDS).

Regulatory Information

Regulations may exist that govern the manufacture, sale, transportation, use and/or disposal of methylene chloride. These regulations may vary by city, state, country or geographic region. Information may be found by consulting the relevant SDS or Contact Us.

Additional Information

- Safety Data Sheet (http://www.dow.com/webapps/msds/msdssearch.asp)
- Contact Us (http://www.dow.com/gco/contact.htm)
- Dow’s Chlorinated Organics web site (http://www.dow.com/gco)
- U.S. Dept. of Health and Human Services, Toxicological Profile for Methylene Chloride, Public Health Service, ATSDR, September 2000
For more business information about methylene chloride, visit Dow’s Chlorinated Organics web site.

References

2 Dow Chlorinated Organics website (http://www.dow.com/gco/prod/meth_ch/index.htm)
6 World Chlor-Alkali Analysis Capacity Tables, Volume II, 2005.
8 www.dow.com/gco/applications
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