Occidental Chemical Corporation
A subsidiary of Occidental Petroleum Corporation

Product Stewardship Summary
Methyl Chloride
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Summary

This Product Stewardship Summary is intended to give general information about Methyl Chloride. It is not intended to provide an in-depth discussion of all health and safety information about the product or to replace any required regulatory communications.

Methyl chloride or chloromethane (CH_3Cl) is a colorless gas that is shipped as a liquid, under pressure. Due to its unique chemical and physical properties, methyl chloride is considered a highly hazardous material. Although not as toxic as chlorine, methyl chloride does exhibit similar hazards with respect to being a compressed gas, but is also extremely reactive and flammable, so it must be stored and handled with this hazard in mind.

1. Chemical Identity

Name: Methyl Chloride
Synonyms: Chloromethane; Monochloromethane
Chemical Abstracts Service (CAS) number: 74-87-3
Chemical Formula: CH_3Cl
Molecular Weight: 50.49

Methyl chloride is a colorless, flammable gas at ambient conditions. It has a sweet, ether-like odor typical of chlorinated hydrocarbons. The vapors are heavier than air and tend to sink to low areas.

2. Production

Methyl chloride or chloromethane (CH_3Cl) is a colorless gas that is shipped as a liquid under pressure. Large amounts of chloromethane are produced naturally in the oceans by the action of sunlight on biomass and chlorine in sea foam. However, all chloromethane that is used in industry is produced synthetically. Methyl chloride is manufactured by two different reactions. Occidental Chemical Corporation's method reacts hydrogen chloride gas through boiling methanol with a zinc chloride catalyst, as defined in formula 2 below:

1) Chlorination of methane:

$$2\ CH_4 + Cl_2 \rightarrow 2\ CH_3Cl + H_2$$

2) Reacting hydrochloric acid with methanol:

$$CH_3OH + HCl \rightarrow CH_3Cl + H_2O$$

Occidental Chemical Corporation is a leading manufacturer of methyl chloride and operates production facilities in Geismar, Louisiana and Wichita, Kansas.

3. Uses

Occidental Chemical Corporation only produces a technical grade methyl chloride. Technical grade is defined as a good quality chemical grade used for commercial and industrial purposes only. Technical grade methyl chloride is not intended for use in food, drug, or medicinal products of any kind. Occidental Chemical Corporation only sells methyl chloride to industrial and commercial users.

Forty nine (49) percent of the methyl chloride produced in the U.S. is consumed as feedstock in the manufacture of the chemical intermediate methyl chlorosilanes, which are used in the production of silicone fluids, elastomers, and resins. The largest volume goes into silicone fluids, which are used in a wide range of products including processing aids such as antifoaming agents, release agents, and light-duty lubricants. It is also used in specialty chemicals for consumer products such as cosmetics, auto polishes, furniture polishes, and paper coatings.

Approximately ***eighteen (18)*** percent of methyl chloride produced in the U.S. is used as a raw material for the production of cellulose ethers such as methyl cellulose, hydroxyproply methylcellulose, and hydroxybutyl methylcellulose.

Methyl chloride is also consumed in the production of certain quaternary ammonium compounds such as dimethyl ammonium chloride and organomodified clays. Dimethyl ammonium chloride is an ingredient found in fabric softeners. Organomodified clays are used primarily in drilling mud in the oil and gas industry to impart lubricity and viscosity to the system. These markets consume approximately ***five (5)*** percent of the methyl chloride produced in the U.S.

Methyl chloride is a raw material used in the production of agricultural chemicals known as herbicides. They include **Dicamba** (3,6-dichloro-2-methoxybenzoic acid), paraquat, monosodium methanearson, and disodium methanearsonate. This market consumes approximately ***six (6)*** percent of the U.S. production of methyl chloride.

