METHYL CHLORIDE

1. Introduction

Methyl chloride [74-87-3] (chloromethane, monochloromethane), CH_3Cl, at ordinary temperatures and pressures is a colorless gas with a very mild odor and sweet taste. Millions of kilograms of methyl chloride are produced naturally every day, primarily in the oceans. Methyl chloride is handled commercially as a liquid. It is miscible with the principal organic solvents and only slightly soluble in water. The dry liquid is stable and noncorrosive; however, in the presence of moisture, the liquid slowly decomposes and becomes corrosive to metals, particularly aluminum, zinc, and magnesium. Gaseous methyl chloride is moderately flammable. Prolonged exposure to high concentrations of the vapor can produce severe toxic effects. Methyl chloride is used mainly in the manufacture of silicones, synthetic rubber, and as a general methylating agent. Impure methyl chloride was produced in the laboratory as early as 1835 by Dumas and Peligot, who heated wood spirit, ie, crude methyl alcohol, with a mixture of sulfuric acid and common salt. It was later made by Schiff and by Walker and Johnson by the reaction of phosphorus chlorides with methyl alcohol. One of the first preparations of pure methyl chloride was probably that of Groves in 1874. Groves passed hydrogen chloride into a boiling solution of zinc chloride in twice its weight of wood spirit. Berthelot obtained the compound by chlorinating methane.

During the last quarter of the nineteenth century, methyl chloride was manufactured on a small scale in Europe for use as a refrigerant and in the synthesis of dyes. Large-scale production began in the United States about 1920, chiefly to meet refrigerant requirements. Manufacture in the United Kingdom began in 1930. Production increased greatly after 1943 when methyl chloride was required as the starting material for methyl silicones and fluorinated refrigerants. After World War II, methyl chloride production in the United States increased more than tenfold and in the late 1980s was between 3.6 and 4.5×10^8 kg per year.

2. Physical and Chemical Properties

The physical properties of methyl chloride are listed in Table 1. Values for vapor pressure, density of liquid and saturated vapor, and enthalpy of liquid methyl chloride are given in Table 2 (1). Methyl chloride is the simplest chlorinated hydrocarbon. Dry methyl chloride in the absence of air does not decompose at an appreciable rate at temperatures approaching 400°C, even in contact with many metals. Thermal dissociation is virtually complete at 1400°C. Oxidative breakdown of the gas requires temperatures of several hundred degrees. Methyl chloride is decomposed by an open flame to give hydrogen chloride and carbon dioxide, with possible formation of small amounts of carbon monoxide and phosgene. The burning velocity of the simple chloroparaffins is inversely proportional to chlorine content (2). Methyl chloride has a burning velocity of 10.9 cm/s, whereas butyl chloride burns at 31.6 cm/s.

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Table 1. **Physical Properties of Methyl Chloride**

Property	Value
mol wt	50.49
mp, °C	−97.7
bp, °C at	
101.3 kPa[a]	−23.73
13.3 kPa[a]	−61.7
1.3 kPa[a]	−92.1
sp gr	
liq, 20/4°C	0.920
gas, 0°C, 101.3 kPa[a] (air = 1)	1.74
density, g/L[b]	2.3045
refractive index	
liq, −23.7°C	1.3712
gas, 25°C	1.0007
surface tension, mN/m (=dyn/cm)	
0°C	19.5
10°C	17.8
20°C	16.2
specific heat, liq, J/g[c]	
20°C	1.599
−15 to 30°C (av)	1.574
C_p, 25°C, 103.4 kPa[a]	0.199
C_v, 25°C	0.155
critical temperature, °C	143.1
critical pressure, kPa[a]	6679.2
critical density, g/cm^3	0.353
critical volume, cm^3/g	2.833
flash point (open cup), °C	−46
autoignition temperature, °C	632
flammability limits in air, vol%	10.7–17.4
combustion velocity, cm/s	10.9
diffusivity in air, 25°C, 101.3 kPa,[a] cm^2/s	0.105
coefficient of cubical expansion, liquid, −30 to 30°C (av)	0.00209
dielectric constant	
liq, −250°C	12.93
gas, 21°C	1.0109
dipole moment, C · m[d]	6.20×10^{-30}
heat of formation, ideal gas, 25°C, kJ/mol[c]	−81.92
free energy of formation, ideal gas, 25°C, kJ/mol[c]	−58.41
latent heat of fusion, J/g[c]	129.7
latent heat of evaporation at bp, J/g[c]	428.4
solubility of methyl chloride in water, 25°C g/100 g H_2O	0.48
solubility of water in methyl chloride, 25°C, g/100 g CH_3Cl	0.0725
solubility of methyl chloride gas, 20°C,	
101.3 kPa[a], mL/100 mL solvent	
benzene	4723
carbon tetrachloride	3756
glacial acetic acid	3679
absolute alcohol	3740

