

# Safety Data Sheet

# Chloroform

Division of Safety  
National Institutes  
of Health



## WARNING!

THIS COMPOUND IS ABSORBED THROUGH THE SKIN AND THE RESPIRATORY AND INTESTINAL TRACTS. IT IS CARCINOGENIC AND TERATOGENIC. IT MAY IRRITATE TISSUES. AVOID FORMATION AND BREATHING OF AEROSOLS OR VAPORS.

LABORATORY OPERATIONS SHOULD BE CONDUCTED IN A FUME HOOD, GLOVE BOX, OR VENTILATED CABINET.

AVOID SKIN CONTACT: IF EXPOSED, WASH WITH SOAP AND WATER. AVOID WASHING THE SKIN WITH SOLVENTS AND ELEVATING ITS TEMPERATURE.

FOR EYE EXPOSURE, IRRIGATE IMMEDIATELY WITH LARGE AMOUNTS OF WATER. FOR INGESTION, DRINK PLENTY OF WATER. INDUCE VOMITING OR REFER FOR GASTRIC LAVAGE. FOR INHALATION, REMOVE VICTIM PROMPTLY TO CLEAN AIR. ADMINISTER RESCUE BREATHING IF NECESSARY. REFER TO PHYSICIAN.

IN CASE OF LABORATORY SPILL, WEAR PROTECTIVE CLOTHING DURING CLEANUP. AVOID SKIN CONTACT OR BREATHING OF AEROSOLS OR VAPORS. USE ABSORBENT PAPER TO MOP UP SPILL. AFTER THE RESIDUE HAS EVAPORATED, WASH DOWN AREA WITH SOAP AND WATER. DISPOSE OF WASTE SOLUTIONS AND MATERIALS APPROPRIATELY.

### A. Background

Chloroform is a colorless, clear, volatile liquid with an ether-like odor. It is readily absorbed through skin, from the gastrointestinal tract, and by inhalation and is moderately toxic by these routes. Eye and skin exposure may produce irritation. It is weakly carcinogenic

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in rodents on chronic ingestion, with target organs being liver and kidney. Its major industrial use is for the production of chlorodifluoromethane (refrigerant); other uses are as a solvent, heat transfer medium, pesticide, and soil fumigant.

### Chemical and Physical Data

1. Chemical Abstract No.: 67-66-3
2. Synonyms:

Methane trichloride	Trichloroform
Methenyl trichloride	Methane, trichloro (9CI)
Methyl trichloride	Trichlormethane
3. Molecular formula:  $\text{CHCl}_3$  structure:  $\text{CHCl}_3$   
weight: 119.38
4. Density:  $1.484 \text{ g/cm}^3$ ; vapor density, 4.13 g/l.
5. Absorption spectroscopy: UV absorption below 200 nm for vapor. Data for IR, UV, NMR, and MS spectra are listed by Grasselli and Ritchey (1975).
6. Volatility: Vapor pressure = 159.6 mm Hg at 20°C. (For values at other temperatures, see pp. D-174 and D-189 in Weast, 1981.)
7. Solubility: 1 g/100 ml of water at 15°C; miscible with ethanol, ether, benzene, carbon tetrachloride, carbon disulfide, and other organic solvents.
8. Description, appearance, and odor: Colorless, nonflammable, volatile, mobile liquid with pleasant ether-like, nonirritating odor.
9. Boiling point: 61.3°C.  
Melting point: -63.2°C.
10. Stability: Slowly decomposes on prolonged exposure to sunlight or air with formation of phosgene, hydrogen chloride, chlorine, carbon dioxide, and water. ("Reagent grade" chloroform usually contains 0.75% ethanol as stabilizer.)
11. Chemical reactivity: Oxidized by chromic acid to phosgene and chlorine. Pyrolyzed at 450°C. Reacts with halogens and halo-

generating agents to yield a variety of compounds. Forms isonitriles with primary amines in alcoholic alkaline solution.

12. Flash point: None.
13. Autoignition temperature: No data.
14. Explosive limits in air: None.

#### Fire, Explosion, and Reactivity Hazard Data

1. Chloroform does not require special fire-fighting procedures or equipment. Fire-fighting personnel should wear air-supplied respirators with full-face masks.
2. Chloroform is nonflammable but produces toxic products in contact with flames or hot surfaces.
3. No incompatibilities are known.
4. Hazardous decomposition products include phosgene, chlorine, and hydrochloric acid.
5. Nonspark equipment is not required. When handled in flammable solvents, the precautions required for such solvents apply.

#### Operational Procedures

The NIH Guidelines for the Laboratory Use of Chemical Carcinogens describe operational practices to be followed when potentially carcinogenic chemicals are used in NIH laboratories. The Guidelines should be consulted to identify the proper use conditions required and specific controls to be implemented during normal and complex operations or manipulations involving chloroform.

Chloroform penetrates several glove materials readily (Sansone and Tewari, 1978). This factor should be taken into account when handling chloroform.

