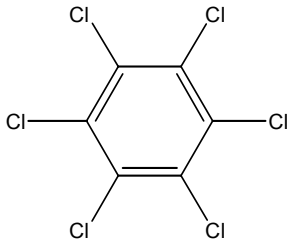
HEXACHLOROBENZENE
CAS No. 118-74-1
First Listed in the *Third Annual Report on Carcinogens*



CARCINOGENICITY

Hexachlorobenzene is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (IARC 1982, 1987). When administered in the diet, hexachlorobenzene induced liver tumors in female rats and mice of both sexes, and hepatomas, liver hemangioendotheliomas, and thyroid adenomas in hamsters of both sexes (IARC 1979, Smith and Cabral 1980).

There is inadequate evidence for the carcinogenicity of hexachlorobenzene in humans. Hepatocellular carcinoma has been associated with porphyria resulting from consumption of grain treated with hexachlorobenzene (IARC 1987). An IARC Working Group reported that although there were no case reports or epidemiological studies available to evaluate the carcinogenicity of hexachlorobenzene in humans, it should be regarded as if it presented a carcinogenic risk to humans (IARC 1979).

PROPERTIES

Hexachlorobenzene occurs as white needles or a gray powder (HSDB 2001, NTP 2001). It is insoluble in water, but is soluble in benzene, carbon disulfide, chloroform, and ether. Under most environmental conditions, it has a very low degradation rate (HSDB 2001). It is combustible, but it does not ignite readily. When heated to decomposition, hexachlorobenzene emits highly toxic fumes of hydrochloric acid, other chlorinated compounds, carbon monoxide, and carbon dioxide. Hexachlorobenzene is a stable and nonreactive compound, but it can react violently with dimethylformamide at temperatures >65°C. The technical grade product contains 98% hexachlorobenzene, 1.8% pentachlorobenzene, and 0.2% tetrachlorobenzene (IARC 1979, HSDB 2001).

USE

No current commercial uses of hexachlorobenzene as an end-product in the United States could be found. It was used as a seed-treatment fungicide for onions, sorghum, wheat, and other grains (IARC 1979); however, all registered pesticide uses were voluntarily cancelled in 1984 (ATSDR 2000). It was also used as a chemical intermediate in dye manufacture and synthesis of other organic chemicals, in the production of pyrotechnic compositions for the military, as a raw material for synthetic rubber, a plasticizer for polyvinyl chloride, and as a wood preservative (ATSDR 2000, HSDB 2001).

PRODUCTION

Commercial production of hexachlorobenzene in the United States was first reported in 1933. Hexachlorobenzene has not been produced commercially in the United States since the late 1970s; however, it is produced as a by-product or impurity during the synthesis of several chlorinated solvents and pesticides, such as tetrachloroethylene, trichloroethylene, carbon tetrachloride, vinyl chloride, atrazine, propazine, simazine, pentachlorophenol, chlorothalonil, and pentachloronitrobenzene. In 1972, an estimated 2.5 million to 4.9 million lb of hexachlorobenzene was produced in the U.S. as a by-product of other chlorinated chemicals. Production as an end product in 1975 was only 3,200 lb compared to 7,770 to 25,350 lb produced as a by-product in 1984. In addition, hexachlorobenzene may be formed during combustion of municipal waste or in waste streams from chlor-alkali and wood-preserving plants (IARC 1979, ATSDR 2000).

Hexachlorobenzene imports in 1977 and 1982 totaled approximately 5,400 and 38,000 lb, respectively (ATSDR 2000, HSDB 2001). Although neither hexachlorobenzene nor DDT is used in the U.S., imports and exports values for hexachlorobenzene and DDT (combined) in 2000 were reported at approximately 58,000 lb and 33,000 lb, respectively (ITA 2001).

The 1979 TSCA Inventory identified two companies producing 5.5 million lb of hexachlorobenzene and one company importing 5,500 lb in 1977 (TSCA 1979). Currently, 10 U.S. chemical companies reportedly produce hexachlorobenzene for on-site use and processing, as a by-product, or as an impurity (ATSDR 2000). In addition, Chemical Sources International (Chem Sources 2001) listed 10 current U.S. suppliers of hexachlorobenzene.