[a] To convert kPa to mm Hg, multiply by 7.5.
[b] At sea level, 45 ft latitude, 0°C, 101.3 kPa.[a]
[c] To convert J to cal, divide by 4.184.
[d] To convert C · m to debye, divide by 3.336×10^{-30}.

Table 2. **Temperature Dependence of Vapor Pressure, Density, and Enthalpy of Methyl Chloride**

Temperature, 0°C	Vapor pressure, kPa[a]	Density		Enthalpy, kJ/kg[b]		
		Liquid, g/mL	Satd vapor, m^3/kg	Satd liquid	Vaporization	Satd vapor
−60	15.6	1.0799	2.23	409.82	460.54	870.36
−50	28.0	1.0620	1.295	424.42	425.18	876.60
−40	47.4	1.0438	0.794	439.12	443.60	882.72
−30	76.7	1.0253	0.508	454.12	434.54	888.66
−20	118.8	1.0064	0.338	469.22	425.22	894.44
−10	177.2	0.9871	0.233	484.42	415.59	900.01
0	255.7	0.9674	0.1648	500.00	405.07	905.07
10	358.2	0.9472	0.1198	516.12	393.64	909.76
20	489.3	0.9264	0.0891	531.57	382.50	914.07
30	652.5	0.9049	0.0675	547.65	370.88	917.93
40	851.6	0.8826	0.0520	563.96	357.39	921.32
50	1092	0.8595	0.0480	580.39	343.90	924.29
60	1375	0.8353	0.0324	597.01	329.75	926.76

[a] To convert kPa to mm Hg, multiply by 7.5.
[b] To convert J to cal, divide by 4.184.

Methyl chloride breaks down to hydrogen chloride, hydrogen, and carbon when in contact with reduced nickel in the presence of excess hydrogen at 210°C (3). It is reduced to methane by heating with calcium hydride at 180°C (4). If the liquid is heated in the presence of moisture, slow hydrolysis to methanol and hydrogen chloride occurs below 100°C. Methyl chloride is readily hydrolyzed by boiling dilute sodium hydroxide solution. At 120°C and 620 kPa (90 psi) methyl chloride saturated with water decomposes at the rate of ca 1 g/100 mL H_2O per hour. A crystalline hydrate [20604-36-8], $CH_3Cl{\cdot}6H_2O$, is formed by subjecting water and methyl chloride to low temperatures. This system has been well studied (5). The quadruple point in the phase diagram is at 20.6°C and 506.9 kPa (5 atm).

Dry methyl chloride is unreactive with all common metals except the alkali and alkaline-earth metals, magnesium, zinc, and aluminum. In dry ether solution, methyl chloride reacts with sodium to yield ethane by the Wurtz synthesis:

$$2\ CH_3Cl + 2\ Na \longrightarrow CH_3CH_3 + 2\ NaCl$$

By the same reaction, methyl chloride can be condensed with higher chloroparaffins to give propane, butane, etc. Methyl chloride reacts with magnesium to form the Grignard reagent methylmagnesium chloride, CH_3MgCl, which has been applied to the synthesis of alcohols and to the preparation of intermediates for the formation of silicone polymers. The reaction with zinc is similar to that with magnesium. Dry methyl chloride vapor does not attack aluminum or its alloys at temperatures up to 60°C. In a damp atmosphere, the alloys, particularly those containing magnesium, are attacked. Reactions with aluminum catalyzed by aluminum chloride can take place with explosive violence.

