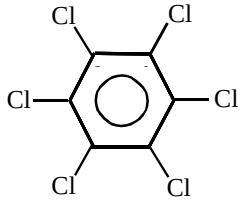
HEXACHLOROBENZENE

Hexachlorobenzene is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 118-74-1

Molecular Formula: C_6Cl_6



Hexachlorobenzene forms white needles. It is slightly soluble in cold alcohol, soluble in benzene, chloroform, ether, carbon disulfide, and boiling alcohol, and insoluble in water (Merck, 1989).

Physical Properties of Hexachlorobenzene

Synonyms: perchlorobenzene; pentachlorophenyl chloride; phenyl perchloryl

Molecular Weight:	284.80
Boiling Point:	323 - 326 °C
Melting Point:	231 °C
Flash Point:	242 °C
Vapor Density:	9.83 (air = 1)
Vapor Pressure:	1.09×10^{-5} mm Hg at 20 °C
Log Octanol/Water Partition Coefficient:	5.31
Conversion Factor:	1 ppm = 11.6 mg/m^3

(HSDB, 1991; Merck, 1989; Sax, 1987; U.S. EPA, 1994a)

SOURCES AND EMISSIONS

A. Sources

Hexachlorobenzene was formerly used for organic synthesis, as a fungicide for seeds, and as a wood preservative. It is formed as a byproduct during the manufacture of other chemicals and pesticides (U.S. EPA, 1994a). The primary stationary sources that have reported emissions of hexachlorobenzene in California are the aerospace industry, sanitary services, and agricultural chemicals manufacturers (ARB, 1997b).

Hexachlorobenzene was registered for use as a pesticide; however as of January 1, 1988, it is no longer registered for pesticidal use in California (DPR, 1996).

B. Emissions

The total emissions of hexachlorobenzene from stationary sources in California are estimated to be less than 1 pound per year, based on data reported under the Air Toxics "Hot Spots" Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

No information about the natural occurrence of hexachlorobenzene was found in the readily-available literature.

AMBIENT CONCENTRATIONS

No Air Resources Board data exist for ambient measurements of hexachlorobenzene. However, the United States Environmental Protection Agency (U.S. EPA) has compiled ambient air data for hexachlorobenzene from several locations throughout the United States. The U.S. EPA estimated a mean ambient concentration of hexachlorobenzene of 0.21 nanograms per cubic meter (ng/m^3) from 1979-80 (U.S. EPA, 1993a).

INDOOR SOURCES AND CONCENTRATIONS

According to the Nonoccupational Pesticide Exposure Study conducted by the U.S. EPA and published in 1990, levels of 32 pesticides were measured in 24-hour samples obtained inside and outside homes located in two cities. Approximately 70 homes in Jacksonville, Florida were monitored in each of 3 seasons, and approximately 50 homes in Springfield/Chicopee, Massachusetts were monitored in each of two seasons. Mean indoor concentrations of hexachlorobenzene ranged from 0.3 to 1.3 ng/m^3 in Jacksonville and from below the detection limits to 0.1 ng/m^3 in Springfield/Chicopee. For both cities, indoor hexachlorobenzene concentrations were higher than corresponding outdoor concentrations (Immerman and Schaum, 1990).

ATMOSPHERIC PERSISTENCE

The dominant chemical loss process for gas phase hexachlorobenzene in the troposphere is by reaction with the hydroxyl (OH) radical. Based on this reaction, the atmospheric half-life and lifetime is calculated to be about 1.4 years and 2 years, respectively (Atkinson, 1995). Air to water exchange to (and from) the oceans and gas-phase hexachlorobenzene and wet and dry deposition of particle-associated hexachlorobenzene are important (Cotham and Bidleman, 1991).

AB 2588 RISK ASSESSMENT INFORMATION

The Office of Environmental Health Hazard Assessment reviews risk assessments submitted under the Air Toxics "Hot Spots" Program. Of the risk assessments reviewed as of April 1996, hexachlorobenzene contributed to the total cancer risk in 3 of the approximately 550 risk assessments reporting a total cancer risk equal to or greater than 1 in 1 million (OEHHA, 1996a).

HEALTH EFFECTS

Probable routes of human exposure to hexachlorobenzene are inhalation, ingestion, and dermal contact (Sittig, 1991).

Non-Cancer: Exposure to hexachlorobenzene may cause eye, skin, and respiratory tract irritation (Sittig, 1991). Long-term oral exposure has been reported to cause liver disease with associated skin lesions (porphyria cutanea tarda) in humans. Effects on the liver, skin, kidneys, immune system, and blood from oral exposure to hexachlorobenzene have been observed in animal studies (U.S. EPA, 1994a).

A chronic, non-cancer Reference Exposure Level (REL) of 2.8 micrograms per cubic meter ($\mu g/m^3$) is listed for hexachlorobenzene in the California Air Pollution Control Officers Association Air Toxics "Hot Spots" Program, Revised 1992 Risk Assessment Guidelines. The toxicological endpoints considered for chronic toxicity are the gastrointestinal system and liver (CAPCOA, 1993). The U.S. EPA has established an oral Reference Dose (RfD) of 8×10^{-4} milligrams per kilogram per day for hexachlorobenzene based on liver effects in rats. The U.S. EPA estimates that consumption of this dose or less, over a lifetime, would not result in the occurrence of chronic, non-cancer effects. The U.S. EPA has determined that data are inadequate to establish a Reference Concentration (RfC) for hexachlorobenzene.

Abnormal physical development of young children orally exposed to hexachlorobenzene was reported in one study. Hexachlorobenzene has been found to decrease the survival rates of newborn animals and to cross the placenta and accumulate in fetal tissue in several animal species (U.S. EPA, 1994a). The State of California has determined under Proposition 65 that hexachlorobenzene is a developmental toxicant (CCR, 1996).

Cancer: Animal studies have reported cancer of the liver, thyroid, and kidney from oral exposure to hexachlorobenzene. The U.S. EPA has placed hexachlorobenzene in Group B2: Probable human carcinogen. The U.S. EPA has established an inhalation unit risk estimate of 4.6×10^{-4} (microgram per cubic meter)$^{-1}$. The U.S. EPA estimates that if an individual were to breathe air containing hexachlorobenzene at 0.002 $\mu g/m^3$, over an entire lifetime, that person would theoretically have no more than a 1 in 1 million increased chance of developing cancer (U.S. EPA, 1994a). The International Agency for Research on Cancer has placed hexachlorobenzene in Group 2B: Possible human carcinogen (IARC, 1987a).

The State of California has determined under Proposition 65 that hexachlorobenzene is a carcinogen (CCR, 1996). The inhalation potency factor that has been used as a basis for

regulatory action in California is 5.1 x 10^{-4} (microgram per cubic meter)$^{-1}$ (OEHHA, 1994). In other words, the potential excess cancer risk for a person exposed over a lifetime to 1 μg/m^3 of hexachlorobenzene is estimated to be no greater than 510 in 1 million. The oral potency factor that has been used as a basis for regulatory action in California is 1.8 (milligram per kilogram per day)$^{-1}$ (OEHHA, 1994).