EXPOSURE

The current potential for exposure to hexachlorobenzene for the general population is limited because commercial production of hexachlorobenzene has ceased in the United States. Nevertheless, it continues to be produced as a by-product from the manufacture of other chlorinated chemicals and persists in the environment from past releases. The production and use of hexachlorobenzene as a fungicide prior to 1984, and its occurrence as a by-product in the manufacture of other chemicals indicate that some human exposure may occur in both occupational and nonoccupational settings. Human exposure may occur through ingestion, inhalation, and skin contact. Populations with potentially high exposures include chemical workers, individuals living near a waste site or industrial facility that may release hexachlorobenzene to the air or drinking water supplies, and individuals who ingest contaminated fish and wildlife (ATSDR 2000, HSDB 2001).

The National Occupational Hazard Survey, conducted by NIOSH (1976) from 1972 to 1974, estimated that 4,400 workers were possibly exposed to hexachlorobenzene in the workplace. The National Occupational Exposure Survey, conducted from 1981 to 1983, indicated that 1,038 workers employed at 10 facilities were potentially exposed to hexachlorobenzene (ATSDR 2000). Occupations with the highest potential for human exposure included fungicide application, organic chemical synthesis, synthetic rubber production, seed disinfection, pesticide production, and wood preservation.

Fourteen of 20 companies listed in EPA's Toxic Release Inventory (TRI) reported environmental releases of 28,125 lb in 1999 (TRI99 2001). Most of these releases were to land with on-site and off-site releases being comparable. More than 94% of the reported releases were from two facilities. According to the TRI99 (2001), annual environmental releases of

hexachlorobenzene ranged from approximately 12,600 lb to more than one million lb between 1988 and 1999. Past airborne emissions of hexachlorobenzene in the United States were estimated to be between 46,300 and 63,900 lb per year. These emissions resulted primarily from pesticide use and the manufacture of chlorinated solvents (Chem. Eng. News 1988). Between 750 and 25,000 lb per year are released as a by-product from chlorinated solvent production plants and approximately 125 to 1,000 lbs per year are released from municipal refuse incineration (ATSDR 2000).

Hexachlorobenzene is among the most persistent environmental pollutants because of its relative stability and resistance to degradation. Hexachlorobenzene released to the environment is taken up by plants and animals and can build up through the food chain (ATSDR 2000).

Human adipose tissue samples collected across the United States between 1973 and 1983 show that the general population is exposed to hexachlorobenzene. However, dietary surveys conducted by the FDA show that the frequency of detection of hexachlorobenzene in foods has declined from approximately 9% in the early 1980s to <2% in 1994. Consequently, the average daily intake of hexachlorobenzene from foods declined by a factor of five during this period (ATSDR 2000).

REGULATIONS

EPA regulates hexachlorobenzene under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Clean Water Act (CWA), Safe Water Drinking Act (SWDA), Resource Conservation and Recovery Act (RCRA), and Superfund Amendments and Reauthorization Act (SARA). Under CERCLA and CWA, a reportable quantity (RQ) of 10 lb was established for hexachlorobenzene, as well as spill reporting requirements. Under RCRA, the EPA has designated this compound as a hazardous constituent of waste and regulates its disposal. Under SARA, EPA has placed hexachlorobenzene on a list of toxic chemicals making it subject to reporting requirements. EPA recommended an upper limit of 0.5 ppm hexachlorobenzene in fatty tissues of cattle, pigs, and sheep, but has not promulgated a tolerance. EPA has set a maximum contaminant level (MCL) of 0.001 mg/L for hexachlorobenzene in drinking water.

FDA has established a contaminant level of hexachlorobenzene in bottled water at 0.001 mg/L.

ACGIH recommends a threshold limit value (TLV) for hexachlorobenzene at 0.002 mg/m^3; the potential for absorption through skin was noted. OSHA regulates hexachlorobenzene under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table 93.

REFERENCES

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