Occidental Chemical Corporation
A subsidiary of Occidental Petroleum Corporation

Product Stewardship Summary
Ethylene Dichloride

Summary

Ethylene Dichloride (EDC) or 1,2-Dichloroethane is a clear, flammable liquid. Its chemical formula is $C_2H_4Cl_2$. Although the vast majority of common chlorinated compounds are non-flammable, EDC has a flash point of 13°C (55.4°F). Since EDC is a flammable liquid, it must be stored and handled with this hazard in mind.

1. Chemical Identity

Name: Ethylene Dichloride
Synonyms: EDC, 1,2-Dichloroethane; 1,2-Bichloroethane; sym-Dichloroethane
Chemical Abstracts Service (CAS) number: 107-06-2
Chemical Formula: C2H4CL2
Molecular Weight: 98.6

Ethylene Dichloride (EDC) or 1,2-Dichloroethane is a clear, flammable liquid. The liquid is heavier than water. EDC evaporates readily at ambient temperatures. It has a sweet odor typical of chlorinated hydrocarbons. The vapors are heavier than air and tend to sink to low areas.

2. Production

EDC is manufactured by OxyChem by two different reactions. Direct chlorination is the reaction of ethylene and chlorine:

$$C_2H_4 + Cl_2 \rightarrow C_2H_4Cl_2$$

Oxychlorination is the reaction of oxygen, ethylene and hydrogen chloride:

$$½O_2 + C_2H_4 + 2HCl \rightarrow C_2H_4Cl_2 + H_2O$$

OxyChem is a leading manufacturer of EDC and operates facilities in Convent, Louisiana; Deer Park, Texas; Geismar, Louisiana; Ingleside, Texas; and LaPorte, Texas.

3. Uses

OxyChem does not sell EDC to household consumers. EDC is used primarily as a raw material in industrial operations that manufacture vinyl chloride monomer (VCM), which is primarily used to manufacture polyvinyl chloride (PVC) resin. EDC is also used as an intermediate in the manufacture of chlorinated and fluorinated compounds.

4. Physical and Chemical Properties

Flammability
EDC is extremely flammable. Direct contact with open flames or a high energy heat source will result in combustion and corrosive, noxious gases. If combustion occurs, extinguish fires using dry chemical, foam, or carbon dioxide. Water may be ineffective, but should be used to keep fire-exposed containers cool.

Reactivity
EDC can be stored in vessels made of common materials of construction. EDC is stable with common metals other than aluminum, magnesium, zinc, and their alloys. Avoid contact with pure oxygen, strong alkalis, alkali metals, open flames and welding arcs, or other high temperature sources, which induce thermal decomposition to irritating and corrosive hydrochloric acid.

5. Health Effects

Inhalation
Overexposure to vapors may result in dizziness, drowsiness, depression, headache, nausea, mental dullness, loss of coordination, or in extreme cases, death. Overexposure can damage the liver and kidneys.

Eye Contact
If liquid EDC is splashed in the eyes, it may result in pain, irritation, and watery eyes. If it is promptly removed by washing, no significant injury should occur. If not removed, serious damage may be the result.

Skin Contact
When EDC is left on the skin, severe irritation can occur. Prolonged exposure of the skin to EDC will remove the skin's natural oils, causing the affected area to become red, rough and dry and can lead to contact dermatitis.

Ingestion
Accidental ingestion of EDC may result in irritation of the gastrointestinal tract, nausea, vomiting, diarrhea, unconsciousness and even death. Death may occur due to central nervous system and cardiovascular system depression. EDC is a liver and kidney poison.

Cancer Studies
Cancer has been observed in studies of rats and mice that were fed large quantities of EDC. In other studies in which rats and mice were exposed to EDC vapors, no specific type of tumor increase was noted. The doses that were administered to the laboratory animals were much higher than the amounts to which humans are exposed in manufacturing facilities. Also, the inhalation route of exposure is more relevant for human exposure. EDC vapor has not been associated with cancer in humans.