Methyl chloride can be converted into methyl iodide or bromide by refluxing in acetone solution in the presence of sodium iodide or bromide. The reactivity of

methyl chloride and other aliphatic chlorides in substitution reactions can often be increased by using a small amount of sodium or potassium iodide as in the formation of methyl aryl ethers. Methyl chloride and potassium phthalimide do not readily react to give *N*-methylphthalimide unless potassium iodide is added. The reaction to form methylcellulose and the Williamson synthesis to give methyl ethers are catalyzed by small quantities of sodium or potassium iodide.

Methyl chloride reacts with ammonia alcoholic solution or in the vapor phase by the Hofmann reaction to form a mixture of the hydrochlorides of methylamine, dimethylamine, trimethylamine, and tetramethylammonium chloride. With tertiary amines, methyl chloride forms quaternary derivatives.

$$CH_3Cl + NR_3 \longrightarrow [R_3NCH_3]^+Cl^-$$

Methyl chloride, as a typical aliphatic chloride, may be used in the Friedel-Crafts reaction (qv):

$$CH_3Cl + C_6H_6 \xrightarrow{AlCl_3} C_6H_5CH_3 + HCl$$

Methylation of aromatic molecules can also be achieved in the vapor phase, over a solid catalyst.

When heated to very high temperatures, methyl chloride couples giving ethylene according to the reaction:

$$2\ CH_3Cl \longrightarrow CH_2{=}CH_2 + 2\ HCl$$

Catalytic reactions at somewhat lower temperatures also produce ethylene and other olefins. When coupled with a methane process to methyl chloride, this reaction results in a new route to the light hydrocarbons that is of considerable interest.

3. Manufacture

The two principal processes for the industrial production of methyl chloride are reaction of hydrogen chloride and methanol, and chlorination of methane. Several variants of both processes are used. Chlorination of methane yields other chlorinated hydrocarbons in substantial amounts; indeed, under certain conditions, methyl chloride may not be the principal product. Because the coproducts, eg, methylene chloride, chloroform, and carbon tetrachloride, are as commercially important as methyl chloride, methane chlorination can be regarded as a multiple product process rather than one with several by-products. The methanol–hydrogen chloride reaction yields methyl chloride as the main product with small amounts of dimethyl ether as the only by-product. It is commercially carried out in both liquid-phase and gas-phase processes. Hydrogen chloride is often the determining factor in choosing the best route to produce methyl chloride. The chlorination route produces HCl while the hydrochlorination route consumes HCl. The separation of unreacted methane and hydrogen chloride by-product

in the chlorination process is most easily, and most often, done by absorbing the HCl in water. If there is a sufficiently large use for aqueous HCl, this process is viable to make methyl chloride on an industrial scale. Solvay describes a process whereby the methane and hydrogen chloride are separated without the use of water (6). The methanol hydrochlorination process is a user of either anhydrous HCl or aqueous hydrochloric acid. The liquid-phase process can use either form of hydrogen chloride. If anhydrous HCl is available, the gas-phase hydrochlorination process is viable. Dimethyl ether produced in both hydrochlorination processes can easily be recovered as methyl chloride by a catalytic, gas-phase process.

Thermal chlorination of methane was first put on an industrial scale by Hoechst in Germany in 1923. At that time, high pressure methanol synthesis from hydrogen and carbon monoxide provided a new source of methanol for production of methyl chloride by reaction with hydrogen chloride. Prior to 1914 attempts were made to establish an industrial process for methanol by hydrolysis of methyl chloride obtained by chlorinating methane.

