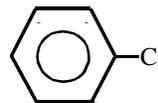


CHLOROBENZENE

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

CAS Registry Number: 108-90-7

Molecular Formula: C₆H₅Cl



Chlorobenzene is a colorless, volatile, very refractive liquid with an almond-like odor. It is insoluble in water and miscible with most organic solvents (Merck, 1989).

Physical Properties of Chlorobenzene

Synonyms: monochlorobenzene; benzene chloride; monochlorbenzene; chlorbenzene; phenyl chloride

Molecular Weight:	112.56
Boiling Point:	131 - 132 °C
Melting Point:	-45 °C (solidifies at -55 °C)
Flash Point:	85 °F (closed cup)
Vapor Density:	3.88 (air = 1)
Vapor Pressure:	11.9 mm Hg at 25 °C
Density/Specific Gravity:	1.107 at 20/4 °C (water = 1)
Log Octanol/Water Partition Coefficient:	2.84
Conversion Factor:	1 ppm = 4.6 mg/m ³

(Howard, 1990; Merck, 1989; Sax, 1987; Sax, 1989)

SOURCES AND EMISSIONS

A. Sources

Chlorobenzene is used as a solvent in pesticide formulations, in degreasing, and other industrial applications (U.S. EPA, 1994a).

The primary stationary sources that have reported emissions of chlorobenzenes in California are crude petroleum and natural gas extraction, plastic materials and synthetics manufacturing, and petroleum refining (ARB, 1997b).

B. Emissions

The total emissions of chlorobenzenes (chlorobenzene, 1,2,4-trichlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, etc.) from stationary sources in California are estimated to be at least 12,000 pounds 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 chlorobenzene was found in the readily-available literature.

AMBIENT CONCENTRATIONS

Chlorobenzene is routinely monitored in California by the statewide Air Resources Board air toxics network. The network's mean concentration of chlorobenzene is estimated to be 0.27 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) or 0.06 parts per billion (ppb) (ARB, 1995d).

The United States Environmental Protection Agency (U.S. EPA) has also conducted a survey of chlorobenzene concentrations throughout different locations in the United States. According to 13 studies from the years 1989 to 1991, the overall mean ambient concentration was estimated to be 0.14 $\mu\text{g}/\text{m}^3$ or 0.03 ppb (U.S. EPA, 1993a).

INDOOR SOURCES AND CONCENTRATIONS

Indoor sources of chlorobenzene have not been determined. Chlorobenzene was not detected in over 1,000 consumer products that were surveyed for chlorinated solvents. There is an indication from very limited studies that it may be emitted from some building materials (Hodgson and Wooley, 1991).

Data on indoor concentrations of chlorobenzene are extremely limited. During June of 1990, 125 households in Woodland, California, were monitored for a variety of toxic air contaminants. Chlorobenzene was present at measurable concentrations in only 10 of 104 samples. The mean concentration of those 10 samples was 0.31 $\mu\text{g}/\text{m}^3$, and the maximum measured concentration was 0.52 $\mu\text{g}/\text{m}^3$. The quantifiable limit for chlorobenzene was about 0.3 $\mu\text{g}/\text{m}^3$. These results suggest that few homes have notable levels of chlorobenzene (Sheldon et al, 1992).

ATMOSPHERIC PERSISTENCE

Chlorobenzene is expected to exist almost entirely in the vapor phase in the atmosphere based upon its vapor pressure. The dominant removal mechanism is expected to be the reaction with hydroxyl (OH) radicals. The calculated half-life and lifetime of chlorobenzene due to reaction with the OH radical are 13 days and 19 days, respectively. The formation of chlorophenols may

be expected from this reaction, by analogy with toluene and the xylenes (Atkinson, 1994).

AB 2588 RISK ASSESSMENT INFORMATION

The Office of Environmental Health Hazard Assessment reviews risk assessments submitted under the Air Toxics “Hot Spots” Program (AB 2588). Of the risk assessments reviewed as of December 1996, for non-cancer effects, chlorobenzene contributed to the total hazard index in 7 of the approximately 89 risk assessments reporting a total chronic hazard index greater than 1. Chlorobenzene also contributed to the total hazard index in 3 of the approximately 107 risk assessments reporting a total acute hazard index greater than 1 (OEHHA, 1996b).

HEALTH EFFECTS

The most probable route of human exposure to chlorobenzene is inhalation.

Non-Cancer: Chlorobenzene is a central nervous system depressant, and may cause respiratory tract, eye, and skin irritation. Chlorobenzene may sensitize the myocardium to the arrhythmogenic effects of epinephrine. A child who ingested chlorobenzene became unconscious and cyanotic and had muscle spasms, but recovered completely. Chronic human exposure to chlorobenzene causes central nervous systems effects with symptoms including numbness, cyanosis, hyperesthesia, and muscle spasms. Headaches and irritation of the eyes, nose and throat have also been reported in humans chronically exposed (U.S. EPA, 1994a).

A chronic non-cancer Reference Exposure Level (REL) of $70 \mu\text{g}/\text{m}^3$ is listed for chlorobenzene 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 kidney, gastrointestinal system and liver, reproductive system including teratogenic and developmental effects and skin irritation (CAPCOA, 1993). The U.S. EPA has the Reference Concentration (RfC) under review, and has calculated an oral Reference Dose (RfD) of 0.02 milligrams per kilogram per day based on histopathologic changes in the liver in dogs. The U.S. EPA estimates that consumption of this dose or less, over a lifetime, would not likely result in the occurrence of chronic, non-cancer effects (U.S. EPA, 1994a).

No information is available on adverse reproductive or developmental effects of chlorobenzene in humans. Chronic inhalation exposure of rats to chlorobenzene did not adversely effect reproductive performance or fertility. However, a slight increase in the incidence of degenerative testicular changes was observed. Chlorobenzene does not appear to be a developmental toxicant and did not produce structural malformations in rats and rabbits acutely exposed by inhalation (U.S. EPA, 1994a).

Cancer: No information is available on the carcinogenic effects of chlorobenzene in humans.

In a study of rats and mice exposed to chlorobenzene via gavage, an increased incidence of neoplastic nodules of the liver was observed in male rats but not in mice or female rats. The U.S. EPA has classified chlorobenzene in Group D: Not classifiable as to human carcinogenicity (U.S. EPA, 1994a). The International Agency for Research on Cancer has not classified chlorobenzene as to its carcinogenicity in humans (IARC, 1987a).