

CHLORODIPHENYL

See "Polychlorinated Biphenyls (PCB's)."

2-CHLOROETHYL VINYL ETHER

- Hazardous waste (EPA)
- Priority toxic pollutant (EPA)

Description: $\text{ClCH}_2\text{CH}_2\text{OCH}=\text{CH}_2$ is a colorless liquid boiling at 109°C .

Code Numbers: CAS 110-75-8 RTECS KN6300000

DOT Designation: —

Synonym: Vinyl 2-chloroethyl ether.

Potential Exposures: The compound finds use in the manufacture of anesthetics, sedatives, and cellulose ethers. NIOSH estimates annual exposure at 23,500 workers. The number of potentially exposed individuals is greatest for the following areas: fabricated metal products; wholesale trade; leather, rubber and plastic, and chemical products (1).

Permissible Exposure Limits in Air: No standards set.

Permissible Concentration in Water: For the protection of freshwater aquatic life: $50,000 \mu\text{g}/\text{l}$ (2). No criteria were developed for saltwater aquatic life or for the protection of human health.

Determination in Water: Inert gas purge followed by gas chromatography with halide specific detection (EPA Method 601) or gas chromatography plus mass spectrometry (EPA Method 624).

Harmful Effects and Symptoms: Very little toxicological data for 2-chloroethyl vinyl ether is available. The oral LD_{50} for 2-chloroethyl vinyl ether in rats is $250 \text{ mg}/\text{kg}$ (moderately toxic). Primary skin irritation and eye irritation studies have also been conducted for 2-chloroethyl vinyl ether. Dermal exposure to undiluted 2-chloroethyl vinyl ether did not cause even slight erythema. Application of undiluted 2-chloroethyl vinyl ether to the eyes of rabbits resulted in severe eye injury.

References

- (1) U.S. Environmental Protection Agency, *2-Chloroethyl Vinyl Ether*, Health and Environmental Effects Profile No. 46, Office of Solid Waste, Washington, DC (April 30, 1980).
- (2) U.S. Environmental Protection Agency, *Chloroalkyl Ethers: Ambient Water Quality Criteria*, Washington, DC (1980).

CHLOROFORM

- Carcinogen (Animal Suspected, IARC) (6)
- Hazardous substance (EPA)
- Hazardous waste (EPA)
- Priority toxic pollutant (EPA)

Description: CHCl_3 , chloroform, is a clear, colorless liquid with a characteristic odor. Though nonflammable, chloroform decomposes to form hydrochloric acid, phosgene, and chlorine upon contact with a flame.

Code Numbers: CAS 67-66-3 RTECS FS9100000 UN 1888

DOT Designation: ORM-A, poison.

Synonym: Trichloromethane.

Potential Exposures: Chloroform was one of the earliest general anesthetics, but its use for this purpose has been abandoned because of toxic effects. Chloroform is widely used as a solvent (especially in the lacquer industry); in the extraction and purification of penicillin and other pharmaceuticals; in the manufacture of artificial silk, plastics, floor polishes, and fluorocarbons; and in sterilization of catgut. The wide industrial usage of chloroform potentially exposes 360,000 workers (OSHA). Chemists and support workers as well as hospital workers are believed to be at a higher risk than the general population.

Chloroform is widely distributed in the atmosphere and water (including municipal drinking water primarily as a consequence of chlorination). A survey of 80 American cities by EPA found chloroform in every water system in levels ranging from <0.3 to 311 ppb.

Incompatibilities: Strong caustics, chemically active metals such as aluminum, magnesium powder, sodium, potassium.

Permissible Exposure Limits in Air: The Federal standard is 50 ppm (240 mg/m^3). The ACGIH recommended 1976 TLV was 25 ppm. NIOSH's recommended limit is a ceiling of 2 ppm based on a one-hour sample collected at 750 ℓ/min . ACGIH (1983/84) has set 10 ppm (50 mg/m^3) as a TWA with the notation that chloroform is an "Industrial Substance Suspect of Carcinogenic Potential for Man." The STEL value is 50 ppm (225 mg/m^3). The IDLH value is 1,000 ppm.

Determination in Air: Charcoal adsorption, workup with CS_2 , analysis by gas chromatography. See NIOSH Methods, Set J. See also reference (A-10).

