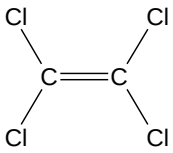
PERCHLOROETHYLENE

Refer to the Safety Data Sheet (SDS) for additional information and before handling this material.

CAS Number: 127-18-4
Synonyms: tetrachloroethylene, perchlor, PCE
Chemical Formula: C_2Cl_4
Molecular Weight: 165.85
Chemical Structure:



Description: Perchloroethylene is a clear, colorless liquid at room temperature. It is volatile, has a sweet odor, and is completely miscible with most organic liquids.

Product Overview

Perchloroethylene is a versatile, chlorinated solvent used in many industries and extensively by dry cleaning facilities. Axiall Corporation produces perchloroethylene at the Lake Charles, Louisiana plant. With over 60 years of responsible production and handling experience, Axiall manufactures perchloroethylene with environmental and public safety consideration. Axiall personnel are experienced in handling and shipping perchloroethylene, and our engineers, scientists, and sales personnel can provide technical assistance to users.

Perchloroethylene is a non-flammable, multipurpose solvent that is relatively inert and inherently more stable than other chlorinated solvents. Its stability is further enhanced by Axiall's stabilizer system. Perchloroethylene has no flash or fire point, lending it important safety strengths over petroleum distillates. As a result, combined with its other desirable chemical and physical properties, perchloroethylene offers many advantages over other solvents.

Production

Axiall produces perchloroethylene through the high temperature oxyhydrochlorination of chlorinated hydrocarbons. Vaporized chlorinated organics are mixed with hydrochloric acid and oxygen inside a catalytic fluidized bed reactor where a series of chlorination and thermal cracking reactions occur. The overall exothermic reaction is carefully controlled to maintain the required temperature. The resulting product is a blend of trichloroethylene and perchloroethylene, which is distillation separated. Perchloroethylene is then further purified by distillation and stabilized to prevent oxidation.

Uses

Perchloroethylene offers many physical and chemical properties that make it the right chlorinated solvent for many applications. It is relatively inert and inherently more stable than other chlorinated solvents. Axiall's perchloroethylene is stabilized to prevent solvent degradation or decomposition, and corrosion of metal parts and equipment. Axiall's stabilizers are designed to be recoverable even after repeated cleaning cycles and from carbon adsorbers. Perchloroethylene's high solvency and high vapor density make it ideal for a variety of end uses, and as a result, perchloroethylene has become the largest volume dry cleaning solvent and the choice for vapor degreasing.

With all downstream applications, appropriate registrations and/or approvals may be required. Possible uses are described below:

- **Drycleaning** - Perchloroethylene is the preferred solvent because, in addition to its non-flammability, it provides a fast, powerful, yet gentle cleaning action with a minimum of mechanical agitation. The result is a cleaner product with less fabric wear. Axiall's perchloroethylene is ideal for all natural and synthetic fibers.
  - *Faster cycles:* The cleaning cycle and drying times are fast with perchloroethylene and, because of its high solvency, fewer stains are left for the spotter. Because it is recoverable, it has a long service life.
  - *Customizable:* Axiall's perchloroethylene works with any dry-cleaning detergent, so the drycleaner can add detergent or soap to make a customized charged system.
- **Vapor Degreasing** - Many industries, including aerospace, automotive, and household appliance production, use perchloroethylene in vapor degreasing for metal parts. Perchloroethylene is ideal for situations that require a high boiling point (above that of water). Many soils, such as waxes and resins, must be melted in order to be solubilized, making perchloroethylene a preferred solvent.
  - *High boiling point:* The high boiling point of perchloroethylene enables it to condense more vapor on the metal than other chlorinated solvents, thus washing the parts more effectively. Perchloroethylene cleans longer and removes higher melt-point pitches and waxes more easily. It is effective with lightweight and light gauge parts that warm up to the temperature of a lower boiling point solvent before cleaning is complete. Perchloroethylene is particularly useful in fine orifices and spot-welded seams.
  - *Azeotropic with water:* Perchloroethylene forms an azeotrope with water. As a result, perchloroethylene allows a vapor degreaser to function as a drying device for metal parts and to remove water films from metals without degradation of the solvent.
- **Chemical Processing** - Perchloroethylene serves as a carrier solvent for fabric finishes, rubber, and silicones. It also is used as an extractant solvent in paint removers and printing inks. It serves as a chemical intermediate in many applications. As with all applications, when using perchloroethylene to decrease the flammability of a mixture, it is important to determine the flash point of the final product as it is to be used prior to selling, since an insufficient quantity of perchloroethylene will not raise the flash point of the mixture.
- **Catalyst Regeneration** - Perchloroethylene is used in the petroleum refinery industry as a source of hydrochloric acid, a promoter, which helps in the regeneration of catalyst in both catalytic reformer and isomerization operations. Product sold into this operation must be a purer, less stabilized grade than most to preclude the poisoning of the platinum catalyst.
- **Fluorocarbon** - Perchloroethylene is used in the manufacture of refrigerants, refrigerant blends, and other fluorinated compounds.

