Hexachloroethane

67-72-1

Hazard Summary

Hexachloroethane is used by the military for smoke-producing devices, in metal and alloy production, and as an ingredient in insecticides. Hexachloroethane acts primarily as a central nervous system (CNS) depressant in humans acutely (short-term) exposed to it. Hexachloroethane is also moderately irritating to the skin, mucous membranes, and liver in humans. Neurological, liver, and kidney effects have been observed in animals exposed to hexachloroethane. No information is available on the chronic (long-term), reproductive, developmental, or carcinogenic effects of hexachloroethane in humans. Hepatocellular carcinomas (liver tumors) were observed in mice following oral exposure to hexachloroethane. EPA has classified hexachloroethane 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) (7), which contains information on oral chronic toxicity and the Reference Dose (RfD), and the carcinogenic effects of hexachloroethane including the unit cancer risk for inhalation exposure and EPA's Health Effects Assessment for Hexachloroethane. (6) Another secondary source is the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for Hexachloroethane. (11)

Uses

- In the United States, about half of the hexachloroethane is used by the military for smoke-producing devices. (11)
- Another use of hexachloroethane is in pyrotechnics. It inhibits the explosiveness of methane and the combustion of ammonium perchlorate. (2,3)
- Hexachloroethane is used as an anthelmintic (to destroy tapeworms) in sheep and cattle. It is also added to the feed of ruminants to prevent methanogenesis and increase feed efficiency, and it is used as an ingredient in some fungicides and insecticides. (2,4,11)
- Hexachloroethane is used in metal and alloy production. (12,11)
- Hexachloroethane has various applications as a polymer additive. It has flameproofing qualities and increases affinity for dyes. (2)

Sources and Potential Expos ure

- The most probable route of exposure to hexachloroethane appears to be the inhalation of contaminated air. (1)
- Some segments of the general population may be exposed by the ingestion of contaminated drinking water. (1)

Assessing Personal Exposure

- Laboratory tests can detect hexachloroethane in blood, urine, or feces. (11)

Health Hazard Information

Acute Effects:

- Hexachloroethane acts primarily as a central nervous system depressant (possibly resulting in mild paralysis) in humans acutely exposed to it and in high concentrations it causes narcosis. (2)
- Hexachloroethane is moderately irritating to the skin, mucous membranes, and liver in humans. (2)
- Liver and kidney effects have been observed in animals acutely exposed to hexachloroethane by ingestion. (3,4)
- Tests involving acute exposure of rats, mice, guinea pigs, and rabbits have demonstrated hexachloroethane to have moderate acute toxicity from ingestion and low acute toxicity from dermal exposure. (5)

Chronic Effects (Noncancer):

- No information is available on the chronic effects of hexachloroethane in humans.
- In one study, chronic inhalation exposure of animals to high concentrations of hexachloroethane resulted in neurobehavioral effects in rats and dogs and increased liver weight in guinea pigs. (6,7)
- In rats chronically exposed to hexachloroethane by ingestion or gavage (experimentally placing the chemical in the stomach), kidney effects have been observed. (6,7)
- The Reference Concentration (RfC) for hexachloroethane is under review by EPA. (7)
- ATSDR calculated an intermediate-duration inhalation minimal risk level (MRL) of 58 milligrams per cubic meter (mg/m^3) (6 parts per million [ppm]). 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. (11)
- The California Environmental Protection Agency (CalEPA) has established a chronic inhalation reference exposure level of 0.08 mg/m^3 for hexachloroethane. The CalEPA reference exposure level is a concentration at or below which adverse health effects are not likely to occur. (12)
- The Reference Dose (RfD) for hexachloroethane is 0.001 milligrams per kilogram body weight per day (mg/kg/d) based on atrophy and degeneration of the renal tubules in rats. 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. (7)
- EPA has medium to high confidence in the study on which the RfD was based because, although it defined a no-observed-adverse-effect level (NOAEL) and a lowest-observed-adverse-effect level (LOAEL), the study used small groups of animals; confidence in the database is medium because, although hexachloroethane has been tested for carcinogenicity and teratogenicity, a NOAEL for chronic toxicity has not been defined; and, consequently, confidence in the RfD is medium.

Reproductive/Developmental Effects:

- No information is available on the reproductive or developmental effects of hexachloroethane in humans.
- At the highest concentrations, rats exposed to hexachloroethane by inhalation exhibited maternal toxicity, but there was no evidence of fetotoxicity or teratogenicity (birth defects). (6,7)
- In rats exposed to high doses of hexachloroethane via gavage, maternal toxicity, a reduced gestation index, a reduction in the number of fetuses per female, and increased fetal resorption rates were observed. (6,7)

Cancer Risk:

- No data are available on the carcinogenic effects of hexachloroethane in humans. (7)
- Hepatocellular carcinomas were observed in mice following chronic oral exposure to hexachloroethane. (7)
- An increased incidence of renal neoplasms were observed in orally-exposed male rats, but not in females. (8)
- EPA has classified hexachloroethane as a Group C, possible human carcinogen. (7)
- EPA uses mathematical models, based on human and animal studies, to estimate the probability of a