3.1. Chlorination of Methane. Methane can be chlorinated thermally, photochemically, or catalytically. Thermal chlorination, the most difficult method, may be carried out in the absence of light or catalysts. It is a free-radical chain reaction limited by the presence of oxygen and other free-radical inhibitors. The first step in the reaction is the thermal dissociation of the chlorine molecules for which the activation energy is about 84 kJ/mol (20 kcal/mol), which is 33 kJ (8 kcal) higher than for catalytic chlorination. This dissociation occurs sufficiently rapidly in the 400 to 500°C temperature range. The chlorine atoms react with methane to form hydrogen chloride and a methyl radical. The methyl radical in turn reacts with a chlorine molecule to form methyl chloride and another chlorine atom that can continue the reaction. The methane raw material may be natural gas, coke oven gas, or gas from petroleum refining.

In a typical thermal chlorination process, the chlorine–methane mixture, with an excess of methane, is fed to a reactor where it mixes with gas previously subjected to reaction. By regulating the chlorine gas flow rate and, consequently, the heat produced by the chlorination reaction, the temperature is maintained at 400–500°C. The gas from the reactor is cooled and the hydrogen chloride removed by water washing in a packed tower. Hydrochloric acid thus obtained is generally commercially salable and is, therefore, advantageous to the economics of the process. Finally, the product gas is scrubbed with caustic liquor, dried by refrigeration, and further cooled to effect its liquefaction. Uncondensed methane is returned to the reactor. The liquefied gas is then fractionally distilled. On fractionation, a typical reaction product yields 35 wt % methyl chloride, 45 wt % methylene chloride, and 20 wt % chloroform plus a small amount of carbon tetrachloride. The relative amounts of these components can be changed by varying the reaction conditions. Solvay (6) suggests using cold, recycled liquid products to absorb the HCl. The noncondensable methane is then recycled back to the reactor. The HCl-containing products are then subjected to sequential distillations. The elimination of water greatly simplifies this process.

Variants of the methane chlorination route are the Hoechst method (7), in which a small quantity of oxygen is present; and a method (8) which uses sulfur monochloride either as catalyst or as the solvent in which the reaction takes

place (9). Chlorination of methane to methyl chloride has been effected in a ternary melt of potassium-, cuprous-, and cupric chlorides at 425–500°C and in a fluidized bed of alumina gel impregnated with a potassium chloride–copper chloride melt; both methods produce approximately the same product mixture of methyl chloride and higher chlorohydrocarbons (10). The McBee-Hass technique of controlled high temperature chlorination (11) can be used to vary ratios of the chloromethanes in the product from almost 100% methyl chloride to carbon tetrachloride exclusively. High selectivities to methyl chloride can be obtained catalytically (12,13) or photochemically (14). Methyl chloride can be coproduced with other products. Mitsubishi (15) describes a high temperature process using ammonium chlorite instead of chlorine, coproducing methyl chloride and ammonia. Processes for the coproduction of trichloroethylene (16) or 1,1,2-trichloroethane (17) with methyl chloride have also been developed.

3.2. Methanol–Hydrogen Chloride Reaction. *Liquid Phase.* The methyl chloride process with the widest use in the United States is the liquid-phase methanol hydrochlorination process. Silicone producers use methyl chloride in its manufacture and produce an aqueous hydrochloric acid stream as a by-product. This by-product HCl is converted back to methyl chloride by hydrochlorination. In fact, it is possible to produce methyl chloride directly from the chloromethylsilane hydrolysis step in the silicone process (18,19) (see SILICON COMPOUNDS, SILICONES).

Liquid mixtures of methanol and hydrochloric acid slowly yield methyl chloride even at 0°C (20,21), The typical process is carried out by contacting the alcohol with hydrochloric acid at 70 to 160°C and 0.1–1 MPa (15–150 psig) in the presence of a catalyst such as zinc chloride, quaternary amines (18,19,22), or with no catalyst at all (23,24). Typically 0.5 to 3% of the methanol is converted to dimethyl ether. Product methyl chloride is taken out of the reactor as a vapor and is cooled to condense as much of the water vapor and HCl as possible. Dimethyl ether and the residual water is then removed and the finished methyl chloride is condensed.

