1,1,2,2-Tetrachloroethane

79-34-5

Hazard Summary

As 1,1,2,2-tetrachloroethane is no longer used much in the United States, current air emissions predominantly result from its use as a chemical intermediate during the manufacture of other chemicals. Low levels have been detected in air. The main effects of 1,1,2,2-tetrachloroethane are liver and neurological effects. Acute (short-term) inhalation exposure to very high levels of 1,1,2,2-tetrachloroethane has resulted in effects on the liver and respiratory, central nervous, and gastrointestinal systems in humans. Chronic (long-term) inhalation exposure to 1,1,2,2-tetrachloroethane in humans results in jaundice and an enlarged liver, headaches, tremors, dizziness, numbness, and drowsiness. Animal studies have shown a significantly increased incidence of liver tumors in mice orally exposed to 1,1,2,2-tetrachloroethane. EPA has classified 1,1,2,2-tetrachloroethane as a Group C possible human carcinogen.

Please Note: The main sources of information for this fact sheet are EPA's Integrated Risk Information System (IRIS) (4), which contains information on the carcinogenic effects of 1,1,2,2-tetrachloroethane, and the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for 1,1,2,2-Tetrachloroethane. (1)

Uses

- The production of 1,1,2,2-tetrachloroethane as an end-product has decreased significantly in the United States. (1)
- In the past, 1,1,2,2-tetrachloroethane was used in large amounts to produce trichloroethylene, tetrachloroethylene, and 1,2,-dichloroethylene. (1)
- It was also used as a solvent, in cleaning and degreasing metals, in paint removers, varnishes and lacquers, in photographic films, as an extractant for oils and fats, and in pesticides. (1)

Sources and Potential Exposure

- As it is no longer widely used in the U.S. as an end-product, present sources of 1,1,2,2-tetrachloroethane are fugitive emissions or discharges when it is generated as a by-product and during chemical production activities in which it is an intermediate product. (1)
- Low levels of 1,1,2,2-tetrachloroethane can be present in both indoor and outdoor air. In the early 1980s, average ambient air concentrations were around 0.005 parts per billion (ppb), and average concentrations in the indoor air of several homes measured 1.8 ppb. (1)
- 1,1,2,2-Tetrachloroethane has been found, in trace amounts, in adhesives, oils, greases, and lubricants; these household products may contaminate indoor air. (1)
- Limited occupational exposure to 1,1,2,2-tetrachloroethane may occur through inhalation of the vapors or through skin contact due to spills or accidents in the workplace. (1)
- 1,1,2,2-Tetrachloroethane has been detected in surface water and groundwater; however, a nationwide survey of drinking water supplies in the 1980s did not find any supplies containing 1,1,2,2-tetrachloroethane. (1)
- 1,1,2,2-Tetrachloroethane has been found at many National Priority List (i.e., Superfund) sites. (1)

Assessing Personal Exposure

- No specific medical tests are available to determine exposure to 1,1,2,2-tetrachloroethane. (1)

Health Hazard Information

Acute Effects:

- Acute exposure to very high levels of 1,1,2,2-tetrachloroethane has caused severe liver destruction in humans. (1,2)
- Respiratory and eye irritation, dizziness, nausea, and vomiting have been noted in humans exposed to fumes at high levels in the workplace. (1)
- Animal studies have reported effects on the liver, eyes, and central nervous system from acute inhalation exposure to 1,1,2,2,-tetrachloroethane. (1)
- Tests involving acute exposure of rats and mice have shown 1,1,2,2-tetrachloroethane to have moderate acute toxicity. (3)

Chronic Effects (Noncancer):

- Chronic exposure of humans to high levels of 1,1,2,2-tetrachloroethane results in effects on the liver (jaundice and an enlarged liver), central and peripheral nervous system (headaches, tremors, dizziness, and drowsiness), and gastrointestinal effects (pain, nausea, vomiting, and loss of appetite). (1)
- Liver effects (fatty degeneration, increased liver weight, inflammatory changes) have also been observed in animals exposed via inhalation. (1)
- EPA has not established a Reference Concentration (RfC) or Reference Dose (RfD) for 1,1,2,2-tetrachloroethane. (4)
- ATSDR has calculated an intermediate-duration inhalation minimal risk level (MRL) of 0.4 parts per million (ppm) (3 milligrams per cubic meter, mg/m^3) for 1,1,2,2-tetrachloroethane based on liver effects in rats. 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)