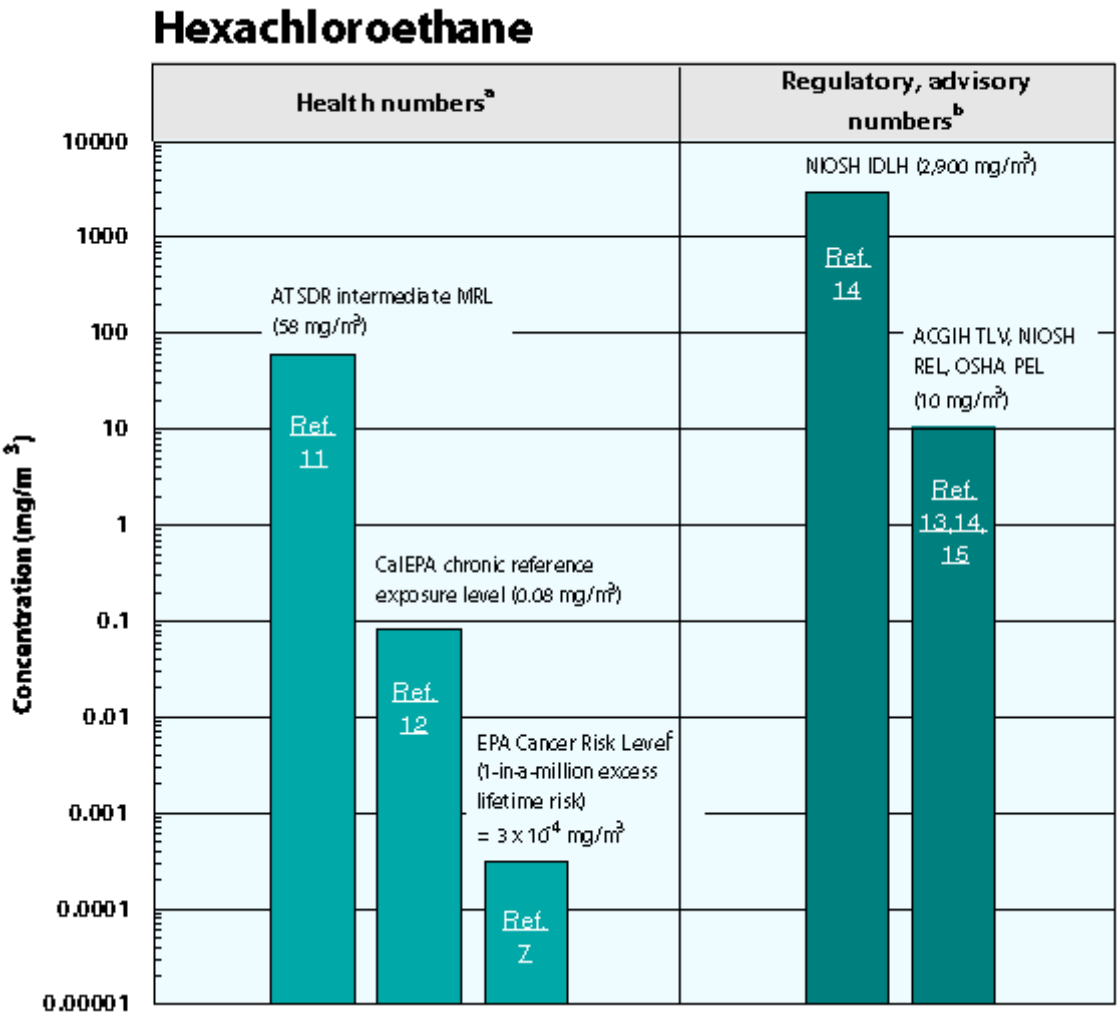
person developing cancer from breathing air containing a specified concentration of a chemical. EPA calculated an inhalation unit risk estimate of 4.0×10^{-6} $(\mu g/m^3)^{-1}$. EPA estimates that, if an individual were to continuously breathe air containing hexachloroethane at an average of 0.3 $\mu g/m^3$ (3×10^{-4} 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 3.0 $\mu g/m^3$ (3×10^{-3} mg/m^3) would result in not greater than a one-in-a-hundred thousand increased chance of developing cancer, and air containing 30.0 $\mu g/m^3$ (3×10^{-2} 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. (7)
- EPA has calculated an oral cancer slope factor of 0.014 $(mg/kg/d)^{-1}$. (7)

Physical Properties

- The empirical formula for hexachloroethane is C_2Cl_6, and it has a molecular weight of 236.74 g/mol. (9)
- Hexachloroethane occurs as colorless rhombic crystals or crystalline powder and is insoluble in water. (9)
- Hexachloroethane has a camphorous odor with an odor threshold of 0.15 ppm. (3,4,10)
- The vapor pressure for hexachloroethane is 0.21 mm Hg at 20 °C, and it has a log octanol/water partition coefficient (log K_{ow}) of 4.04. (6)

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 hexachloroethane: 1 ppm= 9.7 mg/m^3. To convert concentrations in air from $\mu g/m^3$ to mg/m^3: mg/m^3 = ($\mu g/m^3$) × (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.

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.

Summary created in April 1992, updated January 2000

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