

Benzotrichloride

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Hazard Summary

Benzotrichloride is used extensively in the dye industry and as an intermediate in the chemical industry. Acute (short-term) exposure to the vapors of benzotrichloride are highly irritating to the skin and mucous membranes. In mice and rats chronically (long-term) exposed by inhalation, proliferative lesions of the respiratory tract have been observed. Human data on the carcinogenic effects of benzotrichloride are inadequate. Increased incidences of tumors at multiple sites have been observed in female mice treated orally, dermally, and by inhalation. EPA has classified benzotrichloride 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 \(IRIS\)](#) (3), which contains information on the carcinogenic effects of benzotrichloride including the unit cancer risk for oral exposure, and EPA's [Health and Environmental Effects Profile for Benzotrichloride](#). (1) Other secondary sources include the [Hazardous Substances Data Bank \(HSDB\)](#) (6), a database of summaries of peer-reviewed literature, and the [Registry of Toxic Effects of Chemical Substances \(RTECS\)](#) (4), a database of toxic effects that are not peer reviewed.

Uses

- Benzotrichloride is used extensively in the dye industry. (1,7)
- Benzotrichloride is also used in the manufacture of benzoyl chloride, chlorinated toluenes, and benzotrifluoride and as a dyestuff intermediate. (1,7)

Sources and Potential Exposure

- Exposure is most likely to occur from occupational settings because benzotrichloride has no known consumer uses. (1)
- Exposure to the general population from industrial fugitive emissions is not expected to be significant because it hydrolyzes (breaks down) rapidly in the presence of moisture. (1)

Assessing Personal Exposure

- No information was located regarding the measurement of personal exposure to benzotrichloride.

Health Hazard Information

Acute Effects:

- Acute exposure to the vapors of benzotrichloride are highly irritating to the skin and mucous membranes in humans. (2,3)
- Benzotrichloride may cause death or permanent injury after an acute exposure to small quantities by inhalation in humans and animals. (3)
- Large doses have caused central nervous system (CNS) depression in animals. (2)
- Tests involving acute exposure of rats, mice, and rabbits, have demonstrated benzotrichloride to have **extreme** acute toxicity by inhalation, **moderate** acute toxicity by dermal exposure, and **low to moderate** acute toxicity by ingestion. (4)

Chronic Effects (Noncancer):

- No information is available on the chronic effects of benzotrichloride in humans.
- In mice and rats chronically exposed by inhalation, proliferative lesions of the respiratory tract have been observed. In addition, inflammation of the lymph nodes, liver, spleen, and kidneys have also been reported in mice. (1)
- Lesions in the liver, kidneys, and thyroid have been observed in rodents chronically exposed to benzotrichloride in their diet. Proliferative stomach lesions were observed in mice chronically exposed via gavage (experimentally placing the chemical in the stomach). (1)
- EPA has not established a Reference Concentration (RfC) or a Reference Dose (RfD) for benzotrichloride. (3)

Reproductive/Developmental Effects:

- No information is available on the reproductive or developmental effects of benzotrichloride in humans.
- Reduced maternal and fetal weight gain and skeletal anomalies have been reported in rats exposed to benzotrichloride via gavage. (1)

Cancer Risk:

- Several epidemiological studies have been carried out examining occupational exposure to the benzoyl chloride production process, which involves benzotrichloride as an intermediate. However, EPA considers these data to be inadequate, based on the small sample sizes of studies, lack of data on cigarette smoking, and the fact that exposure was to a mixture of chlorinated compounds. (3)
- Increased incidences of tumors at multiple sites have been observed in female mice treated orally, dermally, and by inhalation. In mice exposed to benzotrichloride by inhalation, tumors of the lung, skin, and lymphoid tissue have been observed. Tumors of the stomach, lungs, and thymus have been observed in mice orally exposed to high levels. Skin tumors, lung tumors, and thymus lymphoma have been reported in mice dermally exposed. (1,3,5)
- EPA has classified benzotrichloride as a Group B2, probable human carcinogen. (3)
- EPA uses mathematical models, based on human and 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 $3.6 \times 10^{-4} (\mu\text{g/L})^{-1}$. EPA estimates that, if an individual were to continuously ingest water containing benzotrichloride at an average of $0.003 \mu\text{g/L}$ ($3 \times 10^{-6} \text{ mg/L}$) 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 $0.03 \mu\text{g/L}$ ($3 \times 10^{-5} \text{ mg/L}$) would result in not greater than a one-in-a-hundred thousand increased chance of developing cancer, and water containing $0.3 \mu\text{g/L}$ ($3 \times 10^{-4} \text{ mg/L}$) 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. (3)

Physical Properties

- The chemical formula for benzotrichloride is $\text{C}_7\text{H}_5\text{Cl}_3$, and it has a molecular weight of 195.48 g/mol. (5)
- Benzotrichloride occurs as a colorless to yellowish oily liquid that is insoluble in water. (1–3)
- Benzotrichloride has a penetrating odor; the odor threshold has not been established. (1)
- The vapor pressure of benzotrichloride is 0.23 at 20 °C, and its log octanol/water partition coefficient ($\log K_{ow}$) is 2.92. (1)

Conversion Factors:

To convert concentrations in air (at 25°C) from ppm to mg/m^3 : $\text{mg}/\text{m}^3 = (\text{ppm}) \times (\text{molecular weight of the compound}) / (24.45)$. For benzotrichloride: $1 \text{ ppm} = 7.99 \text{ mg}/\text{m}^3$.

Note: There are very few health numbers or regulatory/advisory numbers for benzotrachloride; thus a graph has not been prepared for this compound. The health values cited in this fact sheet were obtained in December 1999.

Summary created in April 1992, updated in January 2000.

References

1. U.S. Environmental Protection Agency. Health and Environmental Effects Profile for Benzotrachloride. EPA/600/x-86/194. Environmental Criteria and Assessment Office, Office of Health and Assessment, Office of Research and Development, Cincinnati, OH. 1986.
2. The Merck Index. An Encyclopedia of Chemicals, Drugs, and Biologicals. 11th ed. Ed. S. Budavari. Merck and Co. Inc., Rahway, NJ. 1989.
3. U.S. Environmental Protection Agency. [Integrated Risk Information System \(IRIS\) on Benzotrachloride](#). National Center for Environmental Assessment, Office of Research and Development, Washington, DC. 1999.
4. U.S. Department of Health and Human Services. Registry of Toxic Effects of Chemical Substances (RTECS). National Toxicology Information Program, National Library of Medicine, Bethesda, MD. 1993.
5. International Agency for Research on Cancer (IARC). IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans: Some Industrial Chemicals and Dyestuffs. Volume 29. World Health Organization, Lyon. 1982.
6. U.S. Department of Health and Human Services. Hazardous Substances Data Bank (HSDB, [online database](#)). National Toxicology Information Program, National Library of Medicine, Bethesda, MD. 1993.