



Methylene Chloride

Substance Technical Guidelines

UCSC Laboratory Safety Services
Providing a little slug of information on . . .

Chemical Information Overview

Exposure to methylene chloride puts you at increased risk of developing cancer, adverse effects of the heart, central nervous system, liver dysfunction, and skin or eye irritation. Exposure may occur through inhalation or by absorption through the skin. Methylene chloride is one of few chemicals that has a regulatory standard written specifically to protect workers. The solvent is non-flammable but toxic and should be used in the hood or in conjunction with proper personal protective equipment.

Methylene chloride is used as a solvent, especially where high volatility is required. It is a good solvent for oils, fats, waxes, and resins and is frequently used as a paint stripper and degreaser. Methylene chloride is used as an extracting solvent in the pharmaceutical industry and in organic chemistry laboratories. Mixing with methanol, petroleum naphtha or tetrachloroethylene sometimes increases its solvent properties.

Chemical Name: Methylene Chloride
Chemical Family: Organohalogen
Chemical Formula: CH_2Cl_2
Molecular Weight: 84.9
CAS Number: 75-09-2

Synonyms: Dichloromethane (DCM),
MC
Methylene Dichloride,
Methylene Bichloride,
Methane Dichloride;

Physical Data

Description: Colorless liquid, chloroform-like odor

Boiling Point: 104° F (39.8° C)

Specific Gravity: 1.3 (H₂O = 1 @ 20° C)

Ionization Potential: 11.32 eV

Solubility in Water: Moderate (1-10%)

Solvent Solubility: Soluble in most organic solvents.

Vapor Density: 2.9 (Air = 1 @ 20° C)

Odor Threshold: 25 – 50 ppm (NOTE: considered to have poor warning properties due to olfactory fatigue)

Exposure Limits

OSHA Permissible Exposure Limit (PEL):	25 ppm (8 hr TWA)
OSHA Short Term Exposure Limit (STEL):	125 ppm (15 minute)
ACGIH Threshold Limit Value (TLV):	50 ppm (8 hr TWA)
NIOSH Recommended Exposure Limit (REL):	Lowest feasible concentration

Fire and Explosion Hazard

When involved in fire, methylene chloride emits highly toxic and irritating fumes such as phosgene, hydrogen chloride and carbon monoxide. Methylene chloride vapor may form a flammable mixture in an atmosphere that contains a high percentage of oxygen or in temperatures of 212 °F (100 °C) or higher. Closed containers exposed to heat may explode.

Flash Point: No measured FP in conventional closed tester

Lower Explosion Limit: 12%

Upper Explosion Limit: 19%

Autoignition Temperature: 1033°F (556°C)

Flammability Class (OSHA): Combustible Liquid

Extinguishing Media: Use dry chemical, "alcohol foam," carbon dioxide, or water in flooding amounts as fog. Solid streams may not be effective. Cool fire-exposed containers with water from side until well after fire is out. Use of water spray to flush spills can also dilute the spill to produce nonflammable mixtures. Water runoff, however, should be contained for treatment.

National Fire Protection Association section 325M Designation:

Health: 2 (Blue) - Materials hazardous to health, but areas may be entered with full-faced mask self-contained breathing apparatus that provides eye protection.

Flammability: 1 (Red) - Materials that must be preheated before ignition will occur.

Reactivity: 0 (Yellow) - Materials that (in themselves) are normally stable even under fire exposure conditions and are not reactive with water. Normal fire fighting procedures may be used.

Reactivity and Compatibility

Incompatibility (Materials to Avoid): Conditions contributing to the instability of methylene chloride are heat and moisture. Contact with strong oxidizers, caustics, and chemically active metals such as aluminum or magnesium powder, sodium and potassium may cause fires and explosions.

Special Precautions: Liquid methylene chloride attacks some forms of plastics, rubber and coatings.

Acute Effects of Exposure - (Health Hazard Data)

Ingestion (Swallowing): Methylene chloride causes headaches, altered sleep patterns, drowsiness, convulsions, and at higher concentrations central nervous system depression and respiratory failure. Methylene chloride may produce gastrointestinal burns, hemorrhage, and necrosis

Inhalation (Breathing): Because methylene chloride is highly volatile, inhalation is a major route of exposure. Breathing methylene chloride can irritate the nose, throat, and lungs causing coughing and/or shortness of breath. Higher exposures can cause a build-up of fluid in the lungs, a medical emergency, with severe shortness of breath. A concentration of 50,000 ppm is immediately dangerous to life and health from asphyxiation. There have been reported deaths from acute exposure to methylene chloride.

Skin (Dermal): Contact with skin may irritate and burn. Methylene chloride is lipophilic. It may be absorbed through intact skin and readily passes through the blood-brain barrier to exert effects on the nervous system.