Gas Phase. The gas-phase methanol hydrochlorination process is used more in Europe and Japan than in the United States, though there is a considerable body of literature available. The process is typically carried out as follows: vaporized methanol and hydrogen chloride, mixed in equimolar proportions, are preheated to 180–200°C. Reaction occurs on passage through a converter packed with 1.68–2.38 mm (8–12 mesh) alumina gel at ca 350°C. The product gas is cooled, water-scrubbed, and liquefied. Conversions of over 95% of the methanol are commonly obtained. Gamma-alumina has been used as a catalyst at 295–340°C to obtain 97.8% yields of methyl chloride (25). Other catalysts may be used, eg, cuprous or zinc chloride on active alumina, carbon, silica, or pumice (26–30); silica–aluminas (31,32); zeolites (33); attapulgus clay (34); or carbon (35,36). Space velocities of up to300 h^{-1}, with volumes of gas at STP per hour per volume catalyst space, are employed.

A process for manufacturing methyl chloride has been reported that consists essentially of contacting hydrogen chloride with at least a stoichiometric amount of methanol split into at least two portions with a first portion comprising about 60 to 95% of the methanol added to the process in the presence of a first liquid medium at a temperature in the range of about 115°C to 170°C to form a

gaseous mixture containing methyl chloride, and contacting the gaseous mixture with a second methanol portion and adding to a second liquid medium at a temperature in the range of about 100°C to 160°C, and recovering the methyl chloride (37).

3.3. Other Reactions Producing Methyl Chloride. Many other reactions lead to the formation of methyl chloride; some have been proposed as the bases of industrial processes. The most notable of these is methane oxychlorination. A number of patents were obtained by Lummus in the mid- to late 1970s on a higher temperature, molten salt oxychlorination process (38). Catalyst development work has continued and generally consists of mixtures of Cu, Ni, Cr, or Fe promoted with an alkali chloride (39–42). However, there are no industrial examples of the process at this time. Good yields of methyl chloride are obtained in the reaction of dimethyl ether with hydrogen chloride in the presence of water at about 80–240°C and under sufficient pressure to maintain the water as a liquid. Dimethyl ether for this process is obtained as a by-product from methanol hydrochlorination or as a waste from methylcellulose manufacture (43). A process for the preparation of methyl chloride from carbon monoxide, hydrogen, and a halogen source such as hydrogen chloride or chlorine has been patented (44–47). Dimethyl sulfate reacts with aluminum chloride at ordinary temperature or with sodium chloride at elevated temperature to give methyl chloride (48,49). Some methyl chloride results when monochlorodimethyl ether is decomposed with zinc (50). Methane, heated with phosgene at 400°C, is chlorinated to methyl chloride (51) as follows:

$$CH_4 + COCl_2 \longrightarrow CH_3Cl + CO + HCl$$

Methanol, heated at 250°C with chloroform or carbon tetrachloride in contact with active carbon, is converted in part to methyl chloride (52). Methyl chloride has been produced from methoxymagnesium chloride, CH_3OMgCl, a by-product from the manufacture of certain organo–silicon compounds, by heating over 200°C (53).

4. Shipment and Handling

All persons who have occasion to use or handle methyl chloride should be thoroughly instructed and adequately supervised in the proper methods of handling the substance to prevent or minimize exposure to the liquid or its vapors and in the proper methods of disposing of this chemical.