Product Grades

Axiall Corporation offers a number of specialty grades of perchloroethylene, suited for a variety of applications. These grades are described below:

- **Dry cleaning** - Formulated especially for dry cleaning operations, this grade incorporates a stabilizer that is completely removed from garments and leaves no residual odor. Stabilizers are recoverable with the solvent after distilling. Solvent removed from carbon absorbers also is suitable for reuse in dry cleaning. Dry-cleaning grade is not suitable for vapor degreasing. To Axiall's knowledge, this grade meets the requirements of ASTM D4081.
- **Degreasing and General Purpose** - This grade is engineered for many vapor degreasing, cold cleaning and dry cleaning applications. It incorporates stabilizers to protect the solvent against degradation or

decomposition caused by such contaminants as metal chips and fines, acids, alkalis and oxidants. To Axiall's knowledge, this grade meets the requirements of ASTM D4081.

- **Heavy-Duty Degreasing** - This grade is a much more heavily stabilized solvent intended for more rigorous production vapor degreasing. It is not recommended for dry cleaning or general solvent use. The stabilizers incorporated in this grade are designed to protect against contaminants such as metal chips, fines, acid soils and oxidants. It is particularly suitable for degreasing metals that corrode and stain easily such as aluminum, magnesium, zinc, copper and their alloys. The grade's special stabilization gives users increased protection against stainless steel pitting and corrosion. To Axiall's knowledge, this grade meets the requirements of ASTM D4376.
- **Catalyst** - This grade is minimally stabilized and developed for use in catalyst regeneration in the refinery industry.
- **Fluorocarbon** - This grade is used as a feedstock in the manufacture of refrigerants, refrigerant blends, and other fluorinated compounds.

Health Effects

Read and follow all instructions on the product label and review the Safety Data Sheet (SDS) to understand and avoid the hazards associated with perchloroethylene. Wear appropriate personal protective equipment and avoid direct contact. Eye contact with perchloroethylene causes serious eye irritation. Skin contact with perchloroethylene causes skin irritation. Ingestion of perchloroethylene may be harmful if swallowed. Perchloroethylene may be aspirated into lungs during ingestion and/or subsequent vomiting; aspiration of this material will cause severe lung injury, chemical pneumonitis, pulmonary edema or death. Inhalation of perchloroethylene may cause respiratory irritation and may affect the central nervous system; symptoms may include dizziness, drowsiness, lethargy, coma and death. Adrenaline should only be administered after careful consideration following overexposure to perchloroethylene; increased sensitivity of the heart to adrenaline may be caused by overexposure to this product.

