

Benzyl chloride

100-44-7

Hazard Summary

Benzyl chloride is used as a chemical intermediate in the manufacture of certain dyes and pharmaceutical products and as a photographic developer. The acute (short-term) effects of benzyl chloride from inhalation exposure in humans consist of severe irritation of the upper respiratory tract, skin, eyes, and mucous membranes, and lung damage along with pulmonary edema (fluid in lungs). Exposure to high concentrations also causes effects on the central nervous system (CNS). Animal data indicate that long-term exposure to benzyl chloride by gavage (placing it experimentally in the stomachs of mice) increased the incidence of benign and malignant tumors at multiple sites and resulted in a significant increase in thyroid tumors in female rats. EPA has classified benzyl chloride as a Group B2, probable human carcinogen.

Please Note: The main sources of information for this fact sheet are EPA's Integrated Risk Information System (IRIS) (5), which contains information on the carcinogenic effects of benzyl chloride including the unit cancer risk for oral exposure, and EPA's Health and Environmental Effects Profile for Benzyl chloride. (1)

Uses

- Benzyl chloride is used as a chemical intermediate in the manufacture of certain dyes and pharmaceutical, perfume and flavor products. It is also used as a photographic developer. (1)
- Benzyl chloride can be used in the manufacture of synthetic tannins and as a gum inhibitor in petrol. (1)
- Benzyl chloride has been used as an irritant gas in chemical warfare. (1)

Sources and Potential Exposure

- Sources of benzyl chloride emissions into the air include emissions or venting with other gases in industrial settings. Emissions of benzyl chloride from floor tile plasticized by butyl benzyl phthalate have been reported. (1)
- Benzyl chloride has also been detected in emissions from the burning of polyvinyl chloride, neoprene and rigid urethane foam compounds. (1)
- Individuals may be exposed to benzyl chloride through breathing contaminated air or from exposure to water or soil that has been contaminated with benzyl chloride. (1)

Assessing Personal Exposure

- There are tests currently available to determine personal exposure to benzyl chloride through the monitoring of complete blood count and liver and renal function. (1)

Health Hazard Information

Acute Effects:

- Benzyl chloride is intensely irritating to skin, eyes, and mucous membranes in humans. (2)
- The acute effects of benzyl chloride from inhalation consist of severe irritation of the upper respiratory tract and lung damage along with pulmonary edema in humans. (2,3)

- Exposure of humans to high concentrations of benzyl chloride causes effects on the central nervous system including dizziness, headaches, weakness, and rapid fatigue. (2)
- Permanent eye damage may result from contact with the liquid or the vapor forms of benzyl chloride. (2)
- Ingestion of benzyl chloride by humans may cause severe burns of the mouth, throat, and gastrointestinal tract resulting in nausea, vomiting, cramps, and diarrhea. (2)
- Tests involving acute exposure of animals have shown benzyl chloride to have moderate acute toxicity from oral exposure and high acute toxicity from inhalation exposure. (1,4)

Chronic Effects (Noncancer):

- The chronic (long-term) effects of exposure to benzyl chloride in humans have not been studied. (1)
- Animal studies suggest that the stomach and heart are targets of toxic effects from oral exposure to benzyl chloride. (1,2)
- EPA has not established a Reference Dose (RfD) for benzyl chloride. (5)
- EPA has determined that the health effects data are inadequate for establishing a Reference Concentration (RfC) for benzyl chloride. (5)

Reproductive/Developmental Effects:

- No studies were located regarding developmental or reproductive effects in humans from benzyl chloride exposure. (1–3)
- One animal study showed an increase in embryonal mortality, along with retarded development of the offspring in rats given benzyl chloride orally. (1,2)

Cancer Risk:

- Human data are considered inadequate in providing evidence of cancer by exposure to benzyl chloride because the studies involved a small numbers of cancer deaths and were based on exposure to mixtures of chlorinated compounds. (5)
- Animal studies indicate that the long-term exposure to benzyl chloride by gavage (placing it experimentally in the stomachs of mice) increased the incidence of benign and malignant tumors at multiple sites and resulted in a significant increase in thyroid tumors in female rats. (5)
- EPA considers benzyl chloride to be a probable human carcinogen and has ranked it in EPA's Group B2. (5)
- EPA uses mathematical models, based on animal studies, to estimate the probability of a person developing cancer from ingesting water containing a specified concentration of a chemical. EPA has calculated an oral unit risk estimate of 4.9×10^{-6} ($\mu\text{g}/\text{L}$)⁻¹. EPA estimates that, if an individual were to continuously ingest water containing benzyl chloride at an average concentration of $0.20 \mu\text{g}/\text{L}$ ($2.0 \times 10^{-4} \text{ mg}/\text{L}$) over his or her entire lifetime, that person would theoretically have no more than a one-in-a-million increased chance of developing cancer as a direct result of ingesting water containing this chemical. Similarly, EPA estimates that ingesting water containing $2.0 \mu\text{g}/\text{L}$ ($2.0 \times 10^{-3} \text{ mg}/\text{L}$) would result in not greater than a one-in-a-hundred thousand increased chance of developing cancer, and water containing $20.0 \mu\text{g}/\text{L}$ ($2.0 \times 10^{-2} \text{ mg}/\text{L}$) would result in not greater than a one-in-ten thousand increased chance of developing cancer. For a detailed discussion of confidence in the potency estimates, please see IRIS. (5)
- EPA calculated an oral cancer slope factor of $0.17 (\text{mg}/\text{kg}/\text{d})^{-1}$. (5)
- The California Environmental Protection Agency (CalEPA) has calculated an inhalation unit risk level of 4.9×10^{-5} ($\mu\text{g}/\text{m}^3$)⁻¹. (6)

Physical Properties

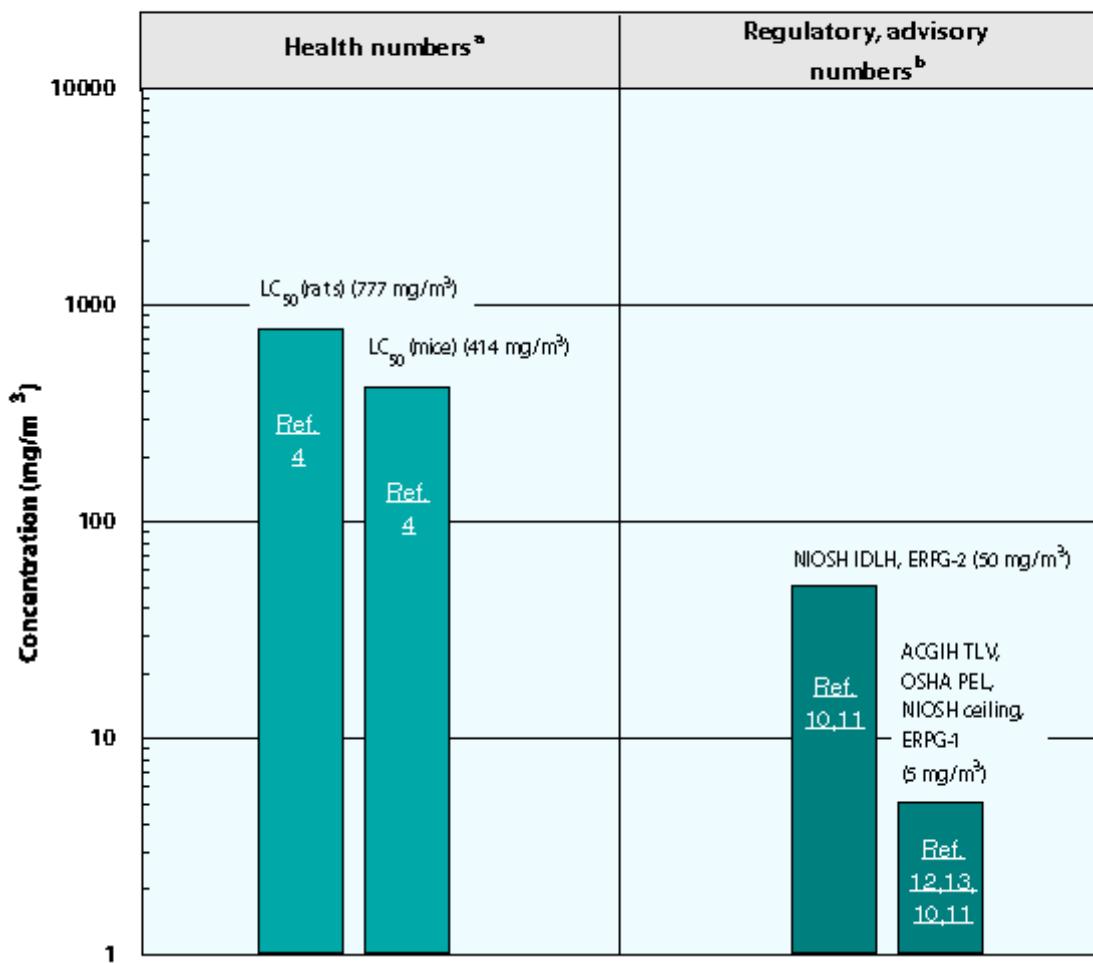
- Benzyl chloride is a colorless liquid with a very pungent odor. (1,7)
- Benzyl chloride has an odor threshold of 0.044 parts per million (ppm). (8)
- Benzyl chloride is insoluble in water. (7)
- The chemical formula for benzyl chloride is $\text{C}_7\text{H}_7\text{Cl}$, and it has a molecular weight of 126.59 g/mol. (2,4,9)