Methyl chloride is transported and stored as liquefied gas under pressure in cylinders, tank trucks, and tank cars. The usual cylinder capacities in the United States are 43.56 and 63.5 kg and 1 t. Cylinders may be fitted with either a short curved or long straight dip-pipe for dispensing liquid methyl chloride. Valves are normally steel and are fitted with a lead or compressed asbestos–fiber outlet washer. Teflon or Viton (for vapor service only) are recommended for gasket material. To allow for liquid expansion in the cylinders, the weight of methyl chloride contained is limited to 83% of the weight of water, which would completely fill the cylinder at 40°C, or 78% of that weight at 65°C, assuming equal

coefficients of expansion. The latter limit is observed when the full cylinders will be subjected to tropical temperatures. Similar filling ratios are employed for other containers. Contact with zinc, aluminum, magnesium, and die castings should be prevented.

Methyl chloride can be supplied in horizontal cylinders of 544–590 kg capacity with valves similar to those mentioned above. Methyl chloride tank cars in the United States have a capacity of 18.1 or 35.4 metric tons and tank cars are usually fitted with four valves grouped together on a manhole cover under a removable protective dome. Two of these valves connect with dip-pipes extending to the bottom of the tank; the remaining two are connected, respectively, to a pressure gauge and to the pressure-balancing pipe for use during the transfer of methyl chloride to storage vessels.

When in use, cylinders of methyl chloride are stacked valve downwards on a suitable stand and connected to the consuming plant by an adapter. To obtain all the methyl chloride, a cylinder may be heated by steam jet or by wrapping with an electric-strip resistance heater controlled to a maximum temperature of 50°C. Compressed nitrogen or natural gas can be used to maintain the flow to the receiving vessel when transferring methyl chloride from a tank car or tank truck; compressed air must never be employed for this purpose. The pipe system carrying methyl chloride should be grounded as a precaution against ignition by static electrical discharge. Liquid trapped between closed valves after methyl chloride has been discharged could expand and burst a joint in the line. To prevent this, the valve at the discharging vessel should be closed first; after the pressure has fallen, the valve at the discharge end of the line can be closed. Fusible safety plugs fitted to tanks and other vessels containing methyl chloride under pressure are customary in the United States. Leakage of methyl chloride from plant or storage vessels must not be investigated by means of a halide lamp; in most instances a leak can be readily located by application of soap solution as the escaping gas forms observable bubbles.

5. Economic Aspects

Table 3 gives information on U.S. producers of methyl chloride and their capacities. Commercial production is by the reaction of methanol and hydrogen chloride. Capacities are flexible as other chloromethanes can be produced in the same equipment (54).

Table 3. **U.S. Methyl Chloride Producers**[a]

Producer	Capacity, 10^3 t/yr (10^6 lb/yr)
The Dow Chemical Company, Freeport, Tex.	68.0 (150)
The Dow Chemical Company, Plaquemine, La.	68.0 (150)
Vulcan, Geismar, La.	45.3 (100)
Vulcan, Wichita, Kans.	61.2 (135)
Total	242.5 (535)

[a]Ref. 54.

Although chlorinated organic chemicals have been under pressure from government regulations, methyl chloide is an important chemical of the group. Methyl chloride's main use is as an intermediate for silicone derivatives. Since methyl chloride is used an intermediate, environmental concerns are minimal compared to some of the other chloromethanes and chlorinated solvents (54).

The historical growth rate (1994–1999) for methyl chloride is 3.5% per year. The projected growth rate through 2003 is 3.0% per year. Demand in 1999 was 322,000 t, the projected demand for 2003 is 362,000 t. Demand equals production plus imports (1999, 500 t) less exports (1999, 7900 t).

5.1. Process. For the period 1994–1999, the high price was \$0.175/kg (\$0.385/lb) and the low was \$0.127/kg (\$0.28/lb) both basis, industrial bulk, tanks, works.

6. Standards

A representative technical grade of methyl chloride contains not more than the following indicated quantities in ppm of impurities: water, 100; acid, such as HCl, 10; methyl ether, 20; methanol, 50; acetone, 50; residue, 100. No free chlorine should be detectable. Traces of higher chlorides are generally present in methyl chloride produced by chlorination of methane. The boiling point should be between −24 and −23°C, and 5–95% should distill within a range of about 0.2°C. It should be clear, colorless, and free from visible impurities.