Eye Contact: Solutions splashed in the eye can cause injuries ranging from transient discomfort and irritation to severe, deep burns. The severity of the effect depends on whether or not the eyes are flushed with water immediately after the accident.

Acute Animal Toxicity:

Oral, rats: LD50 = 1600 mg/kg

Inhalation, mouse: LC50 = 14400 ppm/ 7hr

Inhalation, rats: LC50 = 52 g/m³

Chronic Effects of Exposure - (Health Hazard Data)

Carcinogenicity: Laboratory studies show cancer in rats, mice and hamsters that inhaled methylene chloride for 6 hrs a day, 5 days a week for 2 years. Exposure produced lung and liver tumors in mice and mammary tumors in rats. There are also some human epidemiological studies that show an association between occupational exposure to methylene chloride and increases in bile duct cancer and a type of brain cancer. Other epidemiological studies have not observed a relationship between MC exposure and cancer. OSHA interprets these results to mean that there is suggestive (but not absolute) evidence that MC is a human carcinogen. ACGIH (American Conference of Governmental Hygienists) categorizes methylene chloride as an A3 carcinogen. *A3 - confirmed animal carcinogen with unknown relevance to humans.*

Emergency and First Aid Procedures

Ingestion (Swallowing): Rinse mouth with water. Do not induce vomiting. If the victim is conscious, dilute the ingested methylene chloride by giving water. Keep affected person warm and at rest. Get medical attention immediately.

Inhalation (Breathing): Remove the victim from the exposure area to fresh air immediately. If breathing has stopped, give artificial respiration. Keep the affected person warm and at rest. Qualified first-aid or medical personnel should administer care until the victim can be transported to a medical facility.

Skin Contact. Remove contaminated clothing (including shoes) immediately. Wash the affected area of your body with soap or mild detergent and large amounts of water until no evidence of the chemical remains (at least 10 to 20 minutes). If there are chemical burns, get first aid to cover the area with sterile, dry dressing, and bandages. Get medical attention if you experience appreciable eye or respiratory irritation.

Eye Contact: Wash the eyes immediately with large amounts of water occasionally lifting lower and upper lids, until no evidence of chemical remains (at least 15 to 20 minutes). Remove contact lenses if they are not rinsed by eyewash. Get medical attention immediately. If you have experienced appreciable eye irritation from a splash or excessive exposure, you should be referred promptly to an ophthalmologist for evaluation.

Emergency Procedures

Emergencies: If a spill of appreciable quantity occurs, leave the area quickly unless you are a designated person who has been given specific emergency response training and duty assignments. Do not touch spilled material. Designated persons may stop the leak and shut off ignition sources if these procedures can be done without risk. Designated persons should isolate the hazard area and deny entry except for necessary people protected by suitable protective clothing and respirators adequate for the exposure.

Spill, Leak, and Disposal Procedures

Occupational Spill: For small containers, place the leaking container in your chemical fume hood or other well ventilated area. Clean-up small spills with absorbent material if this can be done safely. For larger spills, leave the area immediately and dial 911 or contact EH&S at 459-2553 directly.

Waste Disposal: Dispose of all hazardous chemical waste through the campus hazardous waste disposal program. Contact EH&S at 459-3086 if you need assistance.

Monitoring and Measurement Procedures

Monitoring Requirements: If you believe your exposure to methylene chloride exceeds the 12.5 ppm action level or the 125 ppm short term exposure limit (STEL), UCSC must monitor your exposure. UCSC is not required to measure every exposure if a "high exposure" employee can be identified. The high exposure person usually spends the greatest amount of time near the process or equipment where MC is used.

Evaluation of 8-hour Exposure: Measurements taken for the purpose of determining time-weighted average (TWA) exposures are best taken with samples covering the full shift. Samples collected must be taken from the employee's breathing zone.

Short-term Exposure Evaluation: If there are tasks that involve brief but intense exposure to methylene chloride, employee exposure must be measured to assure compliance with the STEL. Sample collections are for brief periods, only 15 minutes, but several samples may be needed to identify the peak exposure.

Monitoring Techniques: OSHA specifies the method used for sampling and analysis must accurately evaluate the concentration of methylene chloride in the employees' breathing zone. Sampling may be performed by collecting methylene chloride on liquid or solid sorbents with subsequent chemical analysis. Passive diffusion monitors may also be used and instruments such as real-time continuous monitoring systems and portable direct reading instruments may measure short-term exposure. Worker exposure monitoring must be coordinated through EH&S.

Notification of Results: Workers must be informed of exposure monitoring results either in writing or by posting the results where the worker has ready access to them.

