

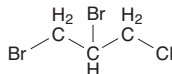
1,2-Dibromo-3-chloropropane

CAS No. 96-12-8

Reasonably anticipated to be a human carcinogen

First listed in the *Second Annual Report on Carcinogens* (1981)

Also known as DBCP



Carcinogenicity

1,2-Dibromo-3-chloropropane is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity from studies in experimental animals.

Cancer Studies in Experimental Animals

Oral exposure to 1,2-dibromo-3-chloropropane caused tumors in two rodent species and at several different tissue sites. 1,2-Dibromo-3-chloropropane administered by stomach tube caused cancer of the forestomach (squamous-cell carcinoma) in rats and mice of both sexes and mammary-gland cancer (carcinoma) in female rats (NCI 1978).

Since 1,2-dibromo-3-chloropropane was listed in the *Second Annual Report on Carcinogens*, additional studies in experimental animals have been identified. Inhalation exposure to 1,2-dibromo-3-chloropropane caused cancer of the nasal cavity (adenocarcinoma, carcinoma, and/or squamous-cell carcinoma) in rats and mice of both sexes. It also increased the combined incidence of benign and malignant tumors of the lung (alveolar/bronchiolar adenoma and carcinoma) in mice of both sexes and the pharynx (squamous-cell papilloma and carcinoma) in female rats, and it caused benign tumors of the tongue (squamous-cell papilloma) in rats of both sexes and the adrenal gland (cortical adenoma) in female rats (NTP 1982, IARC 1999). Exposure to 1,2-dibromo-3-chloropropane in the tank water of male and female zebrafish caused cancer of the liver (hepatocellular carcinoma) and bile duct (cholangiocarcinoma) (IARC 1999).

Cancer Studies in Humans

At the time 1,2-dibromo-3-chloropropane was listed in the *Second Annual Report on Carcinogens*, no epidemiological studies had been identified that evaluated the relationship between human cancer and exposure specifically to 1,2-dibromo-3-chloropropane. Since then, relevant studies in humans have been identified. The International Agency for Research on Cancer reviewed four cohort studies of workers occupationally exposed to 1,2-dibromo-3-chloropropane and one population-based case-control study (IARC 1999). Two of the four cohort studies found an excess of lung cancer in exposed workers. The third cohort study found excesses of liver and biliary-tract cancer, and the fourth found an excess of cervical cancer. However, in some of the studies, workers were exposed to other compounds in addition to 1,2-dibromo-3-chloropropane. IARC concluded that there was inadequate evidence to evaluate the relationship between human cancer and exposure specifically to 1,2-dibromo-3-chloropropane.

Properties

1,2-Dibromo-3-chloropropane is a halogenated aliphatic hydrocarbon which at room temperature is a colorless-to-brown liquid with a pungent odor (IARC 1999). It is slightly soluble in water and miscible with most aliphatic and aromatic hydrocarbons, oils (unspecified), dichloropropane, methanol, ethanol, isopropyl alcohol, and acetone. It may burn, although it does not ignite readily and is gen-

erally considered stable (Akron 2009). Physical and chemical properties of 1,2-dibromo-3-chloropropane are listed in the following table.

Property	Information
Molecular weight	236.4
Specific gravity	2.08 at 20°C/20°C
Melting point	5°C
Boiling point	164°C at 300 mm Hg
Log K_{ow}	2.96
Water solubility	1.2 g/L at 20°C
Vapor pressure	0.58 mm Hg at 20°C
Vapor density relative to air	2.09 at 14°C

Source: HSDB 2009.

Use

1,2-Dibromo-3-chloropropane was previously registered by the U.S. Environmental Protection Agency as a soil fumigant to control nematodes for field crops, vegetables, fruits, nuts, greenhouse and nursery crops, and turf (IARC 1979, ATSDR 1992, HSDB 2009). In 1977, EPA suspended registrations for the uses of products containing the compound except for use with pineapples in Hawaii; this exception was revoked in 1985 (ATSDR 1992). Since then, 1,2-dibromo-3-chloropropane has been used in the United States only as an intermediate in organic synthesis, such as in the synthesis of the fire retardant tris(2,3-dibromopropyl)phosphate, and for research purposes (ATSDR 1992, HSDB 2009).