1. Chemical inactivation: No validated method reported.
2. Decontamination: Turn off equipment that could be affected by chloroform or the materials used for cleanup. If more than 100 ml has been spilled or if there is any uncertainty regarding the procedures to be followed for decontamination, call the NIH Fire Department (dial 116) for assistance. Use absorbent paper to mop up spill. After the residue has evaporated, wash surfaces with copious quantities of water. Glassware should be rinsed (in a hood) with acetone, followed by soap and water. Animal cages should be washed with water.
3. Disposal: No waste streams containing chloroform shall be disposed of in sinks or general refuse. Surplus chloroform or

chemical waste streams contaminated with chloroform shall be handled as hazardous chemical waste and disposed of in accordance with the NIH chemical waste disposal system. Nonchemical waste (e.g., animal carcasses and bedding) containing chloroform shall be handled and packaged for incineration in accordance with the NIH medical-pathological waste disposal system. Potentially infectious waste (e.g., tissue cultures) containing chloroform shall be packaged for incineration, as above. Burnable waste (e.g., absorbent bench top liners) minimally contaminated with chloroform shall be handled as potentially infectious waste and packaged for incineration, as above. Absorbent materials (e.g., associated with spill cleanup) grossly contaminated shall be handled in accordance with the chemical waste disposal system. Radioactive waste containing chloroform shall be handled in accordance with the NIH radioactive waste disposal system.

4. Storage: Store in sealed ampoules or amber screw-capped bottles (or vials) with Teflon cap liners, preferably under refrigeration. Avoid unnecessary exposure to sunlight and moisture.

#### Monitoring and Measurement Procedures Including Direct Field Measurements and Sampling for Subsequent Laboratory Analysis

1. Sampling: For air samples, the recommended method is adsorption on charcoal (NIOSH, 1977) in glass or stainless steel tubes and desorption with carbon disulfide or by heat. Silica gel and porous polymer packings (Tenax, Chromosorbs, Porapak Q) have also been used as adsorbents. Impingers containing m-xylene or pyridine have also been used. Water sampling may be accomplished by adsorption on charcoal or purging from water samples with nitrogen (Kloepfer, 1976).
2. Separation and analysis: The preferred method is GC equipped with a flame ionization detector (detection limit, 0.1 mg/sample) (NIOSH, 1974); an electron capture detector (detection range, 30-130 ppt in air) has also been used (Russell and Shadoff, 1977). GC/FID has been used in the determination of chloroform in blood (Poobalasingam, 1976). A portable IR analyzer for use in monitoring industrial operations, with detection limits below 1 ppm, has been described (Golding, 1974). Colorimetric methods (color formation with alkaline pyridine) are easy to use but are not specific for chloroform (positive reaction also with other halocarbons).

#### Biological Effects (Animal and Human)

1. Absorption: Chloroform is readily absorbed through human and animal skin, lungs, and gastrointestinal tract.
2. Distribution: Radioactivity due to inhalation of labeled chloroform by mice is found (in decreasing order of concentration) in fat, liver, kidney, lung, muscle, blood, and brain (Cohen and Hood, 1969).

3. Metabolism and excretion:  $^{13}\text{C}$ -Chloroform administered orally to humans is mostly exhaled unchanged (up to 68%) and as  $^{13}\text{C}\text{-CO}_2$  (up to 50%) (Fry et al., 1972). Some is metabolized to yield urinary chloride ion and monochloromethyl and dichloromethyl derivatives. In rats, intraperitoneal injection of chloroform also results in a small elevation of carbon monoxide levels in blood. A metabolic scheme has been proposed according to which chloroform is first oxidized to phosgene (believed to be the cause of its hepatotoxicity), which forms a compound with cysteine, followed by further oxidation to carbon monoxide and dioxide (Stevens and Anders, 1981a, 1981b).
4. Toxic effects: Acute LD50 (rat, oral) is 2,000 mg/kg. Target organs in humans and animals are the central nervous system (depression of nervous function, dilation of pupils, respiratory depression leading to arrest), cardiovascular system (hypotension, cardiac arrhythmia in humans), and liver and kidney (fatty infiltration and necrosis). Topical application to eyes and skin results in irritation, erythema, and hyperemia with stinging or burning sensation (Von Oettingen, 1964).
5. Carcinogenic effects: Hepatomas have been produced in mice and mixed kidney tumors in rats on oral administration over periods of many months.
6. Mutagenic and teratogenic effects: There is no evidence for mutagenicity of chloroform. Teratogenic effects have been observed in rats on inhalation (though not on oral administration) during the latter stages of gestation.

#### G. Emergency Treatment

1. Skin and eye exposure: For skin exposure, remove contaminated clothing and wash with soap and water. Since chloroform is readily absorbed through the skin, avoid organic solvents and elevated temperatures. For eye exposure, irrigate immediately with copious quantities of running water for at least 15 minutes.
2. Ingestion: Drink plenty of water. Induce vomiting or refer for gastric lavage.
3. Inhalation: Remove victim promptly to clean air. Administer rescue breathing if necessary.
4. Refer to physician. Consider treatment for pulmonary irritation.

#### H. References

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