

Benzene (C₆H₆)

What is Benzene?

Benzene is a clear, colorless, volatile, non-corrosive, highly flammable, fat-soluble, liquid at room temperature with a strong aromatic odor. Benzene is produced primarily by the petrochemical and petroleum refining industries which are responsible for 98% of the total production in the United States. The major use of benzene is as a chemical intermediate in the manufacture of a variety of consumer goods. In addition, benzene and/or its derivatives are used in dyes, lubricants, solvents, cleaning products, drugs, pesticides and other agricultural chemicals. Benzene is present in gasoline at concentrations averaging less than 2%, but which can be as high as 5%. Most of the benzene produced is a component of petroleum fuels such as gasoline.

Sources of Benzene

- There are three main sources of human exposure to benzene: a) environmental, b) occupational, and c) consumer products.
- Benzene can be released into the environment from a variety of sources including the following: a) gasoline filling stations, b) underground leaking petroleum storage tanks, c) vehicle exhaust fumes, d) cigarette smoke, e) wastewater from industries that use benzene, f) poorly maintained toxic waste sites, g) chemical spills, h) contaminated surface or groundwater, and i) possibly some food products that contain benzene as a natural constituent.
- Occupational exposure can occur in a variety of settings. Some of the more significant exposures are associated with the rubber industry, the shoe manufacturing industry, chemical plants, oil refineries, and gasoline storage, shipment and retail stations.
- Various consumer products that contain benzene include household cleaning products, glues, adhesives, some art supplies, cigarettes, paint, varnish, stain removers, and gasoline. Very small amounts of benzene are found in some foods.

Routes of Exposure and Health Effects

- Benzene can enter the body when a person breathes air contaminated with the vapor or eats or drinks contaminated food or water. Benzene is readily absorbed into the body following inhalation or ingestion. Entry into the body following direct contact with the skin does not occur as readily and is not as significant as the aforementioned routes of exposure.
- Once benzene enters the body it is widely distributed to tissues. Accumulation in body fat is slow; however, the total potential uptake is high in these tissues because of the high lipid solubility of benzene.
- The primary route of environmental exposure of the general public to benzene is through inhalation. Benzene is commonly found in the environment and a large segment of the population is exposed to low levels of the chemical through this route. Inhalation of benzene from cigarette smoke is also a concern.
- Occupational exposure to benzene is mainly through inhalation of the vapor; however, skin contamination with the liquid also occurs. Occupational exposures provide a much greater risk of causing adverse health effects.
- Ingestion of benzene from food products is not considered a significant route of exposure.
- Groundwater can be contaminated with benzene as a result of illegal dumping, leaking from storage tanks, and through leachate from waste disposal sites. Therefore, exposure potential exists when contaminated groundwater is used as a human water supply. Human exposure via contaminated water can occur from consumption (drinking water), direct contact (showers, baths), and inhalation (showers, baths).
- Benzene is considered to be a human carcinogen by the World Health Organization, the International Agency for Research on Cancer and the U.S. Environmental Protection Agency (EPA) and the Occupational Safety and Health Administration (OSHA).
- Exposure to benzene through inhalation or ingestion may produce adverse effects in the blood, on the central nervous system, and the immune system.
- Human health studies have demonstrated significant excesses of leukemia, multiple myeloma, and lymphatic cancers as well as chromosomal aberrations to be associated with exposure to benzene.
- Human health studies also have shown that breathing air containing benzene affects the central nervous system causing effects such as dizziness, headache, nausea and vomiting, fatigue, blurred vision, irregular heart rate and drowsiness.
- Eye, nose, and throat irritation may also occur following exposure to benzene vapor.
- Benzene's toxicity to the immune system manifests itself by depressing infection. As a result, exposure to benzene has the potential to decrease the body's ability to overcome infection.
- While systemic effects are not readily observed following direct contact of small amounts of benzene with the skin, repeated or prolonged contact with the liquid may cause dermatitis.

Regulatory and Advisory Standards

- The EPA has established a Maximum Contaminant Level of 5 micrograms per liter ($\mu\text{g/L}$) for benzene in water.
- The OSHA regulates benzene in the workplace. The Permissible Exposure Limit for an eight-hour workday is 1 part per million (ppm) as a time weighted-average (TWA).

Content Last Modified on 1/16/2009