Protective Equipment and Clothing

Respiratory Protection: You must participate in the UCSC respiratory protection program if you use a respirator. Contact EH&S at 459-5394 for more information.

NIOSH approved full facepiece negative pressure respirators equipped with approved cartridges or canisters may be used for protection from methylene chloride. At concentrations at or above 200 ppm, an air-line or self-contained breathing apparatus (SCBA) is recommended.

Protective Gloves: Wear protective (impervious) gloves to prevent skin contact with methylene chloride. Silver shield gloves provide the greatest protection but offer little dexterity due to their design. Viton gloves (a fluorine containing hydro carbon polymer) offer good protection for accidental splashes or intermittent exposure and may be useful in a laboratory setting. Butyl rubber and nitrile gloves offer very poor resistance to methylene chloride and are not recommended. Most gloves used in a laboratory provide a contact barrier only and should be disposed of immediately when contamination is suspected.

Eye Protection: If you might be splashed in the eyes with methylene chloride, splash goggles or some other type of complete eye protection is essential. You may also need a face shield to supplement the protection provided by goggles, but you must never use just a face shield without other eye protection.

Other Protective Equipment: You must wear protective (impervious) clothing and equipment to prevent repeated or prolonged contact with methylene chloride. In the laboratory setting you should always wear long pants, long sleeves or lab coat and closed toe shoes when handling MC

If you are splashed with methylene chloride, immediately remove contaminated clothing and use the *emergency showers and eyewash fountains* to prevent serious injury. Report the incident to your supervisor and obtain necessary medical support.

Engineering Controls

Ventilation is the most widely applied engineering control method for reducing the concentration of airborne substances in the breathing zones of workers. There are two distinct types of ventilation.

Local Exhaust: Local exhaust ventilation is designed to capture airborne contaminants as near to the point of generation as possible. To protect you, the direction of contaminant flow must always be toward the local exhaust system inlet and away from you. Laboratory chemical fume hoods are a good example of local exhaust ventilation.

General Dilution: General dilution ventilation involves continuous introduction of fresh air into the workroom to mix with/dilute the contaminated air and lower the concentration in your breathing zone. Effectiveness depends on the number of air changes per hour and where devices emitting methylene chloride are located in the area. In some circumstances general dilution ventilation may be the only practical method of control but it is the least effective and should be used with extreme caution when working with a material as potentially hazardous and volatile as methylene chloride.

Work Practices

Work practices and administrative procedures are an important part of a methylene chloride control system. If you are asked to perform a task in a certain manner to limit your exposure, it is important that you follow these procedures. If you are unsure what work practices to follow, it is necessary that you find out before you begin your work. If you would like assistance in reviewing your procedures, contact EH&S at 459-4454.

Medical Surveillance

UCSC must make a medical surveillance program available at no expense to employees who are exposed to methylene chloride concentrations above the action level (12.5 ppm as an 8-hour average) for more than 30 days a year or at concentrations exceeding the PEL or STEL (25 ppm 8 hr TWA or 125 ppm 15 minute respectively) for more than 10 days a year. If you are exposed to methylene chloride at concentrations over either of these levels. UCSC must provide all medical examinations relating to your exposure at a reasonable time and place and at no cost to you.

Access to Information Requirements Under the Methylene Chloride Standard

- (1) Your supervisor is required to inform you of information contained in Appendix A of the Methylene Chloride Standard. UCSC must instruct you in the proper work practices, emergency procedures, and the correct use of protective equipment.
- (2) Your supervisor is required to determine whether you are being exposed to methylene chloride. You have the right to observe employee measurements and to record the results obtained. UCSC is required to inform you of your exposure. If UCSC determines you are being over exposed, they are required to inform you of the actions that are being taken to reduce your exposure to within the permissible exposure limits.
- (3) UCSC is required to keep records of any exposure and medical examinations. These records must be kept for thirty years.
- (4) UCSC is required to release your exposure and medical records to you upon request.
- (5) Your supervisor is required to provide labels and material safety data sheets (MSDS) for all materials, mixtures or solutions composed of greater than 0.1 percent methylene chloride. An example of a label that would satisfy these requirements would be:

Danger Contains Methylene Chloride Potential Cancer Hazard

May cause dizziness, headache, irritation of the throat and lungs, loss of consciousness and death at high concentrations.

Avoid skin contact. Contact with liquid causes skin and eye irritation.

The information contained in this document is adapted from the Federal OSHA Standard 1910.1052 Methylene Chloride, Appendix A – Substance Safety Data Sheet and Technical Guidelines for Methylene Chloride

The full text of the standard can be found on the Cal-OSHA web page at: <http://165.235.90.100/title8/5202.html>