7. Analytical Methods

The most widely used method of analysis for methyl chloride is gas chromatography. A capillary column medium that does a very good job in separating most chlorinated hydrocarbons is methyl silicone or methyl (5% phenyl) silicone. The detector of choice is a flame ionization detector. Typical molar response factors for the chlorinated methanes are methyl chloride, 2.05; methylene chloride, 2.2; chloroform, 2.8; carbon tetrachloride, 3.1, where methane is defined as having a molar response factor of 2.00. Most two-carbon chlorinated hydrocarbons have a molar response factor of about 1.0 on the same basis.

There is no specific color or other reaction by which methyl chloride can be detected or identified. Quality testing of methyl chloride for appearance, water content, acidity, nonvolatile residue, residual odor, methanol, and acetone is routinely done by production laboratories. Water content is determined with Karl Fischer reagent using the apparatus by Kieselbach (55). Acidity is determined by titration with alcoholic sodium hydroxide solution. The nonvolatile residue, consisting of oil or waxy material, is determined by evaporating a sample of the methyl chloride at room temperature. The residue is examined after evaporation for the presence of odor. Methanol and acetone content are determined by gas chromatography.

8. Health and Safety Factors

Methyl chloride is one of the more toxic of the chlorinated hydrocarbons, and there is no adequate warning of the presence of harmful concentrations. The delay in the development of symptoms is characteristic of the toxic effect of methyl chloride. The signs and symptoms of intoxication may not develop for several hours after termination of exposure and may become progressively worse for several days before improvement begins or death occurs. Repeated exposure to low concentrations damages the central nervous system, and, less frequently, the liver, kidneys, bone marrow, and cardiovascular system (56). Methyl chloride intoxication causes headache, blurred vision, loss of coordination, and reversible personality change involving moroseness, depression, and anxiety. Routine urine and blood tests have no diagnostic value (57). Massive methyl chloride inhalation has produced myocardial damage (58). Daily exposure to concentrations of 500 ppm is extremely dangerous, even for a period of two weeks or less (59). The OSHA personal exposure level guideline and the ACGIH TLV are 50 ppm; STEL 100 ppm (56). Methyl Chloride is a flammable gas and a very dangerous fire hazard when exposed to heat, flame, or powerful oxidizers (56).

9. Environmental Concerned and Regulations

Methyl chloride as well as the other chlorinated methanes are heavily regulated at the national, state, and local level. The manufacturing, storage, and disposal of methyl chloride may be regulated. Methyl chloride is reportable under SARA 312 (inventory) and 313 (emissions). In addition, the nonpermitted release of methyl chloride is reportable at a 100 pound (45.5 kg) quantity under CERCLA. Finally, fugitive monitoring regulations and programs may apply to individual facilities. The discharge of methyl chloride to the waterways may be regulated under OCPSF guidelines or other permitted parameters. Disposal of methyl chloride and methyl chloride-containing wastes may be regulated under RCRA as a listed discarded commercial chemical (U045) or a characteristically hazardous waste. The potential exposure to methyl chloride by workers may be regulated by OSHA or the state Industrial Hygiene Department. In addition, various state and local regulations may impose other reporting and regulatory standards. Contacting the Environmental or Regulatory Compliance Department before importing, purchasing, selling, using, or disposing of methyl chloride is strongly recommended.

10. Uses

Methyl chloride uses break down into the following categories: intermediates for silicons (89%); methyl cellulose ethers (3%); quaternary ammonium compounds (3%), herbicides (2%); butyl rubber (1%); and miscellaneous uses (2%) (54).

Most methyl chloride is used as an intermediate feedstock in silicone fluids, elastomers, and resins. Silicon fluids are used in processing aids, such as surfactants, release agents, and lubricants. They are also used in cosmetics, polishes,

paper coating, and in electrical, pharmaceutical, and medicinal applications. Silicone elastomers are used by the construction industry in sealants and adhesives. Silicone resins are used in high-temperature duty and weather resistant coatings (54).

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