

REFERENCE DATA SHEET ON COMMON CHLORINATED SOLVENTS

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POTENTIAL PROBLEM AREAS AND USES

- Dry cleaning operations
- Fluorocarbon manufacture
- Solvents for fats, oils, waxes, resins
- Fire extinguishers
- Organic synthesis
- Polymer manufacture
- Heat exchange medium
- Chemical intermediate
- Extraction of caffeine
- Vapor degreasing
- Parts cleaning
- Engine cleaner
- Degreasing agent
- Cleaning printed circuit boards
- Adhesives solvent
- Aerosol propellant
- Foam plastic blowing agents
- Paint removers

PHYSICAL DATA

The chlorinated organic solvents discussed in this data sheet are all colorless liquids at room temperature. They have vapor densities ranging from 2.9 to 5.8 (air = 1). These vapor densities, however, are not usually reached at normal room temperatures. For example, perchloroethylene has a vapor pressure of 19 mm at 77 °F; therefore, the highest concentration it can be in air at that temperature is approximately 2.5% by volume, or 25,000 parts per million. Solvents with higher vapor pressures (lower boiling points) would have higher maximum concentrations. Most of these compounds have odors described as ethereal, sweetish, pleasant, or resembling chloroform. Odor detection limits for most of these compounds are higher than the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs). More than half of them, those containing 80% or more chlorine, do not have flash points. Some of those with no normal flash point may have upper and lower explosive limits at elevated temperatures.

IMPLICATIONS

The odor of most of these compounds cannot be relied upon to determine if overexposure occurs, and chemical cartridge respirators are not acceptable because the worker is unable to determine if the cartridge is exhausted at concentrations higher than the Permissible Exposure Limit. Although these vapors may be denser than air, they do not necessarily become more concentrated in depressions, since air movement, evaporative cooling or other thermal conditions may cause them to exhibit other behaviors.

HEALTH EFFECT DATA

Most of these compounds can affect the central nervous system, liver, and kidneys. Most also will defat the skin causing dermatitis, and are irritating to the skin, eyes, and mucous membranes. Some can be absorbed through intact skin, and several are suspected or known to cause cancers. Several can cause rapid and erratic heartbeats. A summary of some of the properties is shown in Table I.

IMPLICATIONS

Many of these solvents were formerly in widespread use because of their excellent solvent power and lack of flammability. Health effects information developed in the last few years have caused many of them to be replaced by less toxic materials. Two of them are also suspected of causing damage to the upper atmosphere ozone layer and will be phased out for that reason.

TABLE 1 - SELECTED PROPERTIES

Compound	CAS Number	Liquid Density	Vapor Density	Flash Point, °F	ppm Odor Threshold	PEL ppm	STEL ppm
Perchloroethylene (Tetrachloroethylene)	127-18-4	1.6	5.8	NA ⁽¹⁾	47	25	-
1,1,2,2-Tetrachloroethane	79-34-5	1.6	5.8	NA ⁽¹⁾	72	1, S ⁽²⁾	-
1,1,2-Trichloroethane	79-00-5	1.4	4.6	NA ⁽¹⁾	⁽³⁾	10, S	-
Carbon tetrachloride ⁽⁴⁾	56-23-5	1.6	5.3	NA ⁽¹⁾	250	2	-
Chloroform	67-66-3	1.5	4.1	NA ⁽¹⁾	192	2	-
Methylene chloride	75-09-2	1.3	2.9	NA ⁽¹⁾	160	500 ⁽⁵⁾	1,000 ⁽⁵⁾
Trichloroethylene	79-01-6	1.5	4.5	NA ⁽¹⁾	82	50	200
Methyl chloroform (1,1,1-Trichloroethane) ⁽⁴⁾	71-55-6	1.3	4.6	NA ⁽¹⁾	390	350	450
1,2,3-Trichloropropane	96-18-4	1.4	5.1	164	⁽³⁾	10	-
Ethylene dichloride	107-06-2	1.2	3.4	56	26	1	2

1,2-Dichloropropane (<i>Propylene dichloride</i>)	78-87-5	1.2	3.9	60	0.5	75	110
1,2-Dichloroethylene	540-59-0	1.3	3.4	37	(3)	200	-
1,1-Dichloroethane	75-34-3	1.2	3.4	17	445	100	-

- = No Short Term Exposure Limit has been established for this material.

1. Does not normally burn and does not have a reported flash point.
2. S = Skin. This material is reported to be absorbed through intact skin.
3. No reliable odor threshold information was found for this chemical.
4. Production of these chemicals is scheduled to be 100% phased out by January 1, 1996 because of suspected harm to the earth's ozone layer.
5. OSHA has published a proposed rule to reduce the Permissible Exposure Limit for methylene chloride to an 8-hour time-weighted-average of 25 ppm, and a 15 minute Short Term Exposure Limit (STEL) of 125 ppm.

TOXICITY INFORMATION FOR INDIVIDUAL COMPOUNDS

Perchloroethylene is not classified as a carcinogen. It can affect the central nervous system* (CNS), and cause irritation of the skin, eyes, and upper respiratory tract.

