Ethylene Dichloride (1,2-Dichloroethane)

107-06-2

Hazard Summary

Exposure to low levels of ethylene dichloride can occur from breathing ambient or workplace air. Inhalation of concentrated ethylene dichloride vapor can induce effects on the human nervous system, liver, and kidneys, as well as respiratory distress, cardiac arrhythmia, nausea, and vomiting. Chronic (long-term) inhalation exposure to ethylene dichloride produced effects on the liver and kidneys in animals. No information is available on the reproductive or developmental effects of ethylene dichloride in humans. Decreased fertility and increased embryo mortality have been observed in inhalation studies of rats. Epidemiological studies are not conclusive regarding the carcinogenic effects of ethylene dichloride, due to concomitant exposure to other chemicals. Following treatment by gavage (experimentally placing the chemical in the stomach), several tumor types were induced in rats and mice. EPA has classified ethylene dichloride ethylene dichloride as a Group B2, probable human carcinogen.

Please Note: Ethylene dichloride is also known as 1,2-dichloroethane. The main sources of information for this fact sheet are EPA's Integrated Risk Information System (IRIS) (3), which contains information on the carcinogenic effects of ethylene dichloride including the unit cancer risk for inhalation exposure, and the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for 1,2-Dichloroethane. (1)

Uses

- Ethylene dichloride is primarily used in the production of vinyl chloride as well as other chemicals. It is used in solvents in closed systems for various extraction and cleaning purposes in organic synthesis. It is also added to leaded gasoline as a lead scavenger. (1)
- It is also used as a dispersant in rubber and plastics, as a wetting and penetrating agent. (1)
- It was formerly used in ore flotation, as a grain fumigant, as a metal degreaser, and in textile and PVC cleaning. (1)

Sources and Potential Exposure

- Inhalation of ethylene dichloride in the ambient or workplace air is generally the main route of human exposure. The compound may be released during its production, storage, use, transport, and disposal. (1)
- Exposure may also occur through the consumption of contaminated water. But usually ethylene dichloride will evaporate quickly into the air from the water or soil. (1)
- The average levels of ethylene dichloride in the air of seven urban locations in 1980-1981 ranged from 0.1 to 1.5 parts per billion (ppb). (1)

Assessing Personal Expos ure

• Breath samples may be used to determine whether or not someone has been recently exposed to ethylene dichloride. (1)

Health Hazard Information

Acute Effects:

- Acute inhalation exposure of humans to ethylene dichloride can affect the nervous system, with effects including narcosis, nausea, and vomiting. (1)
- An occupationally exposed man died from cardiac arrhythmia after acute (short-term) inhalation exposure to very high levels of ethylene dichloride. (1)
- Cardiac arrhythmia, pulmonary edema, bronchitis, hemorrhagic gastritis and colitis, depression, and changes in the brain tissue have been reported in humans that ingested large amounts of ethylene dichloride. (1)
- Effects reported in animals exposed by inhalation are similar to those for humans. (1)
- Clouding of the cornea and eye irritation have been observed in animals and are thought to be the result of vapor contact with the eyes. (1)
- Acute animal tests in rats, mice, and rabbits have demonstrated ethylene dichloride to have moderate acute toxicity from inhalation or dermal exposure and moderate to high acute toxicity from oral exposure. (2)

Chronic Effects (Noncancer):

- No information is available on the chronic effects of ethylene dichloride.
- Chronic inhalation exposure to ethylene dichloride produced effects on the liver and kidneys in animals. (1)
- Some studies have reported changes in the liver and kidneys and effects on the immune system and central nervous system in animals chronically exposed by ingestion. (1)
- EPA has not established a Reference Dose (RfD) or a Reference Concentration (RfC) for ethylene dichloride. (3)
- ATSDR has established an intermediate oral minimal risk level (MRL) of 0.2 milligram per kilogram body weight per day (mg/kg/d) based on kidney effects in animals. The MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects over a specified duration of exposure. Exposure to a level above the MRL does not mean that adverse health effects will occur. The MRL is intended to serve as a screening tool. (1)
- ATSDR has established a chronic inhalation MRL of 0.8 milligrams per cubic meter (mg/m³) (0.2 parts per million [ppm]) based on liver effects in animals and an acute inhalation MRL of 0.8 mg/m³ (0.2 ppm) based on immunological effects in animals. (1)
- The California Environmental Protection Agency (CalEPA) has established a chronic reference exposure level of 0.4 mg/m for ethylene dichloride based on liver effects in rats. The CalEPA reference exposure level is a concentration at or below which adverse health effects are not likely to occur. (5)

Reproductive/Developmental Effects:

- No information is available on the reproductive or developmental effects of ethylene dichloride in humans.
- Decreased fertility and increased embryo mortality have been observed in inhalation studies of rats. (1)

Cancer Risk:

- Epidemiological occupational studies could not link exposure to ethylene dichloride specifically with excess cancer incidence. (1)
- An increased incidence of colon and rectal cancer in men over 55 years of age exposed to ethylene dichloride in the drinking water has been reported. However, the study population was concomitantly exposed to other chemicals. (1)
- Following treatment by gavage (experimentally placing the chemical in the stomach), several tumor types (including increased incidences of forestomach squamous-cell carcinomas, circulatory system hemangiosarcomas, mammary adenocarcinoma, alveolar/bronchiolar adenomas, endometrial stromal polyps and sarcomas, and hepatocellular carcinomas) were induced in rats and mice. (1,3,4)
- An increased incidence of lung papillomas has been reported in mice after topical application. (1,3)
- EPA has classified ethylene dichloride as a Group B2, probable human carcinogen. (3)
- EPA uses mathematical models, based on human and animal studies, to estimate the probability of a person developing cancer from breathing air containing a specified concentration of a chemical. EPA

calculated an inhalation unit cancer risk estimate of 2.6×10^{-3} (µg/m³)⁻¹. EPA estimates that, if an individual were to continuously breathe air containing ethylene dichloride at an average of 0.04 $\mu\text{g/m}^{2}$ (4 x 10^{-5} mg/m³) over his or her entire lifetime, that person would theoretically have no more than a one-in-amillion increased chance of developing cancer as a direct result of breathing air containing this chemical. Similarly, EPA estimates that breathing air containing 0.4 μ g/m³ (4 x 10⁻⁴ mg/m³) would result in not greater than a one-in-a-hundred thousand increased chance of developing cancer, and air containing 4.0 $\mu g/m^{3}$ (4 x 10⁻³ mg/m³) would result in not greater than a one-in-ten thousand increased chance of developing cancer. For a detailed discussion of confidence in the potency estimates, please see IRIS. (3)

Physical Properties

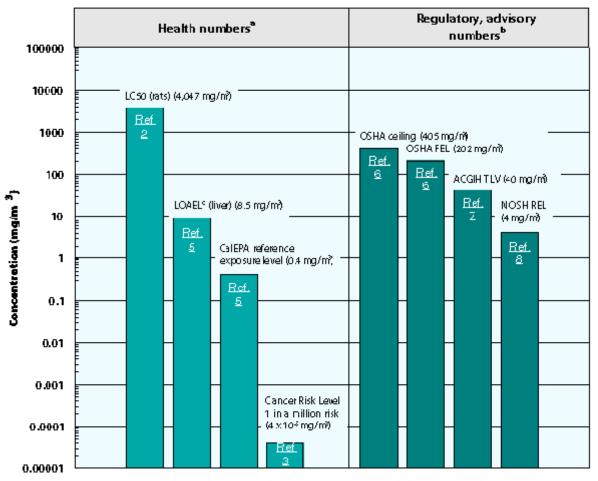
- 1,2-Dichloroethane is a common synonym for ethylene dichloride.
- The chemical formula for ethylene dichloride is C₂ H₄Cl₂, and its molecular weight is 98.96 g/mol. (1)
 Ethylene dichloride occurs as a colorless, oily, heavy liquid that is slightly soluble in water. (1)
- Ethylene dichloride has a pleasant chloroform-like odor, with an odor threshold of 6-10 ppm. (1)
- The vapor pressure for ethylene dichloride is 64 mm Hg at 20 °C, and its log octanol/water partition coefficient (log K) is 1.48. (1)

Conversion Factors:

To convert concentrations in air (at 25°C) from ppm to mg/m³: mg/m³ = (ppm) × (molecular weight of the compound)/(24.45). For ethylene dichloride: 1 ppm = 4.05 mg/m³. To convert concentrations in air from μ g/m³ to mg/m³ : mg/m³ = (μ g/m³) × (1 mg/1,000 μ g).

Health Data from Inhalation Exposure

1,2-Dichloroethane



ACGIH TLV -- American Conference of Governmental and Industrial Hygienists' threshold limit value expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effects.

 LC_{50} (Lethal Concentration $_{50}$)--A calculated concentration of a chemical in air to which exposure for a specific length of time is expected to cause death in 50% of a defined experimental animal population.

NIOSH REL -- National Institute of Occupational Safety and Health recommended exposure limit; NIOSH-

 $recommended\ exposure\ limit\ for\ an\ 8-\ or\ 10-h\ time-weighted-average\ exposure\ and/or\ ceiling.$

OSHA PEL--Occupational Safety and Health Administration's permissible exposure limit expressed as a timeweighted average; the concentration of a substance to which most workers can be exposed without adverse effect averaged over a normal 8-h workday or a 40-h workweek.

OSHA PEL ceiling value --OSHA's permissible exposure limit ceiling value; the concentration of a substance that should not be exceeded at any time.

The health and regulatory values cited in this factsheet were obtained in December 1999.

ື Health numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.

Regulatory numbers are values that have been incorporated in Government regulations, while advisory numbers are nonregulatory values provided by the Government or other groups as advice. OSHA numbers are regulatory, whereas NIOSH and ACGIH numbers are advisory.

The NOAEL is from the critical study used as the basis for the CalEPA chronic reference exposure level.

These cancer risk estimates were derived from oral data and converted to provide the estimated inhalation risk.

Summary created in April 1992, updated January 2000

References

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