- The vapor pressure for benzyl chloride is 1.20 mm Hg at 25 °C, and it has a log octanol/water partition coefficient ($\log K_{ow}$) of 2.70. (9)

Conversion Factors: To convert concentrations in air (at 25°C) from ppm to mg/m³: $mg/m^3 = (ppm) \times (\text{molecular weight of the compound})/(24.45)$. For benzyl chloride: 1 ppm = 5 mg/m³. To convert from µg/m³ to mg/m³: $mg/m^3 = (\mu\text{g}/m^3) \times (1 \text{ mg}/1,000 \mu\text{g})$.

Health Data from Inhalation Exposure

Benzyl Chloride



ACGIH TLV—American Conference of Governmental and Industrial Hygienists' threshold limit value expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effects.

AIHA ERPG—American Industrial Hygiene Association's emergency response planning guidelines. ERPG 1 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor; ERPG 2 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed up to one hour without experiencing or developing irreversible or other serious health effects that could impair their abilities to take protective action.

LC_{50} (Lethal Concentration₅₀)—A calculated concentration of a chemical in air to which exposure for a specific length of time is expected to cause death in 50% of a defined experimental animal population.

NIOSH IDLH—National Institute of Occupational Safety and Health's immediately dangerous to life or health

concentration; NIOSH recommended exposure limit to ensure that a worker can escape from an exposure condition that is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from the environment.

NIOSH REL ceiling --NIOSH's recommended exposure limit ceiling; the concentration that should not be exceeded at any time.

OSHA PEL--Occupational Safety and Health Administration's permissible exposure limit expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effect averaged over a normal 8-h workday or a 40-h workweek.

The health and regulatory values cited in this factsheet were obtained in December 1999.

^a Health numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.

^b Regulatory numbers are values that have been incorporated in Government regulations, while advisory numbers are nonregulatory values provided by the Government or other groups as advice. OSHA numbers are regulatory, whereas NIOSH and ACGIH numbers are advisory.

Summary created in April 1992, updated in January 2000.

References

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