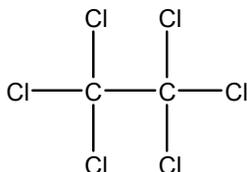


HEXACHLOROETHANE

CAS NO. 67-72-1

First Listed in the *Seventh Annual Report on Carcinogens*



CARCINOGENICITY

Hexachloroethane is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (NTP 1989, IARC 1999). When administered in corn oil by gavage, hexachloroethane induced increased incidences of renal neoplasms and marginally increased incidences of adrenal pheochromocytoma in male rats. There was no corresponding evidence of carcinogenic activity in female rats. A significant increase in incidence of hepatocellular carcinomas was observed in similarly treated mice of both sexes (IARC 1979, 1999).

Little data is available to evaluate the carcinogenicity of hexachloroethane in humans. No association between exposure to hexachloroethane and cancer incidence was observed in one cohort study of workers at aluminum foundries and smelters in Sweden (IARC 1999).

PROPERTIES

Hexachloroethane is a colorless, nonflammable, crystalline solid with a camphor-like odor. It is insoluble in water, but is soluble in ethanol, diethyl ether, benzene, chloroform, and oils. Although hexachloroethane is nonflammable, at temperatures greater than 185°C it may emit toxic and irritating fumes containing tetrachloroethylene and carbon tetrachloride. It is reactive with alkalis, zinc, cadmium, aluminum, hot iron, and mercury. These reactions produce spontaneously explosive chloroacetylenes (HSDB 2000).

USE

The applications of hexachloroethane have been quite extensive; however, industrial uses are diminishing. It has been used as an anthelmintic to treat fascioliasis (liver flukes) in sheep and cattle; however, FDA approval for this use was withdrawn in 1971. Hexachloroethane has been used in metal and alloy production, mainly in refining aluminum alloys. It is also used for removing impurities from molten metals, recovering metals from ores or smelting products, and improving the quality of various metals and alloys. Hexachloroethane has been used as a degassing agent for magnesium, and it inhibits the explosiveness of methane and the combustion of ammonium perchlorate. Hexachloroethane mixed with stoichiometric amounts of zinc, zinc oxide, or titanium dioxide is commonly used in military smoke munitions (e.g., candles and grenades used to generate "smoke" or "fog", and pyrotechnics). Hexachloroethane has been used as an additive in combustible liquids (ignition suppressant) and fire extinguishing fluids. Hexachloroethane has had a variety of applications as a polymer additive. It has flame-proofing qualities, increases sensitivity to radiation cross linking, and it is used as a vulcanizing agent. Added to polymer fibers, hexachloroethane acts as a swelling agent and increases affinity for

dyes. It is a main ingredient in production of some types of synthetic diamonds. Other uses of hexachloroethane in the U.S. have included: a plasticizer for cellulose esters, an accelerator in rubber, a retardant in fermentation processes, a moth repellent, a component of submarine paints, and a constituent of various fungicidal and insecticidal formulations. With the possible exception of use for smoke generation, only limited quantities of hexachloroethane are used in these applications (IARC 1979, 1999, ATSDR 1997, HSDB 2000).

Prior to 1979, approximately 50% of the hexachloroethane distributed was used by the military to produce smoke and pyrotechnic devices, 30% to 40% was used to manufacture degassing pellets to remove air bubbles from molten ore at aluminum foundries, and 10% to 20% was used as an antihelmintic to control sheep flukes. Large amounts of hexachloroethane continue to be used by the military. It was estimated that an average of 192,802 lb of hexachloroethane was used annually at the major facility manufacturing the smoke and pyrotechnic devices between 1966 and 1977 (ATSDR 1997).

PRODUCTION

Commercial production of hexachloroethane began in the U.S. in 1921 and continued until 1967 (IARC 1979, ATSDR 1997). It is also produced and used in-house or recycled in feedstock to produce tetrachloroethylene or carbon tetrachloride. It is produced as a by-product of industrial chlorination of C₂ hydrocarbons. Twenty-two current U.S. suppliers were identified (Chem Sources 2001). Estimated production in 1977 was between 2 and 20 million lb (ATSDR 1997). More recent production data were not located.