**CNS effects (CNS depression) for all of these compounds can include varying degrees of headache, dizziness, sleepiness, or unconsciousness, depending on the degree of exposure and the length of exposure. Very high exposure can cause death.*

1,1,2,2-Tetrachloroethane is considered to be a potential carcinogen by the National Institute for Occupational Safety and Health (NIOSH). It can be absorbed through intact (unbroken) skin. It can cause CNS effects, and can damage the kidney and liver.

1,1,2-Trichloroethane is not listed as a carcinogen by the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), or OSHA. It can be absorbed by intact skin. Causes CNS depression and kidney and liver damage. It is a more potent CNS depressant than chloroform.

Carbon tetrachloride is listed as a suspect carcinogen, but the American Conference of Governmental Industrial Hygienists (ACGIH) is dropping it to a rating of A3, an animal carcinogen at relatively high doses, not a likely human carcinogen; however, liver cancer has been reported. It can be absorbed through intact skin. It causes CNS depression, can damage the kidneys, liver, or lungs, and can cause aplastic anemia. It can cause rapid and irregular heartbeat, which can be fatal. Health effects appear to be greatly increased by alcohol consumption.

Chloroform is a suspect carcinogen. It causes CNS depression, rapid and irregular heartbeat, and liver and kidney damage. It was formerly used in cough medicines, and as an anesthetic.

Methylene chloride is listed by the ACGIH as a potential carcinogen. It causes CNS depression, liver and kidney damage, and can cause elevated blood carboxyhemoglobin (also caused by exposure to carbon monoxide). Contact of the liquid with skin or eyes causes painful irritation and possible burns. It has often been used in paint removers.

Trichloroethylene is considered a suspect carcinogen. It can cause CNS depression, can affect kidneys, liver, and lungs, and can cause rapid and irregular heartbeat that can cause death. Causes skin, eye, and mucous membrane irritation. Toxic effects are increased when combined with alcohol, caffeine, and other drugs. It has been used extensively in vapor degreasers.

Methyl chloroform is not listed as a carcinogen by NIOSH or NTP. It is one of the least toxic of the chlorinated solvents, but can cause death at high concentrations. It can cause CNS depression, rapid and irregular heartbeat, and irritation to the skin, eyes, and respiratory tract.

1,2,3-Trichloropropane is not listed as a suspect carcinogen. It can be absorbed through intact skin. The liquid is highly irritating to the skin and eyes. It can cause CNS depression, and liver and kidney effects. The odor is reported to be unpleasant.

Ethylene dichloride is flammable, and is considered one of the more toxic of these solvents. It is considered a potential carcinogen, although not listed as such by ACGIH or OSHA. It can cause CNS depression, and damage to liver, kidneys, heart, and digestive system. Eye contact with this chemical can cause irritation and serious injury, if not removed promptly.

Propylene dichloride is not listed by ACGIH or OSHA as a potential carcinogen. It can cause CNS depression, and liver or kidney damage, and can cause eye, skin, and mucous membrane irritation. It has a low odor threshold.

1, 2-Dichloroethylene is highly flammable. It is not listed as a suspect carcinogen. It is a CNS depressant, and can irritate skin, eyes, or mucous membranes. It has been used as an anesthetic in humans. It is available in two isomeric forms.

1,1-Dichloroethane is highly flammable. It is not listed as a suspect carcinogen. It is a CNS depressant, but seems to be less likely than other chlorinated solvents to cause liver or kidney damage.

MEASUREMENT OF CHLORINATED SOLVENTS

Short term measurements of most of these solvents can be done with length-of-stain detector tubes, such as Draeger, MSA, or Sensidyne/Gastec, but these tubes are not usually

specific for any one compound, and accuracy may be poor. Most, if not all of these materials can be analytically determined using Method 1003, "Hydrocarbons, Halogenated" from the *NIOSH Manual of Analytical Methods, Third Edition*. Collection is on charcoal tubes, using a calibrated sampling pump, and analysis is by gas chromatography.

IMPLICATIONS

Colorimetric detection methods may give false readings due to interfering air contaminants, and may be representative only of the area immediately adjacent to the sampling location.

DOCUMENTATION

There are numerous OSHA, ACGIH, NIOSH, and EPA documents concerning allowable exposure levels, uses, and toxicity of these chemicals. Effects of exposures at various concentrations are well documented in some of these publications for animal exposures, as well as limited data, when known, concerning human exposures. There are well-documented methods for identifying and measuring concentrations in the workplace. Computer models are available that can calculate potential exposures when data is lacking.

This is not a Material Safety Data Sheet but rather a Reference Data Sheet that has been compiled from a number of sources, and is intended to be a concise, relatively non-technical source of information on a particular material or category of materials. It is provided in good faith and is believed to be correct as of the date compiled; however, Meridian Engineering & Technology makes no representation as to the comprehensiveness or accuracy of the information. It is expected that individuals receiving the information will exercise their independent judgment in determining its appropriateness for a particular purpose. Accordingly, Meridian Engineering & Technology will not be responsible for damages of any kind resulting from the use of or reliance upon such information.