



**Product Stewardship Summary
Perchloroethylene**

August 31, 2017 version

Summary

This Product Stewardship Summary is intended to give general information about Perchloroethylene. 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.

Perchloroethylene is a colorless, volatile, nonflammable liquid with the chemical formula, C₂Cl₄. Perchloroethylene is used primarily as a chemical intermediate in the production of several fluorinated compounds. Its other major uses are as a solvent in commercial and industrial cleaning, a dry cleaning solvent, and degreasing of fabricated metals and as a solvent in automotive aerosols. Occidental Chemical Corporation does not sell perchloroethylene into the dry cleaning application.

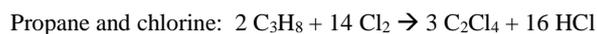
1. Chemical Identity

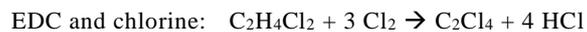
Name: Perchloroethylene
Synonyms: Tetrachloroethylene; Perc; PCE
Chemical Abstracts Service (CAS) number: 127-18-4
Chemical Formula: C₂Cl₄
Molecular Weight: 165.82

Perchloroethylene is a colorless, volatile, nonflammable liquid. It has a sweet, ether-like odor. Its vapors are heavier than air and can collect in low lying and/or poorly ventilated areas. While the odor threshold is low, < 5 ppm, perchloroethylene quickly desensitizes olfactory responses; therefore, odor is not an adequate warning of toxic levels.

2. Production

Perchloroethylene is produced mainly by reacting hydrocarbons such as propane or propylene or chlorinated hydrocarbons such as ethylene dichloride (EDC) with chlorine. The byproduct of each reaction is hydrochloric acid (HCl). Some reactions include:





Occidental Chemical Corporation is a leading manufacturer of perchloroethylene. Perchloroethylene is manufactured at our facilities in Geismar, Louisiana and Wichita, Kansas.

3. Uses

Occidental Chemical Corporation does not sell perchloroethylene to household consumers or to dry cleaners. Perchloroethylene is used primarily as a chemical intermediate in the production of several fluorinated compounds that are then used as refrigerants. Its other major uses are for the cleaning and degreasing of fabricated metals and as a solvent in automotive aerosols. It has also been used as a replacement for carbon tetrachloride in the isomerization process in the petroleum refining industry.

4. Physical and Chemical Properties

Perchloroethylene is not flammable and has no measurable flash point. It also has a low vapor pressure, meaning that at room temperature, it does not evaporate as readily as other solvents.

Perchloroethylene does not contribute to the depletion of stratospheric ozone. The U.S. EPA has approved the use of perchloroethylene as a replacement for stratospheric ozone depleting solvents in the following applications:

- CFC-113 and methyl chloroform in the metals and electronics cleaning sectors
- CFC-11, CFC-113, and methyl chloroform in solvent applications in aerosol and pressurized containers
- CFC-11, CFC-113, methyl chloroform, and HCFC-141b as solvents in the aerosols sector, and
- Methyl chloroform used in adhesives, coatings and inks.

Perchloroethylene can be stored in vessels made of common materials of construction. Perchloroethylene is stable with common metals other than aluminum.

5. Health Effects

Perchloroethylene is readily absorbed if inhaled or ingested. Dermal exposure to the liquid can cause burns and irritation, but absorption across intact skin is slow. Systemic toxicity is unlikely unless liquid on the skin is prevented from evaporating by heavy clothing or other impermeable covering; however, exposure by any route may cause systemic effects.

Inhalation

The major symptoms of acute overexposure to perchloroethylene are central nervous system effects typical of anesthesia, which generally disappear when the individual is removed from exposure. Exposure to concentrations of 200 parts per million (ppm) or more has been associated with dizziness, confusion, headache, nausea, and irritation of the eyes and mucous tissue. At higher exposures (>600 ppm) these symptoms are intensified. Exposure to extremely high levels (>1,500 ppm) may lead to unconsciousness due to

anesthesia and, in extreme cases, death from respiratory depression or the onset of a fatal cardiac arrhythmia induced by epinephrine sensitization. Increased sensitivity of the heart to adrenaline may be caused by overexposure to perchloroethylene; therefore, caution should be used when considering administration of adrenaline following exposure.