Reproductive Studies
Based on rodent studies, EDC is not expected to effect fertility. There are no conclusive data to suggest that EDC is a reproductive hazard.

Developmental Studies
Overall, the available information does not indicate that EDC is a developmental toxicant in animals at doses below those that cause other toxic effects. There are no conclusive data to suggest that EDC is a developmental hazard.

6. Environmental Effects

If released to land, EDC is expected to have high mobility in soil, and it may travel to underground water sources. Volatilization from moist surfaces is expected to be an important fate process. The potential for volatilization from dry soil surfaces also exists based on the vapor pressure. Biodegradation is not expected to be an important environmental fate process in soil based on a variety of degradation tests.

When EDC is released to surface water, its primary loss will be by volatilization. The half-lives for a model river and a model lake are 4 hours and 4 days, respectively. Hydrolysis is not expected to be an important environmental fate process because EDC lacks functional groups that hydrolyze. Chemical and biological degradation is expected to be very slow. Adsorption to suspended solids and sediment is not expected.

When released to air, EDC will exist as a vapor in the ambient atmosphere. It will degrade by reaction with hydroxyl radicals that are formed photochemically in the atmosphere. The half-life is estimated to be 63 days.

EDC has exhibited moderate toxicity in fish. This compound is not expected to bioconcentrate in fish due to its low octanol/water partition coefficient (1.48). The measured log BCF in bluegill sunfish is 0.30.

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 EDC. Exposures could occur by inhalation of vapors or by contact to the skin or eye. EDC 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 EDC for use directly in consumer products.
- Releases – If a spill occurs, emergency personnel should wear protective equipment to minimize exposures.

8. Recommended Risk Management Measures

EDC is flammable and can react with certain materials of construction. In addition, personnel exposure must be controlled. Prior to using EDC, carefully read and comprehend the Material Safety Data Sheet. The following are some risk management measures that are effective against these hazards:

- Work areas where EDC is used should be fire resistant. EDC must be stored in a National Fire Prevention Association (NFPA) Class I area. During EDC transfers from one container to another, equipment should be properly grounded and bonded to prevent the build up of static electricity. If discharged, this build up could create an igniting spark.

- Work areas where EDC is used should be well ventilated to limit solvent vapors to below exposure limits and to limit the concentration of potentially flammable vapors.
- To avoid overexposure to EDC vapors, monitor the EDC vapor concentration in the work place. If vapors are above exposure limits, install additional engineering controls (such as localized ventilation) to reduce EDC 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 EDC.
- Proper labeling, handling and storage of EDC will reduce the likelihood of accidental ingestion or inhalation.
- Equipment used for EDC storage or processing should be constructed of the proper materials. For example, bulk storage containers should be constructed of either mild carbon, or stainless steel. Do not use aluminum as a material of construction. Storage tanks should not be constructed of, nor contain, any non-compatible plastic components. Carbon steel is the material of choice for piping. For more detailed information regarding materials of construction, refer to the OxyChem Handbook.
- Personnel involved with EDC manufacturing operations should be properly trained. For detailed recommendations regarding personnel involved in unloading EDC from barges or tank trucks, refer to the OxyChem Handbook.

9. Product Stewardship Programs

An OxyChem product handbook is available for EDC. The handbook includes technical data regarding the product as well as more detailed information about handling, storing, and using EDC safely. In addition, specific information for unloading barges, tank cars, and tank trucks of EDC is provided. Other topics include recommendations on storage and equipment.