U.S. imports of hexachloroethane increased from the 1970s to the 1980s. Imports were reported at 1.6 million lb in 1976, more than 2 million lb in 1977, approximately 2.5 million lb in 1985 and approximately 4.5 million lb in 1986 (ATSDR 1997). Imports have apparently declined in recent years. Total U.S. imports for hexachloroethane and tetrachloroethane combined were approximately 1.5 million lb in 1989 and 612,000 lb in 2000 (USDOC 1990, ITA 2001). U.S. exports of hexachloroethane and tetrachloroethane combined were 714,000 lb in 2000 (ITA 2001).

EXPOSURE

The primary routes of potential human exposure to hexachloroethane are through inhalation or ingestion of contaminated drinking water or fish. Hexachloroethane exposure to the general public is expected to be relatively low. Workers at industrial facilities where hexachloroethane is used or produced, either intentionally or as a by-product, may be exposed through inhalation or dermal absorption. Military or civilian personnel working with smoke or pyrotechnic devices that contain hexachloroethane could be exposed. One study reported hexachloroethane concentrations in the smoke ranging from 0.64 to 1.26 mg/m³ (ATSDR 1997). Annual environmental releases reported to the EPA's Toxic Release Inventory (TRI) ranged from approximately 5,400 to 360,000 lb for the years 1988 to 1999. In 1999, 19 facilities reported releasing 71,485 lb. One facility reported more than half of the total U.S. releases and three facilities accounted for approximately 93% of the total (TRI99 2001). In 1999, 43,500 lb were released to air, 9,274 lb were released to land, 320 lb were injected underground, one lb was released to surface water, and 18,390 lb were released off site. The TRI data, however, do not include military facilities because they are exempt from reporting (ATSDR 1997).

Hexachloroethane is relatively persistent in the environment and has been detected in the

atmosphere and in drinking water at low levels; however, it is rarely found in surface waters, biota, ambient soil, sediments, or commercial food products. It was detected in only 2% of 1,253 effluent samples, one of 882 ambient surface-water samples, and none of 116 fish samples collected in the early 1980s. Although some bioconcentration in fish has been reported, biomagnification through the food chain is unlikely because hexachloroethane rarely occurs in surface water and it is rapidly metabolized by fish (ATSDR 1997).

In 1976, an initial list of 671 potential airborne pollutants was developed. From this list, only 77, including hexachloroethane, have actually been measured in ambient air (NTP 1989). Class and Ballschmitter (1987) analyzed several atmospheric halocarbons in air samples from sampling sites distant from inhabited areas in the region of the North and South Atlantic and the Indian Oceans. They estimated that the emissions of hexachloroethane into the Northern Hemisphere were less than 1 kiloton per year and that the tropospheric lifetime of hexachloroethane was very long.

A NIOSH survey listed the real estate, paper and allied products, lumber and wood products, and amusement and recreation services industries as those that may have used hexachloroethane. In an occupational hazard survey conducted from 1972 to 1974, it was estimated that approximately 1,500 workers were potentially exposed to hexachloroethane (NIOSH 1976). The National Occupational Exposure Survey conducted by NIOSH from 1981 to 1983 indicated that 8,515 workers, including 575 women, were potentially exposed to hexachloroethane. This estimate was derived from observations of the actual use of the compound (62% of total observations) and the use of trade name products known to contain the compound (38%) (NIOSH 1984).

REGULATIONS

EPA regulates hexachloroethane under the Clean Air Act (CAA), Clean Water Act (CWA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), and Superfund Amendments and Reauthorization Act (SARA). Hexachloroethane is a toxic pollutant of air and water. EPA has established water quality criteria for hexachloroethane, effluent guidelines, rules for regulating hazardous spills, general threshold amounts, and requirements for handling and disposal of hexachloroethane wastes. A reportable quantity (RQ) of 100 lb (45.4 kg) has been set for hexachloroethane under SARA. Hexachloroethane is regulated as a hazardous constituent of wastewater under RCRA.

ACGIH recommends a threshold limit value (TLV) at 1 ppm (9.7 mg/m³); the potential for absorption through the skin has been noted. NIOSH has set the recommended exposure limit (REL) for hexachloroethane to be the lowest feasible concentration, with a skin notation. The OSHA sets the permissible exposure limit (PEL) at 1 ppm (10 mg/m³) 8-hr time-weighted average (TWA); the potential for skin absorption was noted. OSHA also regulates hexachloroethane under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table 94.

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