Chronic inhalation overexposure to perchloroethylene may cause damage to the liver and kidneys. Perchlorethylene has been studied extensively for cancer both in the U.S. and Europe by government, industry and academia in multiple species and biological test systems. In a 1986 National Toxicology Program (NTP) study, rats and mice were exposed over their lifetime to airborne concentrations up to 200 ppm (for mice) and 400 ppm (for rats). A significant increase in the incidence of liver tumors was observed for male and female mice. An increased incidence of leukemia was observed for rats (both sexes) and an increase in kidney tumors was noted for male rats only. At the present time the International Agency for Research on Cancer (IARC) lists perchloroethylene in Group 2A, as a substance considered "probably carcinogenic to humans." Several epidemiology studies have investigated cancer mortality and have shown no consistent link between exposure to perchloroethylene and cancer. However, it is strongly suggested that perchloroethylene customers review their industrial hygiene programs and institute good operating practices designed to limit employee exposure below the established airborne exposure limits.

The United States Occupational Safety and Health Administration (OSHA) and the American Conference of Governmental Industrial Hygienists® (ACGIH) have established or recommended occupational airborne exposure limits for perchloroethylene. The OSHA Permissible Exposure Limit (PEL) is an 8-hour time-weighted average (TWA) of 100 ppm. OSHA's limits also include a short term exposure limit, or STEL, of 200 ppm for 15 minutes. The ACGIH Threshold Limit Value (TLV) is 25 ppm for an 8-hour TWA and 100 ppm for a 15-minute STEL.

Depending on conditions, perchloroethylene or its vapors, when in contact with flames, hot glowing surfaces or electric arcs, can decompose to form hydrogen chloride gas, which is highly irritating to the nose and throat, and possible traces of phosgene, an extremely poisonous gas.

Before handling, it is important that engineering controls are operating and protective equipment requirements and personal hygiene measures are being followed. People working with this chemical should be properly trained regarding its hazards and its safe use and should be given the opportunity to review this document and the safety data sheet.

Environmental Effects

Perchloroethylene should be kept out of lakes, streams, ponds, or other water sources. Perchloroethylene shows a low bioaccumulation potential.

Exposure Potential

Precautions should be taken to minimize potential harm to people, animals, and the environment. Potential for exposure may vary depending upon site-specific conditions. When handling perchloroethylene, always refer to the Safety Data Sheet and Product Warning Label and follow all instructions and warnings. Based on the expected uses for perchloroethylene, exposure could be through:

- **Workplace exposure** - Exposure can occur either in a perchloroethylene manufacturing facility or in the various industrial facilities that use perchloroethylene. Good industrial hygiene practices and the use of personal protective equipment will, when combined with proper training and environment, health and safety practices, contribute to a safe work environment.
- **Environmental releases** - In the event of a spill, contain the spill to prevent contaminated soil, surface or ground water. Industrial spills (releases to soil or water) should be controlled by workplace spill programs which include containment around loading and unloading operations and storage tanks and employee training. Many aspects of a spill control program are mandated by federal, state and local requirements. In addition, if a spill occurs, governmental reporting may be required. Refer to the Safety Data Sheet for instructions to contain and clean up a spill to minimize exposure.
- **Consumer exposure** - Perchloroethylene is often a component in brake cleaner and can be found in other chemical cleaning solvents. Read all labels and follow manufacturer's directions. Keep all chemical products out of the reach of children.

Safe Handling and Storage

As tested by standard methods, perchloroethylene has no flash point, fire point or auto-ignition temperature. Depending upon conditions, this material or it is vapors when in contact with flames, hot glowing surfaces or electric arcs can decompose to form hydrogen chloride gas and possible traces of phosgene. Fire and explosion hazards can be minimized by adequate ventilation, using the proper types and arrangement of equipment, and reasonable precautions and care in handling.

Perchloroethylene should be stored away from direct sunlight in a dry, cool and well-ventilated area away from incompatible materials. It should not be stored above 35°C (95°F). Depending on conditions, when perchloroethylene is exposed to high temperatures, heat, or ignition, hydrogen chloride gas, which is highly irritating to the nose and throat, as well as trace levels of phosgene gas, an extremely poisonous gas, may be produced. As a result, all ignition sources should be eliminated. All metal parts of equipment must be grounded to avoid ignition of vapors by static electricity discharge.