OxyChem is a member of an industry coalition, the Hazardous Air Pollutant (HAP) Task Force, that is completing toxicity testing for EDC under an agreement with EPA. The testing will provide data requested in the proposed HAP Test Rule and the Children's Health Initiative. The following work is expected to be completed by the end of Calendar Year 2009:

- Combined acute inhalation toxicity and neurotoxicity study
- Oral subchronic neurotoxicity study
- Reproductive oral toxicity study
- Route to route modeling, validation and simulations

10. Regulatory Compliance Information

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

U.S. Environmental Protection Agency:

- Clean Air Act: EDC is included on the Clean Air Act, Section 112(b) list of Hazardous Air Pollutants.
- Clean Water Act – Water Quality Criteria:
  - Based on fish/shellfish and water consumption = 0.38 μg/L
  - Based on fish/shellfish consumption only = 37 μg/L
- Comprehensive Environmental Response, Compensation, and Liability Act: Releases of EDC in excess of the Reportable Quantity of 100 pounds must be reported.
- Emergency Planning and Community Right-to-know Act: EDC is a listed substance that is subject to reporting requirements under Section 313 of the act. These reports are often called Toxic Release Inventory (TRI) Reports.
- Resource Conservation and Recovery Act:
  - Characteristic Toxic Hazardous Waste code D028. The code applies if waste contains 0.5 mg/L or more EDC as determined by the Toxicity Characteristic Leaching Procedure.
  - Listed Hazardous Waste Codes in which listing is based wholly or partly on EDC include U077, F024, F025, K018, K019, K020, K029, K030, and K096.
- Safe Drinking Water Act – Maximum Contaminant Level (MCL) = 0.005 mg/L
- Toxic Substances Control Act – EDC is subject to an enforceable consent agreement.

Food and Drug Administration - Maximum permissible level in bottled water = 0.005 ppm

World Health Organization – EDC is subject to the Prior Informed Consent (PIC) Convention. The designation was based on pesticide uses, not on industrial uses. According to the PIC Convention, export of a chemical can only take place with the prior informed consent of the importing Party.

Occupational Safety and Health Administration - Permissible Exposure Limits:

- 8 hour time weighted average: 50 ppm
- Ceiling: 100 ppm
- Peak (5 minutes in any 3 hour period): 200 ppm

American Conference of Governmental Industrial Hygienists - Threshold Limit Value = 10 ppm averaged over an 8 hour day.

National Institute for Occupational Safety and Health – Recommended Exposure Levels:

- 8 hour time weighted average: 1 ppm
- 15 minute short term exposure limit: 2 ppm
- Immediately Dangerous to Life and Health concentration: 50 ppm

11. Sources for Additional Information

ACGIH, Documentation of the Threshold Limit Values and Biological Exposure Indices, 7th ed., 2001.

AIHA, Odor Thresholds for Chemicals with Established Occupational Health Standards, American Industrial Hygiene Association, Fairfax, VA, 1993.

ATSDR, Toxicological Profile for 1,2-dichloroethane, September, 2001.

Clayton, G.D. and Clayton, F.E. (1994). Patty's Industrial Hygiene and Toxicology, 4th ed., John Wiley & Sons, Inc., pp. 4098 - 4108.

HSDB, Hazardous Substances Databank Number: 65, Last Revision Date: 20050624.

IARC, Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, Supplement 7, Vol 71, (1999).

NIOSH, Ethylene Dichloride, IDLH Documentation, August 16, 1996.

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

Organization for Economic Cooperation and Development (OECD) SIDS Initial Assessment Profile: 1,2-Dichloroethane, UNEP Publications, October 2002.

OxyChem Product Handbook web site: http://www.oxy.com/OurBusinesses/Chemicals/Products/Pages/ChlorineandDerivatives.aspx#chem_edc

OxyChem Material Safety Data Sheet web site: http://msds.oxy.com/

Reprotox, Reprotox Record Number: 1090, Last Revision Date: August 1, 2005.

RTECS, RTECS Number: KL0525000, Review Date: 200711.

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

13. Preparation Date: 12/12/2008 **Revised**: 02/19/2013

This Product Stewardship Summary is intended to give general information about the product discussed above. 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.