Production

1,2-Dibromo-3-chloropropane was first synthesized in 1833 and first produced commercially in the United States in 1955 (IARC 1979). In 1969, U.S. production was 3.9 million kilograms (8.6 million pounds). Estimates of annual production in 1974 and 1975 were 18 million to 20 million pounds (IARC 1999), and in 1977, two companies producing 1,2-dibromo-3-chloropropane were identified (ATSDR 1992). 1,2-Dibromo-3-chloropropane is no longer commercially manufactured in the United States and was not reported to be produced for sale by any manufacturing plant worldwide in 2009 (ATSDR 1992, SRI 2009). Nevertheless, 21 suppliers were identified worldwide in 2009, including 13 U.S. suppliers (ChemSources 2009). No information on U.S. imports or exports of 1,2-dibromo-3-chloropropane was found.

Exposure

Potential routes of exposure to 1,2-dibromo-3-chloropropane include inhalation, dermal contact, and ingestion (NCI 1978). Widespread exposure of the general population or of workers to 1,2-dibromo-3-chloropropane is not likely, since registered uses of the chemical as a soil fumigant in the United States were cancelled in 1985 (ATSDR 1992). In 1974, U.S. farmers applied 9.8 million pounds of 1,2-dibromo-3-chloropropane; in 1977, 0.8 million pounds was used in California alone (HSDB 2009). Exposure of the general population to small quantities of 1,2-dibromo-3-chloropropane could still occur through ingestion or inhalation exposure to previously contaminated groundwater used as tap water and to food irrigated with contaminated groundwater. Household uses of groundwater, such as for bathing, showering, or dishwashing, might result in inhalation exposure (Clark and Snedeker 2005). However, exposure from contaminated groundwater is limited, because 1,2-dibromo-3-chloropropane was used in only a few geographical locations, and contamination is not widespread (IARC 1979, ATSDR 1992, Clark and Snedeker 2005). 1,2-Dibromo-3-chloropropane has been identified as a constituent of concern at eight hazardous-waste sites on EPA's National Priorities List, three each in California and Hawaii, and one each in Colorado and Florida (ATSDR 1992).

When released to air, 1,2-dibromo-3-chloropropane exists as a vapor and is degraded by photochemically produced hydroxyl radicals to 1,2-dibromopropanol, chlorobromopropanol, and 1-bromo-3-chloro-2-propanone, with a half-life of 37 days (HSDB 2009). Air concentrations measured while it was being applied in a vineyard by injection into the soil ranged from 3 ppb 5 feet above ground in the middle of the field to 11 ppb in the cab of the tractor pulling the injection rig. When released to surface water, 1,2-dibromo-3-chloropropane will volatilize rapidly. When released to soil, it may leach into groundwater or volatilize into the air, because it is not expected to bind strongly to soil or sediment (ATSDR 1992). Biodegradation in soil is possible, but is expected to be slow. Between 1978 and 1991, 1,2-dibromo-3-chloropropane was found in 1,829 of 20,545 groundwater-monitoring wells at concentrations of 0.001 to 8,000 µg/L. It was found in 275 drinking-water wells at concentrations of up to 7.4 µg/L.

The National Occupational Hazard Survey (conducted from 1972 and 1974) estimated that 9,682 workers were exposed to 1,2-dibromo-3-chloropropane (NIOSH 1976). No more recent estimates of the number of potentially exposed workers were found. However, its use as a soil fumigant was discontinued in 1985, and it is likely that only small amounts are used for chemical synthesis and research purposes. In 1977, exposure levels were estimated to range from less than 1 to 6 mg/m³ (100 to 600 ppb) in production and formulation plants (IARC 1979).