Permissible Concentration in Water: To protect freshwater aquatic life: 28,900 $\mu\text{g}/\ell$ on an acute basis and 1,240 $\mu\text{g}/\ell$ on a chronic basis. To protect saltwater aquatic life: no value set due to insufficient data. To protect human health: preferably zero. An additional lifetime cancer risk of 1 in 100,000 results at a level of 1.9 $\mu\text{g}/\ell$.

Determination in Water: Gas chromatography (EPA Method 601) or gas chromatography plus mass spectrometry (EPA Method 624).

Routes of Entry: Inhalation of vapors, ingestion, skin and eye contact.

Harmful Effects and Symptoms: *Local* – Chloroform may produce burns if left in contact with the skin.

Systemic – Chloroform is a relatively potent anesthetic at high concentrations. Death from its use as an anesthetic has resulted from liver damage and from cardiac arrest. Exposure may cause lassitude, digestive disturbance, dizziness, mental dullness, and coma. Chronic overexposure has been shown to cause enlargement of the liver and kidney damage. Alcoholics seem to be affected sooner and more severely from chloroform exposure. Disturbance of the liver is more characteristic of exposure than central nervous system depression or renal injury. There is animal experimental evidence that indicates chloroform is a carcinogen.

Chloroform
oral administration
mice, male
female rats
sterilized oral

Points of

Medical
include appropriate
should be given
ism. Expiration
exposure.

First Aid
chemical contact
large amount
and perform
medical attention
not make an

Personal
reasonable
reasonable
skin is wet
or contaminated

Respiratory
500 ppm
1,000 ppm
Esc

Disposal
other combustion
to prevent the
the halo acids
Where possible
to the supplier

References

- (1) National Institute of Standards and Technology, Washington, D.C.
- (2) National Institute of Standards and Technology, No. 9-C1
- (3) U.S. Environmental Protection Agency, Washington, D.C.
- (4) National Academy of Sciences, Washington, D.C.
- (5) U.S. Environmental Protection Agency, Health Effects Research Laboratory, Research Triangle Park, N.C.
- (6) International Agency for Research on Cancer, Lyon, France.
- (7) See Reference (1)
- (8) Sax, N.I., Ed., *Handbook of Hazardous Materials*, New York, N.Y., Wiley-Interscience, 1974.
- (9) See Reference (1)
- (10) Sax, N.I., Ed., *Handbook of Hazardous Materials*, New York, N.Y., Wiley-Interscience, 1974.

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to form hydro-

eral anesthetics,
effects. Chloro-
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facture of carbon
disulfide; and in
the potentially ex-
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pitalization.

form (including
chloroform). A survey
of chloroform in levels

such as alu-

100 ppm (240
mg/m³) is recom-
mended. Levels
collected at
work with the no-
n-carcinogenic Po-
tential (TLV) value is

analysis by
gas chromatography

to protect
human health
at 100,000

liquid or gas

to protect

burns if

concentra-

tion and

irritation

to cause

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of the liver

or

formation

Chloroform was tested in three experiments in mice and in one in rats by oral administration. It produced hepatomas and hepatocellular carcinomas in mice, malignant kidney tumours in male rats and tumours of the thyroid in female rats. In another series of experiments in male mice chloroform administered orally produced benign and malignant kidney tumours (9).

Points of Attack: Liver, kidneys, heart, eyes, skin.

Medical Surveillance: Preplacement and periodic examinations should include appropriate tests for liver and kidney functions, and special attention should be given to the nervous system, the skin, and to any history of alcoholism. Expired air and blood levels may be useful in estimating levels of acute exposure.

First Aid: If this chemical gets into the eyes, irrigate immediately. If this chemical contacts the skin, wash with soap promptly. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration. When this chemical has been swallowed, get medical attention. Give large quantities of salt water and induce vomiting. Do not make an unconscious person vomit.

Personal Protective Methods: Wear appropriate clothing to prevent any reasonable probability of skin contact. Wear eye protection to prevent any reasonable probability of eye contact. Employees should wash promptly when skin is wet or contaminated. Remove nonimpervious clothing promptly if wet or contaminated.

Respirator Selection:

500 ppm: SA/SCBA

1,000 ppm: SAF/SCBAF

Escape: GMOV/SCBA

Disposal Method Suggested: Incineration, preferably after mixing with another combustible fuel. Care must be exercised to assure complete combustion to prevent the formation of phosgene. An acid scrubber is necessary to remove the halo acids produced.