Avoid contact with strong alkalis, such as caustic soda, strong acids, and oxidizing agents. Contact of perchloroethylene with aluminum must be avoided because solvent decomposition can occur.

Appropriate personal protective equipment, as described in the perchloroethylene Safety Data Sheet, should always be worn to avoid contact with the eyes, skin and clothing or to prevent the inhalation of the gas, fumes or vapor.

Packaging and Shipping

Axiall ships perchloroethylene primarily in tank trucks, tank cars, 55 gallon drums, and small packages customized for dry cleaning applications which are available through Axiall's distribution partners.

- **Drums** - Shipments of perchloroethylene are packaged in 55 gallon drums and shipped in trucks or ships.
- **Tank cars** - Single compartment rail cars are available with capacities of 10,000 and 20,000 gallons.
- **Tank trucks** - Axiall ships perchloroethylene in bulk tank trucks with a capacity of 20 tons.
- **Barges** - Axiall ships perchloroethylene in barges that range from 1,000 to 1,500 tons.
- **Ships** - Axiall ships perchloroethylene in ocean going vessels of several million pounds.
- **Small package for dry cleaning** - Axiall's distribution partners have options for customizable sizes for dry cleaners.

Fire and Explosion Hazards

Perchloroethylene by itself is nonflammable and not explosive. Perchloroethylene has no flash or fire point as tested by standard methods. Since vapors are heavier than air, they will spread along the ground and may accumulate in low or confined areas.

During a fire, promptly isolate the scene by removing all persons from the vicinity of the incident. No other action shall be taken without suitable training. Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Physical and Chemical Properties

Perchloroethylene is a chlorinated 2-carbon nonpolar solvent. It is a suitable solvent for organic compounds that do not dissolve well in hydrocarbons, polar solvents, and many organic materials. Chlorinated hydrocarbons tend to decompose when exposed to light, heat, oxygen, or water. The decomposition process is accelerated by the presence of metals and metal salts, and the presence of the decomposed solvent itself tends to catalyze further decomposition. To maximize stability, Axiall stabilizes perchloroethylene solvents prior to shipment.

Properties of Perchloroethylene	
Boiling Point	250°F (121°C)
Freezing Point	-8.2°F (-22.3°C)
Specific Gravity at 20°C	1.6
Vapor Pressure at 20°C	14.2 mm Hg
Density at 20°C	13.6 lbs/gal

Regulatory Information

The perchloroethylene Safety Data Sheet contains regulatory information, including Chemical Inventory Status, California Proposition 65 status, and Transportation Classifications. The following is additional regulatory information.

North American Regulatory Information

- **CONEG Regulation/Model Toxics in Packaging Legislation** - Lead, cadmium, mercury and hexavalent chromium are not intentionally added to perchloroethylene, and based on the formula and Axiall's experience with the product, the sum of the incidental concentration levels of these metals is not expected to exceed 100 parts per million (ppm) by weight.
- **RCRA** – Commercial grade perchloroethylene, if discarded or spilled, would be a listed hazardous waste under 40 CFR 261.33, specifically U210 – tetrachloroethylene CAS 127-18-4. In addition, perchloroethylene, if discarded or spilled, as well as other wastes generated during use of perchloroethylene or containing perchloroethylene may exhibit one or more hazardous waste characteristics under 40 CFR 261.24, including D039 – toxic. (Note: Axiall provides information on U.S. hazardous waste criteria for the product as manufactured. It remains the obligation of the user to evaluate their specific waste and to manage, treat, and dispose of unused material, residues, and containers in accordance with applicable federal, state, and local requirements.)
- **VOC Information** - Perchloroethylene is exempt from the definition of volatile organic compounds (VOC) as defined in 40 CFR 51.100.
- **HAP Information** - Perchloroethylene is a hazardous air pollutant (HAP) as listed in the Clean Air Act Amendments of 1990, 42 USC 7412 (b).
- **Ozone-Depleting Chemicals** - Perchloroethylene is not/does not contain ozone depleting chemicals (40 CFR 82, Subpart A, Appendix F).
- **Toxic Pollutants / Priority Pollutants** - Perchloroethylene contains toxic pollutants/priority pollutants as listed in 40 CFR 401.15.
- **CERCLA Hazardous Substance** - Perchloroethylene (tetrachloroethylene) appears in the List of Hazardous Substances and Reportable Quantities table (40 CFR 302.4) with a reportable quantity (RQ) of 100 pounds (45.4 Kg).
- **TSCA Information** - Perchloroethylene is not currently subject to any rule or order under TSCA Sections 4,5,7,8(a), or 8(d).