Regulations

Department of Transportation (DOT)

1,2-Dibromo-3-chloropropane is considered a hazardous material, and special requirements have been set for marking, labeling, and transporting this material, including transporting it in tank cars.

Environmental Protection Agency (EPA)

Clean Air Act

National Emission Standards for Hazardous Air Pollutants: Listed as a hazardous air pollutant.

Comprehensive Environmental Response, Compensation, and Liability Act

Reportable quantity (RQ) = 1 lb.

Emergency Planning and Community Right-To-Know Act

Toxics Release Inventory: Listed substance subject to reporting requirements.

Federal Insecticide, Fungicide, and Rodenticide Act

All registrations have been cancelled.

Resource Conservation and Recovery Act

Listed Hazardous Waste: Waste code for which the listing is based wholly or partly on the presence of 1,2-dibromo-3-chloropropane = U066.

Listed as a hazardous constituent of waste.

Safe Drinking Water Act

Maximum contaminant level (MCL) = 0.0002 mg/L.

Food and Drug Administration (FDA, an HHS agency)

Maximum permissible level in bottled water = 0.0002 mg/L.

Occupational Safety and Health Administration (OSHA, Dept. of Labor)

While this section accurately identifies OSHA's legally enforceable PELs for this substance in 2018, specific PELs may not reflect the more current studies and may not adequately protect workers.

Permissible exposure limit (PEL) = 0.001 ppm.

Comprehensive standards for occupational exposure to 1,2-dibromo-3-chloropropane have been developed.

Guidelines

National Institute for Occupational Safety and Health (NIOSH, CDC, HHS)

Listed as a potential occupational carcinogen.

References

Akron. 2009. *The Chemical Database*. The Department of Chemistry at the University of Akron. <http://ull.chemistry.uakron.edu/erd> and search on CAS number. Last accessed: 4/28/09.

ATSDR. 1992. *Toxicological Profile for 1,2-Dibromo-3-Chloropropane*. Agency for Toxic Substances and Disease Registry. <http://www.atsdr.cdc.gov/toxprofiles/tp36.pdf>.

ChemSources. 2009. *Chem Sources - Chemical Search*. Chemical Sources International. <http://www.chemsources.com/chemonline.html> and search on dibromochloropropane. Last accessed: 4/28/09.

Clark HA, Snedeker SM. 2005. Critical evaluation of the cancer risk of dibromochloropropane (DBCP). *J Environ Sci Health C Environ Carcinog Ecotoxicol Rev* 23(2): 215-260.

HSDB. 2009. *Hazardous Substances Data Bank*. National Library of Medicine. <http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB> and search on CAS number. Last accessed: 4/28/09.

IARC. 1979. 1,2-Dibromo-3-chloropropane. In *Some Halogenated Hydrocarbons*. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans, vol. 20. Lyon, France: International Agency for Research on Cancer. pp. 83-96.

IARC. 1999. 1,2-Dibromo-3-chloropropane. In *Re-evaluation of Some Organic Chemicals, Hydrazine, and Hydrogen Peroxide*. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans, vol. 71. Lyon, France: International Agency for Research on Cancer. pp. 479-500.

NCI. 1978. *Bioassay of Dibromochloropropane for Possible Carcinogenicity (CAS No. 96-12-8)*. Technical Report Series no. 28. DHEW (NIH) Publication no. 78-828. Bethesda, MD: National Institutes of Health. 48 pp.

NTP. 1982. *Carcinogenesis Bioassay of 1,2-Dibromo-3-Chloropropane (CAS no. 96-12-8) in F344/N Rats and B6C3F₁ Mice (Inhalation Study)*. NTP Technical Report Series no. 206. NIH Publication no. 82-1762. Research Triangle Park, NC, and Bethesda, MD: National Toxicology Program. 174 pp.

SRI. 2009. *Directory of Chemical Producers*. Menlo Park, CA: SRI Consulting. Database edition. Last accessed: 4/28/09.