Another ***one (1)*** percent of the U.S. production of methyl chloride is used as a raw material in the production of butyl elastomers. Butyl rubber is used in inner tubes and inner liners for tires. Additionally, butyl elastomers are used in automotive mechanical goods, caulks and sealants, and pharmaceuticals.

4. Physical and Chemical Properties

Flammability

Methyl chloride is extremely flammable. If a fire occurs, it should not be extinguished until the leak is isolated and stopped. Escaping unburned methyl chloride is potentially explosive. Direct contact with open flames or a high energy heat source will result in combustion and corrosive, noxious gases. If combustion occurs, extinguish fires using dry chemical or carbon dioxide. Water may be ineffective, but should be used to keep fire-exposed containers cool.

Reactivity

Carbon steel containers and schedule 80 piping are suitable for handling dry methyl chloride. Cast or ductile iron and brass or copper-bearing alloys should NOT be used in methyl chloride service. Aluminum and aluminum alloys must NOT be used in methyl chloride storage or handling systems since

trimethyl aluminum is formed when methyl chloride contacts aluminum. Zinc and magnesium alloys also must be avoided in equipment or piping for methyl chloride service.

5. Health Effects

Inhalation
Overexposure to vapors may result in stomach or intestinal upset with pain, nausea, vomiting, and/or diarrhea; decreased blood pressure; increased heart rate; nervous system depression with headache, dizziness, fatigue, drowsiness, or unconsciousness; temporary changes in mood or behavior; confusion, loss of coordination; staggering; slurred speech; vertigo; tremor; visual disturbances; convulsions; coma; kidney, liver, and/or cardiovascular system damage; respiratory failure; or in extreme cases, death.

Eye Contact
Methyl chloride can cause serious eye damage. Contact with liquid or with rapidly expanding gas may cause frostbite.

Skin Contact
Contact with liquid or with rapidly expanding gas may cause frostbite.

Ingestion
Because methyl chloride is a gas, ingestion of this material is highly unlikely.

Cancer Studies
The International Agency for Research on Cancer (IARC) has concluded that there is inadequate evidence for carcinogenicity in animals or humans. The Human Health Assessment Group in EPA's Office of Health and Environmental Assessment has evaluated methyl chloride for carcinogenicity. According to their analysis, the weight-of-evidence for methyl chloride is group C, which is based on limited evidence in animals. No data are available for humans. As a group C chemical, methyl chloride is considered possibly carcinogenic to humans.

Reproductive Studies
Methyl chloride causes testicular toxicity in rats. In one study of mice, fetal heart malformations were observed; however, this result could not be duplicated by other researchers. There are no human data.

6. Environmental Effects

When methyl chloride is released to surface water, its primary loss will be by volatilization. The half-lives for a model river and a model lake are 46 minutes and 3 days, respectively. Adsorption to suspended solids and sediment is not expected. It may leach into groundwater where it can slowly biodegrade under anaerobic conditions. It can slowly hydrolyze to form hydrochloric acid.

When released to air, methyl chloride will exist as a vapor in the ambient atmosphere. It will degrade by reaction with hydroxyl radicals that are formed photochemically in the atmosphere. The half-life is estimated to be 310 days.

Methyl chloride has exhibited low toxicity in fish. This compound is not expected to bioconcentrate in aquatic organisms.

7. Exposure

The most likely ways exposures could occur are:

- Worker exposure – Exposure could occur in the manufacturing facility or in industrial facilities that use methyl chloride. Exposures could occur by inhalation of vapors. Methyl Chloride is used in closed systems in manufacturing processes to minimize exposures. In addition, good industrial hygiene practices and personal protective equipment minimize the risk of exposure. However, methyl chloride odors are reported to not be noticeable at potentially dangerous concentrations. Therefore, safety precautions have been outlined in the Methyl Chloride Handbook referenced in 9 below.
- Consumer exposure –Occidental Chemical Corporation does not sell methyl chloride for use directly in consumer products.
- Releases – If a spill occurs, emergency personnel should wear protective equipment to minimize exposures. Further details related to Safety, First Aid, and Spills/Precautions are detailed in the Methyl Chloride Handbook referenced in 9 below.

