1,1,2-Trichloroethane

79-00-5

Hazard Summary

1,1,2-Trichloroethane is used as a chemical intermediate and a solvent. No information is available on the acute (short-term), chronic (long-term), developmental, reproductive, or carcinogenic effects of 1,1,2-trichloroethane in humans. The only effect that has been noted in humans is stinging and burning sensations of the skin upon dermal exposure to the chemical. Acute animal studies have reported effects on the liver, kidney, and central nervous system (CNS) from inhalation and oral exposure to 1,1,2-trichloroethane, while chronic animal studies have reported effects on the liver and immune system from oral exposure. An animal study reported liver tumors and adrenal tumors in mice, but no tumors in rats, exposed to 1,1,2-trichloroethane by gavage (experimentally placing the chemical in the stomach). EPA has classified 1,1,2-trichloroethane 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) (3), which contains information on oral chronic toxicity and the RfD, and the carcinogenic effects of 1,1,2-trichloroethane including the unit cancer risk for inhalation exposure, and the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for 1,1,2-Trichloroethane. (1)

Uses

- 1,1,2-Trichloroethane is primarily used as a chemical intermediate in the production of 1,1-dichloroethene. It is also used as a solvent for chlorinated rubbers, fats, oils, waxes, and resins. (1,6)

Sources and Potential Exposure

- Very low levels of 1,1,2-trichloroethane have been detected in ambient air; the samples tested usually contained around 0.01 to 0.05 parts per billion (ppb) of 1,1,2-trichloroethane. (1)
- 1,1,2-Trichloroethane has not been reported in food or soil, and exposure from contaminated drinking water appears to be rare. (1)
- Exposure to 1,1,2-trichloroethane may occur in the workplace where it is used as a solvent. (1)

Assessing Personal Exposure

- There is no commonly used medical test to measure exposure to 1,1,2-trichloroethane. (1)

Health Hazard Information

Acute Effects:

- No information is available on the acute effects of 1,1,2-trichloroethane in humans from inhalation or oral exposures. Studies on dermal exposure to 1,1,2-trichloroethane in humans have reported stinging and burning sensations and transient whitening of the skin. (1)
- Animal studies have reported effects on the liver, kidney, and CNS from acute inhalation and oral exposure to 1,1,2-trichloroethane. (1)
- Tests involving acute exposure of mice and rats have shown 1,1,2-trichloroethane to have moderate and high acute toxicity from inhalation and oral exposures, respectively. (1,2)

Chronic Effects (Noncancer):

- No information is available on the chronic effects of 1,1,2-trichloroethane in humans from inhalation or oral exposure. (1)
- Animal studies have not observed adverse effects from chronic inhalation exposure to 1,1,2-trichloroethane. Effects on the liver and immune system have been noted in chronic oral studies. (1)
- EPA has not established a Reference Concentration (RfC) for 1,1,2-trichloroethane. (3)
- The California Environmental Protection Agency (CalEPA) has established a chronic reference exposure level of 0.4 milligrams per cubic meter (mg/m^3) 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. (6)
- The Refence Dose (RfD) for 1,1,2-trichloroethane is 0.004 milligrams per kilogram body weight per day (mg/kg/d) based on clinical serum chemistry in mice. The RfD is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups), that is likely to be without appreciable risk of deleterious noncancer effects during a lifetime. It is not a direct estimator of risk but rather a reference point to gauge the potential effects. At exposures increasingly greater than the RfD, the potential for adverse health effects increases. Lifetime exposure above the RfD does not imply that an adverse health effect would necessarily occur. (3)
- EPA has medium confidence in the critical study on which the RfD is based because of its balanced strengths (clinical chemistries) and weaknesses (lack of histopathology and a no-observed-adverse-effect level [NOAEL]); medium confidence in the supporting database; and, consequently, medium confidence in the RfD. (3)

Reproductive/Developmental Effects:

- No information is available regarding developmental or reproductive effects of 1,1,2-trichloroethane in humans from inhalation or oral exposure. (1)
- Animal studies have not reported developmental or reproductive effects from oral exposure to 1,1,2-trichloroethane. (1)

Cancer Risk:

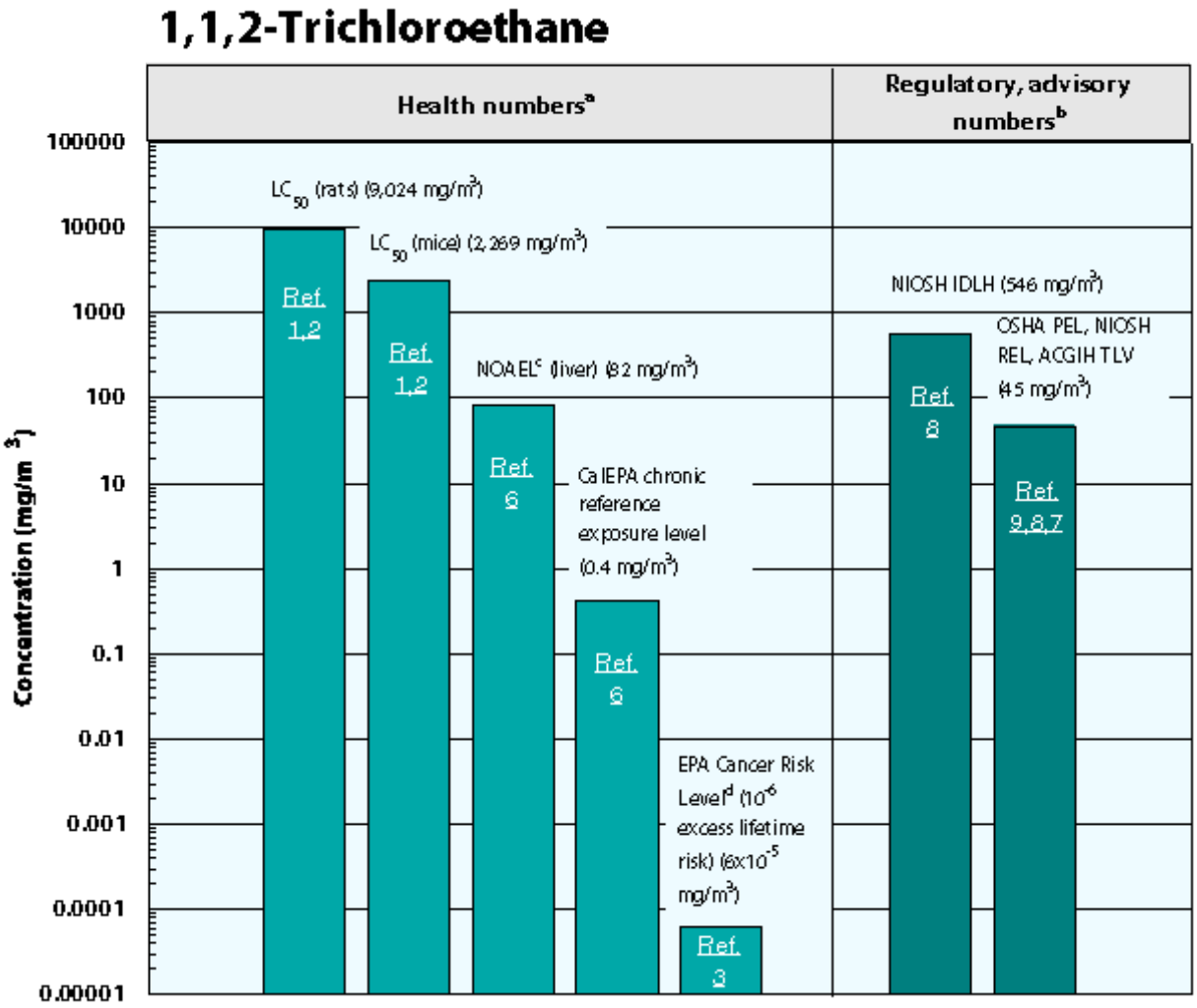
- No studies are available regarding cancer in humans from inhalation or oral exposure. (1)
- A study by the National Toxicology Program reported liver tumors and adrenal tumors in mice, but no tumors in rats from exposure to 1,1,2-trichloroethane by gavage. (1,3,4)
- EPA has classified 1,1,2-trichloroethane as a Group C, possible human carcinogen. (3)
- 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 1.6×10^{-5} $(\mu g/m^3)^{-1}$. EPA estimates that, if an individual were to continuously breathe air containing 1,1,2-trichloroethane at an average of 0.06 $\mu g/m^3$ (6×10^{-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 breathing air containing 0.6 $\mu g/m^3$ (6×10^{-4} mg/m^3) would result in not greater than a one-in-a-hundred thousand increased chance of developing cancer, and air containing 6.0 $\mu g/m^3$ (6×10^{-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 factors, please see IRIS. (3)
- EPA has calculated an oral cancer slope factor of 5.7×10^{-2} $(mg/kg/d)^{-1}$. (3)

Physical Properties

- The chemical formula for 1,1,2-trichloroethane is $C_2H_3Cl_3$, and the molecular weight is 133.41. (1)
- 1,1,2-Trichloroethane is a colorless, sweet-smelling liquid; the odor threshold is not available. (1,5)
- The vapor pressure for 1,1,2-trichloroethane is 22.49 mm Hg at 25 °C, and it has a log octanol/water partition coefficient ($\log K_{ow}$) of 2.42. (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-trichloroethane: 1 ppm = 5.46 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



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 IDLH --National Institute of Occupational Safety and Health immediately dangerous to life and health; NIOSH concentration representing the maximum level of a pollutant from which an individual could escape within 30 minutes without escape-impairing symptoms or irreversible health effects.
NIOSH REL --NIOSH's 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 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]

[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] This NOAEL is from the critical study used to derive the CalEPA reference exposure level.

[d] 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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6. California Environmental Protection Agency (CalEPA). Technical Support Document for the Determination of Noncancer Chronic Reference Exposure Levels. Draft for Public Review. Office of Environmental Health Hazard Assessment, Berkeley, CA. 1997
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.
8. National Institute for Occupational Safety and Health (NIOSH). Pocket Guide to Chemical Hazards. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention. Cincinnati, OH. 1997.
9. Occupational Safety and Health Administration (OSHA). Occupational Safety and Health Standards, Toxic and Hazardous Substances. Code of Federal Regulations. 29 CFR 1910.1000. 1998.