Prolonged or repeated exposure to concentrations of 200 ppm or more may cause damage to the nervous system and liver.

Perchloroethylene has been studied by governmental agencies, industry groups, and academia extensively for cancer, both in the U.S. and E.U., and results are varied. At the present time the International Agency for Research on Cancer (IARC) classifies perchloroethylene in Group 2A, as a substance considered "probably carcinogenic to humans." NTP listed perchloroethylene as "reasonably anticipated" to be a carcinogen based on a finding of "sufficient" evidence of carcinogenicity in experimental animals. In addition, several epidemiology studies have investigated cancer mortality among worker groups and have shown no consistent link between exposure to perchloroethylene and cancer.

Ingestion

Swallowing perchloroethylene may be harmful. Effects may include nausea, vomiting, abdominal cramps and diarrhea. It can also produce narcotic effects such as dizziness or drowsiness. Perchloroethylene is an aspiration hazard, meaning it can get into the lungs if swallowed, possibly causing lung damage or even death.

6. Environmental Effects

If released to soil, perchloroethylene is expected to have moderate mobility. Perchloroethylene has often been detected in groundwater. Volatilization from moist soil surfaces into the air is expected to be an important process. Perchloroethylene may volatilize from dry soil surfaces based upon its vapor pressure. Volatilization half-lives in the range of 1.2-5.4 hours were measured for perchloroethylene from a sandy loam soil surface and volatilization half-lives of 1.9-5.2 hours were measured from an organic topsoil. Biodegradation is expected to occur slowly in soils under both aerobic and anaerobic conditions.

If released into water, perchloroethylene is not expected to adsorb to suspended solids and sediment in water. The biodegradation half-lives of perchloroethylene in aerobic and anaerobic waters were reported as 180 and 98 days, respectively. Volatilization from water surfaces into the air is expected to be an important process. Estimated volatilization half-lives for a model river and model lake are 1 hour and 5 days, respectively.

If released in air, the tropospheric half-life of tetrachloroethylene is about 3 months and its halogenated degradation products are short-lived. This relatively short half-life implies that no effect of tetrachloroethylene can be expected in stratospheric ozone depletion and in global warming. Tetrachloroethylene has a negligible tropospheric ozone creation potential in the atmosphere.

Perchloroethylene is toxic to aquatic life on an acute basis. In laboratory studies the concentrations that were lethal to 50% of the fish exposed ranged from 5 to 21.4 milligrams per liter. Bioaccumulation of perchloroethylene in aquatic species is unlikely

in view of its physical and chemical properties. Measured bioconcentration factors of 49-62 in fish suggest bioconcentration in aquatic organisms is low to moderate.

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 perchloroethylene. Exposures could occur by inhalation of vapors. Perchloroethylene 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.
- Consumer exposure – OxyChem does not sell perchloroethylene for use directly in consumer products or to dry cleaners.
- Releases – If a spill occurs, emergency personnel should wear protective equipment to minimize exposures.

8. Recommended Risk Management Measures

Prior to using perchloroethylene, carefully read and comprehend the Safety Data Sheet. The following are some recommended risk management measures:

- Work areas where perchloroethylene is used should be well ventilated to limit solvent vapors to below exposure limits.
- To avoid overexposure to perchloroethylene 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 perchloroethylene 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 gloves) when working with perchloroethylene.
- Proper labeling, handling and storage of perchloroethylene will reduce the likelihood of accidental exposure.
- Avoid environmental contamination by keeping perchloroethylene out of water supplies, sewers and soil. Do not discharge it into drains surface water or groundwater.
- Equipment used for perchloroethylene storage or processing should be constructed of the proper materials. Do not use aluminum as a material of construction.
- Personnel involved with perchloroethylene manufacturing operations should be properly trained.