Reproductive/Developmental Effects:

- No studies are available regarding developmental or reproductive effects in humans from inhalation or oral exposure to 1,1,2,2-tetrachloroethane. (1)
- Animal studies have not reported reproductive effects from inhalation exposure to 1,1,2,2-tetrachloroethane, while an oral study in rats reported histopathological changes in the testes. (1)
- No effects to the offspring of male rats exposed to 1,1,2,2-tetrachloroethane via inhalation were reported. (1)

Cancer Risk:

- Oral exposure to 1,1,2,2-tetrachloroethane in mice resulted in an increased incidence of hepatocellular carcinomas, while no increase in tumors was reported in rats. (1,4)
- EPA has classified 1,1,2,2-tetrachloroethane as a Group C possible human carcinogen. (4)
- EPA uses mathematical models, based on animal studies, to estimate the probability of a person developing cancer from breathing air containing a specified concentration of a chemical. EPA has calculated an inhalation unit risk estimate of 5.8×10^{-5} $(\mu g/m^3)^{-1}$ based on oral data in mice. EPA estimates that, if an individual were to continuously breathe air containing 1,1,2,2-tetrachloroethane at an average of 0.02 $\mu g/m^3$ (2.0×10^{-5} mg/m^3) over his or her entire lifetime, that person would theoretically have no more

than a one-in-a-million increased chance of developing cancer as a direct result of breathing air containing this chemical. Similarly, EPA estimates that continuously breathing air containing 0.2 µg/m^3 (2.0×10^{-4} mg/m^3) would result in not greater than a one-in-a-hundred thousand increased chance of developing cancer over a lifetime, and air containing 2.0 µg/m^3 (2.0×10^{-3} mg/m^3) 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. (4)

- EPA has also calculated an oral cancer slope factor of 0.2 $(mg/kg/d)^{-1}$. (4)