Other Regulatory Information

- **RoHS/WEEE** - Perchloroethylene has been reviewed with regard to the EU Directive 2011/65/EU "Restriction on the Use of Certain Hazardous Substances" (RoHS 2). Based on our knowledge of this product and information on the raw material suppliers' Safety Data Sheets, this product does not contain cadmium, hexavalent chromium, lead, mercury, polybrominated biphenyls (PBBs) or polybrominated diphenyl ethers (PBDEs) at levels greater than the tolerated maximum concentration values established by the directive.

Additional Product Information

- **Source** - Perchloroethylene is derived from mineral and petroleum sources and has not been derived from plant, animal, synthetic or fermentation sources.
- **Allergenic Materials** - Perchloroethylene is not manufactured using any of the following allergenic materials: carmine/cochineal extracts, celery, colors/color additives, dyes/food dyes, eggs/egg products, seafood/fish/shellfish/crustaceans, flavors, glutens, legumes, milk, mollusks, monosodium glutamate

(MSG), mustards, plant nuts/seeds/oils (sesame, sunflower, safflower, canola, etc.), peanuts/peanut products, protein hydrolysates, soy/soybeans/soybean products, spices, sulfites, sulfates, tree nuts/tree nut oils and wheat.

- **Bovine Spongiform Encephalopathy** - Perchloroethylene is not of animal origin, and, to Axiall's knowledge, does not contribute to Transmissible Spongiform Encephalopathy (TSE)/Bovine Spongiform Encephalopathy (BSE).
- **Genetically Modified Organisms (GMOs)** - Perchloroethylene is not manufactured with and does not contain genetically modified organisms.
- **Natural Latex Rubber** - Perchloroethylene is not manufactured with and does not contain natural latex rubber as defined in 21 CFR 801.437(b)(1).
- **Nutritional Value** - Perchloroethylene does not have nutritional value.

Product Stewardship

Axiall Corporation is committed to managing perchloroethylene so that it can be safely used by its employees and customers. Axiall's relationships with its customers encourage communication about safety and environmental stewardship.

Additional Information

For more information regarding Axiall's perchloroethylene, contact our customer service department by calling 800-243-6774.

References

- Axiall Corporation Web page: http://www.axiall.com/
- Axiall Safety Data Sheets: http://www.axiall.com/products/safety-data-sheets/

Notice

Prior to its use, the user is responsible for determining the suitability of the product or products covered by this Product Stewardship Summary and for complying with all federal, state, and local laws and regulations in connection with its use. Neither Axiall Corporation nor any of its affiliates shall be responsible for any damages of any kind whatsoever resulting from the use of or reliance on this Product Stewardship Summary or product or products to which it refers.

This Product Stewardship Summary is intended only to provide a general summary of the potential hazards associated with the product or products described herein. It is not intended to provide detailed information about potential health effects and safe use and handling information and, although Axiall Corporation believes this information is correct, Axiall Corporation makes no warranties as to its completeness or accuracy. Appropriate literature has been assembled which provides information concerning the health and safety precautions that must be observed when handling the Axiall Corporation product(s) mentioned in this document. Before working with any of these products, users must read and become familiar with the available information on product hazards, proper use, and handling. Information is available in several forms, such as safety data sheets (SDS) and product labels. A copy of Axiall's SDS for perchloroethylene can be obtained by going to the company's website www.axiall.com.

This information is subject to change without notice.

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