9. Product Stewardship Programs

Occidental Chemical Corporation provides bulletins to help perchloroethylene customers handle the product safely. Occidental Chemical Corporation is also a member of the Halogenated Solvents Industry Association Alliance (HSIA). Through the HSIA, we are

sponsoring studies of perchloroethylene under ATSDR's (Agency for Toxic Substances and Disease Registry) Substance-Specific applied Research Program.

10. Regulatory Compliance Information

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

Coast Guard, Department of Homeland Security:

Minimum requirements have been established for safe transport of perchloroethylene on ships and barges.

Consumer Product Safety Commission (CPSC):

Visual novelty devices containing perchloroethylene have labeling requirements.

Department of Transportation (DOT):

Perchloroethylene is considered a hazardous material and a marine pollutant, and special requirements have been set for marking, labeling, and transporting this material, including transporting it in tank cars.

U.S. Environmental Protection Agency:

Clean Air Act:

- National Emission Standards for Hazardous Air Pollutants: Listed as a hazardous air pollutant.
- New Source Performance Standards: Manufacture of perchloroethylene is subject to certain provisions for the control of volatile organic compound emissions.
- Urban Air Toxics Strategy: Identified as one of 33 hazardous air pollutants that present the greatest threat to public health in urban areas.

Clean Water Act:

- Effluent guidelines: Listed as a toxic pollutant.
- Water quality criteria: Based on fish or shellfish and water consumption = 10 ug/L; based on fish or shellfish consumption only = 29 ug/L.

Comprehensive Environmental Response, Compensation, and Liability Act: Reportable quantity (RQ = 100 lbs.).

Emergency Planning and Community Right-To-Know Act: Toxics Release Inventory: Listed substance subject to reporting requirements.

Resource Conservation and Recovery Act:

- Characteristic Hazardous Waste: Toxicity characteristic leaching procedure (TCLP) threshold = 0.7 mg/L.
- Listed Hazardous Waste: Waste codes for which the listing is based wholly or partly on the presence of perchloroethylene = U210, F001, F002, F024, F025,

K016, K019, K020, K073, K116, K150, K151. Listed as a hazardous constituent of waste.

Safe Drinking Water Act: Maximum contaminant level (MCL) = 0.005 mg/L.

Food and Drug Administration (FDA): Maximum permissible level in bottled water = 0.005 mg/L.

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: 25 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: 150 ppm

11. Sources for Additional Information

ATSDR, Toxicological Profile for Tetrachloroethylene, September 1997.

HSDB, Hazardous Substances Databank Number: 124, Last Revision Date: 20120503.

IARC (2014), IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, Vol. 106

IUCLID Dataset, Tetrachloroethylene, Substance ID: 127-18-4, February 18, 2000.

NIOSH, Tetrachloroethylene, IDLH Documentation, August 16, 1996.

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

Occidental Chemical Corporation Product Information on Company web site:
<http://www.oxy.com/OurBusinesses/Chemicals/Products/Pages/Chlorine-and-Derivatives.aspx>

Report on Carcinogens, Fourteenth Edition; U.S. Department of Health and Human Services, Public Health Service, National Toxicology Program.

Reprotox, Reprotox Record Number: 1239, Last Revision Date: November 4, 2016.

RTECS, RTECS Number: KX3850000, Review Date: 201610.

U.S. Environmental Protection Agency, Protection of Stratospheric
Ozone, 40 CFR Parts 9 and 82; Federal Register, Volume 59 Issue 53
(Friday, March 18, 1994)

U.S. Environmental Protection Agency, Draft Toxicological Review of
Tetrachloroethylene (Perchloroethylene) (CAS No. 127-18-4), June 2008.

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

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