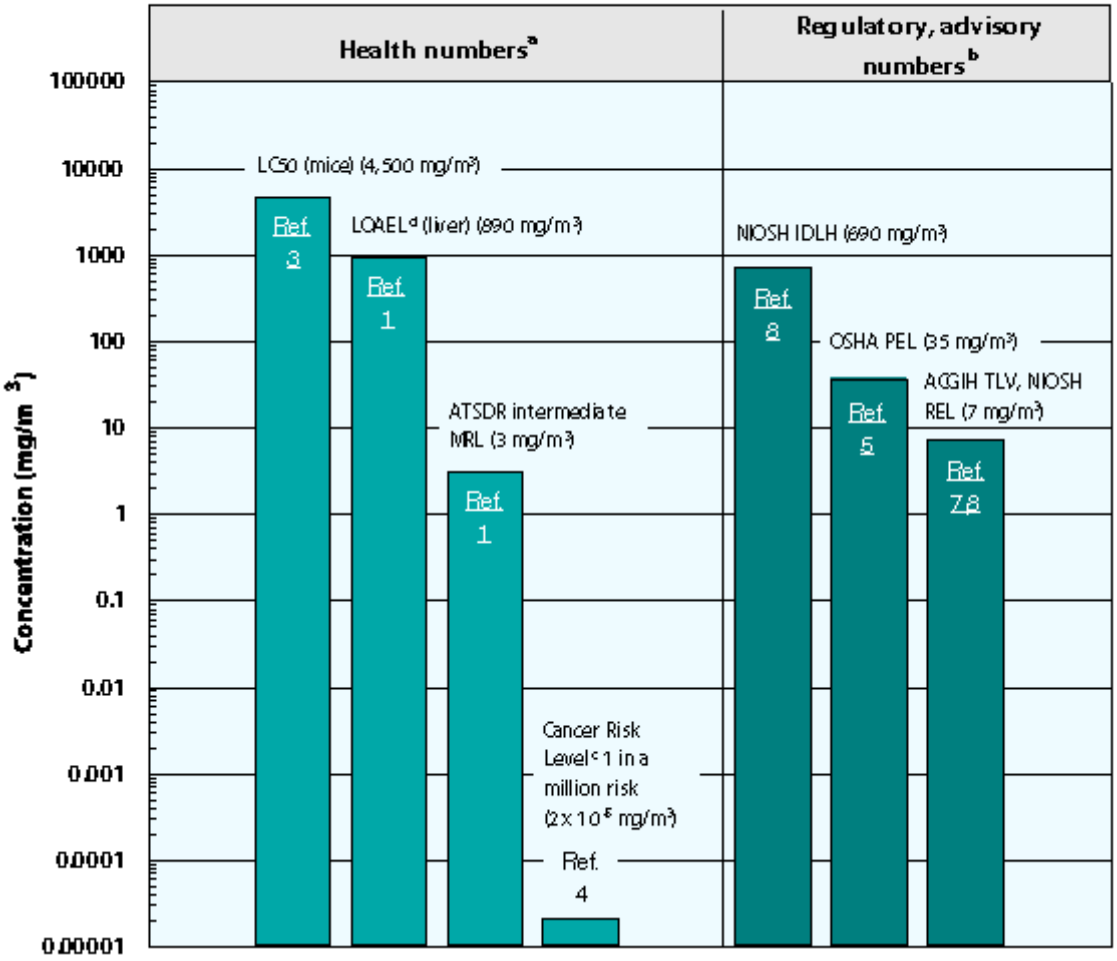
Physical Properties

- 1,1,2,2-Tetrachloroethane is a colorless, dense liquid that has a sweet, chloroform like odor. (1,6)
- The odor threshold for 1,1,2,2-tetrachloroethane is 1.5 ppm. (6)
- The chemical formula for 1,1,2,2-tetrachloroethane is $C_2H_2Cl_4$, and the molecular weight is 167.85 g/mol. (1,2)
- The vapor pressure for 1,1,2,2-tetrachloroethane is 5.95 mm Hg at 25 °C, and it has a log octanol/water partition coefficient (log K_{ow}) of 2.39. (1)
- The half-life in air is about 60 days. (1)

Conversion Factors:
To convert concentrations in air (at 25°C) from ppm to mg/m^3: mg/m^3 = (ppm) × (molecular weight of the compound)/(24.45). For 1,1,2,2-tetrachloroethane: 1 ppm = 6.86 mg/m^3. To convert concentrations in air from µg/m^3 to mg/m^3: mg/m^3 = (µg/m^3) × (1 mg/1,000 µg).

Health Data from Inhalation Exposure

1,1,2,2-Tetrachloroethane



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's recommended exposure limit; NIOSH-recommended exposure limit for an 8- or 10-h time-weighted-average exposure and/or ceiling.

NIOSH IDLH -- NIOSH's immediately dangerous to life or health concentration; NIOSH recommended exposure limit to ensure that a worker can escape from an exposure condition that is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from the environment.

OSHA PEL --Occupational Safety and Health Administration's permissible exposure limit expressed as a time-weighted 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.

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

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

[b] 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.

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

[d] The LOAEL is from the critical study used as the basis for the ATSDR intermediate MRL.

Summary created in April 1992, updated January 2000

References

1. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for 1,1,2,2-Tetrachloroethane (Update). U.S. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 1996.
2. U.S. Department of Health and Human Services. Hazardous Substances Data Bank (HSDB, online database). National Toxicology Information Program, National Library of Medicine, Bethesda, MD. 1993.
3. U.S. Department of Health and Human Services. Registry of Toxic Effects of Chemical Substances (RTECS, online database). National Toxicology Information Program, National Library of Medicine, Bethesda, MD. 1993.
4. U.S. Environmental Protection Agency. Integrated Risk Information System (IRIS) on 1,1,2,2-Tetrachloroethane. National Center for Environmental Assessment, Office of Research and Development, Washington, DC. 1999.
5. Occupational Safety and Health Administration (OSHA). Occupational Safety and Health Standards, Toxic and Hazardous Substances. Code of Federal Regulations 29 CFR 1910.1000. 1998.
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7. American Conference of Governmental Industrial Hygienists (ACGIH). 1999 TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents, Biological Exposure Indices. Cincinnati, OH. 1999.
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