Where possible it should be recovered, purified by distillation, and returned to the supplier.

References

- (1) National Institute for Occupational Safety and Health, *Criteria for a Recommended Standard: Occupational Exposure to Chloroform*, NIOSH Document No. 75-114, Washington, DC (1975).
- (2) National Institute for Occupational Safety and Health, *Current Intelligence Bulletin No. 9—Chloroform*, Washington, DC (1976).
- (3) U.S. Environmental Protection Agency, *Chloroform: Ambient Water Quality Criteria*, Washington, DC (1980).
- (4) National Academy of Sciences, *Chloroform, Carbon Tetrachloride and Other Halomethanes: An Environmental Assessment*, Washington, DC (1978).
- (5) U.S. Environmental Protection Agency, *Chloroform, Health and Environmental Effects Profile No. 47*, Office of Solid Waste, Washington, DC (April 30, 1980).
- (6) International Agency for Research on Cancer, *IARC Monographs on the Carcinogenic Risks of Chemicals to Humans*, 20, 401, Lyon, France (1979).
- (7) See Reference (A-61).
- (8) Sax, N.I., Ed., *Dangerous Properties of Industrial Materials Report*, 1, No. 4, 44-47, New York, Van Nostrand Reinhold Co. (1981).
- (9) See Reference (A-62). Also see Reference (A-64).
- (10) Sax, N.I., Ed., *Dangerous Properties of Industrial Materials Report*, 3, No. 5, 101-106, New York, Van Nostrand Reinhold Co. (1983).

- (11) Parmeggiani, L., Ed., *Encyclopedia of Occupational Health & Safety*, Third Edition, Vol. 1, pp 463-464, Geneva, International Labour Office (1983).
 (12) United Nations Environment Programme, *IRPTC Legal File 1983*, Vol. I, pp VII/185-88, Geneva, Switzerland, International Register of Potentially Toxic Chemicals (1984).

CHLOROMETHYL METHYL ETHER

- Carcinogen (Suspected Human, IARC)(3)
- Hazardous waste (EPA)
- Priority toxic pollutant (EPA)

Description: $\text{ClCH}_2\text{OCH}_3$, chloromethyl methyl ether, is a volatile, corrosive liquid boiling at 59°C. Commercial chloromethyl methyl ether contains from 1 to 7% bis(chloromethyl) ether, a known carcinogen.

Code Numbers: CAS 107-30-2 RTECS KN6650000 UN 1239

DOT Designation: Flammable liquid and poison.

Synonyms: CMME, methyl chloromethyl ether, monochloromethyl ether, chloromethoxymethane.

Potential Exposures: Chloromethyl methyl ether is a highly reactive methylating agent and is used in the chemical industry for synthesis of organic chemicals. Most industrial operations are carried out in closed process vessels so that exposure is minimized.

Permissible Exposure Limits in Air: Chloromethyl methyl ether is included in the Federal standard for carcinogens; all contact with it should be avoided. ACGIH (1983/84) has designated it an "Industrial Substance Suspect of Carcinogenic Potential for Man."

Determination in Air: Collection by impinger, analysis by gas chromatography with electron capture detector (A-10).

Permissible Concentration in Water: No criteria have been set for the protection of freshwater or saltwater aquatic life due to lack of data. For the protection of human health: preferably zero.

Routes of Entry: Inhalation of vapor and possibly percutaneous absorption.

Harmful Effects and Symptoms: *Local* – Vapor exposure results in severe irritation of the skin, eyes and nose. Rabbit skin tests using undiluted material resulted in skin necrosis.

Systemic – Chloromethyl methyl ether is only moderately toxic given orally. Acute exposure to chloromethyl methyl ether vapor may result in pulmonary edema and pneumonia.

Several studies of workers with CMME manufacturing exposure have shown an excess of bronchiogenic cancer predominately of the small cell-undifferentiated type with relatively short latency period (typically 10 to 15 years). Therefore, commercial grade chloromethyl methyl ether must be considered a carcinogen (4). It is not known whether or not chloromethyl methyl ether's carcinogenic activity is due to bis(chloromethyl) ether (BCME) contamination, but this may be a moot question inasmuch as two of the hydrolysis products of CMME can combine to form BCME.

Animal experiments to determine chloromethyl methyl ether's ability to produce skin cancer indicated marginal carcinogenic activity; highly pure CMME