8. Recommended Risk Management Measures

Methyl chloride is flammable and can react with certain materials of construction. In addition, personnel exposure must be controlled. Prior to using methyl chloride, carefully read and comprehend the Safety Data Sheet (SDS). The following are some risk management measures that are effective against these hazards:

- Work areas where methyl chloride is used should be fire resistant. Methyl chloride must be stored in a National Fire Prevention Association (NFPA) Class I area. During methyl chloride transfers from one container to another, equipment should be properly grounded and bonded to prevent the build up of static electricity. If discharged, this build up could create an igniting spark.
- Work areas where methyl chloride is used should be well ventilated to limit solvent vapors to below exposure limits and to limit the concentration of potentially flammable vapors.
- To avoid overexposure to methyl chloride vapors, monitor the vapor concentration in the work place. If vapors are above exposure limits, install additional engineering controls (such as localized ventilation) to reduce methyl chloride vapor concentrations to safe operating levels.
- To prevent eye contact, protective eye wear (such as splash goggles, a full face shield, or safety glasses with side shields) must be worn.
- To prevent skin contact, wear protective clothing (including glovescompatible with methyl chloride) when working with methyl chloride.
- Proper labeling, handling and storage of methyl chloride will reduce the likelihood of accidental exposure.
- Equipment used for methyl chloride storage or processing should be constructed of the proper materials. For example, bulk storage containers should be constructed of either mild carbon, or stainless steel. Do not use aluminum as a material of construction. Storage tanks should not be constructed of, nor contain, any non-compatible plastic components. Carbon steel is the material of choice for piping.
- Personnel involved with methyl chloride manufacturing operations should be properly trained.
- Further details related to Risk Management Measures are detailed in the Methyl Chloride Handbook referenced in 9 below

9. Product Stewardship Programs

Occidental Chemical Corporation provides technical bulletins and a Methyl Chloride Handbook to help methyl chloride customers handle the product safely. The following documents are located at http://www.oxy.com/OurBusinesses/Chemicals/Products/Pages/Chlorine-and-Derivatives.aspx:

Reaction of Methyl Chloride with Aluminum

Emission Control of Methyl Chloride Process Streams

Compressor Unloading of Methyl Chloride Tank Cars

Methyl Chloride Applications

Methyl Chloride Handbook

Storage and Handling Hazards

Storage and Handling Requirements

10. Regulatory Compliance Information

The following is a summary of regulations and guidelines that may pertain to methyl chloride (additional regulations and guidelines may apply):

Coast Guard, Department of Homeland Security:

- Requirements for Liquid Hazardous Materials: See 46 CFR 151.55-1(c) [special requirements for the materials of construction of equipment that may come into contact with various cargoes]
- Compatibility Groups: Group No. 36

Department of Homeland Security – Chemical Facility Anti-Terrorism Standards (CFATS):

- Release Minimum Concentrations: 1% Minimum Concentration
- Release STQs: 10,000 lb STQ
- Security Issues: Release Flammable

Department of Transportation (DOT):

- Hazardous Substances and Reportable Quantities: 100 lbs RQ (Chloromethane; Methane, chloro-)
- Emergency Response Guide (ERG) Number: 115

U.S. Environmental Protection Agency:

Clean Air Act:

- National Emissions Standards for Hazardous Air Pollutants: Listed as a hazardous air pollutant.
- Accidental Release Prevention – Toxic Substance: 10,000 lb threshold quantity.
- HON Rule – Oranic HAPS: Present (listed under Methylchloride): Group IV

- Volatile Organic Compounds (VOCs) in Synthetic Organic Chemicals Manufacturing Industry (SOCMI): Present

Clean Water Act:

- Listed as a Priority Pollutant
- Listed as a Toxic Pollutant (listed under Halomethanes)
- Total Toxic Organics for Electroplating Point Source Category
- Total Toxic Organics for Metal Finishing Point Source Category: 0.01 mg/L TTO

Comprehensive Environmental Response, Compensation, and Liability Act: CERCLA/SARA:

- Section 313 – Emission Reporting: 0.1% de minimis concentration
- Hazardous Substances and their Reportable Quantities (RQ): 1000 lb

Resource Conservation and Recovery Act (RCRA):

- U Series Wastes – Acutely Toxic Wastes & Other Hazardous Characteristics: U045 (ignitable waste, toxic waste)
- Basis for Listing – Appendix VII: Included in waste streams: F024, F025, F039, K009, K010, K149, K150, K157
- TSD Facilities Griound Water Monitoring: Present
- Hazardous Constituents – Appendix VII to 40 CFR 261(474): U045
- Phase 4 LDR Rule – Universal Treatment Standards: 0.19 mg/L wastewater; 30 mg/kg nonwastewater
- Halogenated Organic Compounds (HOCs): Category I – Volatiles
- List for Hazardous Constituents
- Constituents for Detection Monitoring

Safe Drinking Water Act:

- Contaminant Candidate List: Present
- Ten Day HA for 10-Kg Child: 0.4 mg/L
- One Day HA for 10-Kg Child: 9 mg/L

Toxic Substance Control Act (TSCA):

- Section 8(d) – 716.120(a) – Health and Safety Reporting: Effective 10/04/1982; Sunset 10/04/1992
- Section 4 – Chemical Test Rules (40 CFR 799): Sunset 07/30/1994

Occupational Safety and Health Administration - Permissible Exposure Limits:

- 8-hour time weighted average: 100 ppm
- Ceiling: 200 ppm
- Peak (5 minutes in any 3-hour period): 300 ppm

American Conference of Governmental Industrial Hygienists - Threshold Limit Values

- 8-hour time weighted average: 50 ppm
- Short Term (15-minute average): 100 ppm

National Institute for Occupational Safety and Health – Recommended Exposure Levels:

- Immediately Dangerous to Life and Health concentration: 2,000 ppm

11. Sources for Additional Information

ACGIH, Documentation of the Threshold Limit Values and Biological Exposure Indices, 6th ed., (1991), p. 953-957.

ATSDR, Toxicological Profile for Chloromethane, December 1998.

Clayton, G.D. and Clayton, F.E. (1994). Patty's Industrial Hygiene and Toxicology, 4th ed., John Wiley & Sons, Inc., pp. 4011 – 4021.

Grant, W. Morton (1986). Toxicology of the Eye, Clarence C. Thomas, Pub., pp. 612-613.

HSDB, Hazardous Substances Databank Number: 883, Last Revision Date: 20160519.

IARC (1987), IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Suppl. 7, Overall Evaluations of Carcinogenicity: An Updating of IARC Monographs Volumes 1-42, p. 246.

IARC (1986), IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Vol. 41, Some halogenated Hydrocarbons and Pesticide Exposures, pp. 161-186.

IARC (1999), IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Vol. 71, Re-evaluation of Some Organic Chemicals, Hydrazine and Hydrogen Peroxide, pp. 737-747.

IUCLID Dataset, Chloromethane, Substance ID: 74-87-3, February 19, 2000.

NIOSH, Methyl Chloride, IDLH Documentation, August 16, 1996.

Occidental Chemical Corporation SDS [Safety Data Sheet] web site:
http://www.oxy.com/OurBusinesses/Chemicals/Products/Pages/SDS.aspx

Reprotox, Reprotox Record Number: 1960, Last Revision Date: May 17, 2017.

RTECS, RTECS Number: PA6300000, Review Date: 201510.

12. Contact Information: For additional information, call 1-800-752-5151 or 1-972-404-3700.