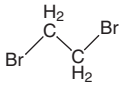
1,2-Dibromoethane (Ethylene Dibromide) CAS No. 106-93-4

Reasonably anticipated to be a human carcinogen
First Listed in the *Second Annual Report on Carcinogens* (1981)



Carcinogenicity

1,2-Dibromoethane (ethylene dibromide) is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (IARC 1977, 1987, 1999). When administered by gavage in corn oil, technical-grade 1,2-dibromoethane induced squamous cell carcinomas of the forestomach in rats of both sexes, hepatocellular carcinomas in females, and hemangiosarcomas in males. The same route of administration induced squamous cell carcinomas of the forestomach and alveolar-bronchiolar adenomas in mice of both sexes (NCI 1978). When administered by inhalation, 1,2-dibromoethane induced increased incidences of carcinomas, adenocarcinomas, and adenomas of the nasal cavity and hemangiosarcomas of the circulatory system in male and female rats; mesotheliomas of the tunica vaginalis and adenomatous polyps of the nasal cavity in males; and fibroadenomas of the mammary gland and alveolar-bronchiolar adenomas and carcinomas in females. 1,2-Dibromoethane administered by inhalation induced alveolar-bronchiolar carcinomas and adenomas in mice of both sexes, and hemangiosarcomas, subcutaneous fibrosarcomas, carcinomas of the nasal cavity, and adenocarcinomas of the mammary gland in females (NTP 1982). Topical application of 1,2-dibromoethane induced tumors of the skin, lung, and forestomach in mice (IARC 1987, 1999).

No adequate data were available to evaluate the potential carcinogenicity of 1,2-dibromoethane in humans (IARC 1977, 1987, 1999). IARC has concluded that results from three epidemiological studies that examined occupational exposure to 1,2-dibromoethane were inconclusive due to the worker's exposures to mixtures of chemicals and the low statistical power of the studies (IARC 1999).

Properties

1,2-Dibromoethane is a clear, colorless, volatile liquid with a characteristic sweet, chloroform-like odor. The compound is slightly soluble in water, and soluble in ethanol, ether, acetate, and benzene. 1,2-Dibromoethane is noncombustible but may decompose upon heating to produce corrosive and/or toxic fumes. It also reacts as an alkylating agent and liberates bromide (IARC 1999, HSDB 2001).

Use

Historically, the primary use of 1,2-dibromoethane was as a lead scavenger in antiknock mixtures added to gasolines. Lead scavenging agents transform the combustion products of lead alkyls to forms that are more likely to be vaporized from engine surfaces. In 1978, 90% of the 1,2-dibromoethane produced was used for this purpose. Annual consumption of 1,2-dibromoethane in the United States has decreased due to EPA regulations banning the use of lead in gasolines (IARC 1977, ATSDR 1992).

Another major use of 1,2-dibromoethane in the past was as a pesticide and ingredient of soil and grain fumigant formulations. It was used for post-harvest application to a variety of vegetable, fruit, and grain crops. It was also used to kill fruit flies on citrus fruits and in the soil to protect grasses in environments such as golf courses. By 1984, EPA regulations had eliminated most of the use of 1,2-dibromoethane as a pesticide in the United States (ATSDR 1992).

Currently, 1,2-dibromoethane is used as a chemical intermediate in synthesis and as a nonflammable solvent for resins, gums, and waxes. The major chemical made from 1,2-dibromoethane is vinyl bromide, which is used as a flame retardant in modacrylic fibers. It also has been used as an intermediate in the preparation of dyes and pharmaceuticals (ATSDR 1992).

Production

Production of 1,2-dibromoethane has been declining over the years, due to the banning of its use as a pesticide and regulations against the use of leaded gasoline. Annual U.S. production of 1,2-dibromoethane peaked at 332 million lb in 1974, but by 1982 had declined to 169.8 million lb. More recent production data were not available (ATSDR 1992, HSDB 2001).

In 1978, the U.S. exported 84.8 million lb of 1,2-dibromoethane; this value declined to 29.8 million lb in 1981 and further declined to approximately 5.4 million lb in 2000. In 1980, imports for 1,2-dichloroethane were reported at 0.861 million lb. Imports of ethylene dibromide and fluorinated, brominated, or iodinated derivatives of acyclic hydrocarbons were approximately 4.5 million lb in 2000 (ATSDR 1992, ITA 2001). Twenty-six current U.S. suppliers were listed for 1,2-dibromoethane (Chem Sources 2001).

Exposure

1,2-Dibromoethane has been widely released to the environment from its historical use as a gasoline additive and a fumigant. Its persistence in soil and groundwater has led to its detection in ambient air, soil, groundwater, and food (ATSDR 1992). According to the Toxic Chemical Release Inventory (TRI), environmental releases have declined drastically over the years. In 1988, total releases were reported to be 99,418 lb; this quantity declined to 18,788 lb in 1994 and further declined to 10,054 lb in 1998. However, in 1999 environmental releases increased to 44,650 lb, with 15 U.S. suppliers reporting releasing the compound. Approximately 80% of this 1999 release were reported by one facility (TRI99 2001).

For the general population, exposure to 1,2-dibromoethane through ingestion of contaminated drinking water is the most important route. EPA estimated the daily intake from drinking water to range from 0 to 16 µg/kg per day. Ingestion of contaminated foods and inhalation of ambient air appear to be less important sources of exposure to 1,2-dibromoethane; EPA estimated the maximum intake from the former to be 0.09 µg/kg/day and from the latter to range from 0 to 79 µg/kg/day. However, inhalation of 1,2-dibromoethane released to indoor air from contaminated groundwater, such as while showering, may play an important role in human exposure (ATSDR 1992). Currently, no estimates were available of occupational exposure to the compound. Current occupational exposure to 1,2-dibromoethane appears to be substantially reduced when compared to past levels (ATSDR 1992). The National Occupational Exposure Survey (1981-1983) indicated that about 9,000 workers were potentially exposed to 1,2-dibromoethane (IARC 1999).

Regulations

DOT

1,2-Dibromoethane is considered a hazardous material and special requirements have been set for marking, labeling, and transporting this material

EPA

Clean Air Act
- NESHAP: Listed as a Hazardous Air Pollutant (HAP)
- NSPS: Manufacture of substance is subject to certain provisions for the control of Volatile Organic Compound (VOC) emissions
- Urban Air Toxics Strategy: Identified as one of 33 HAPs that present the greatest threat to public health in urban areas

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
Most registrations have been cancelled
Resource Conservation and Recovery Act
Listed Hazardous Waste: Waste codes in which listing is based wholly or partly on substance - U067, K117, K118, K136
Listed as a Hazardous Constituent of Waste
Safe Drinking Water Act
Maximum Contaminant Level (MCL) = 0.00005 mg/L

FDA

Action levels for 1,2-dibromoethane in food and in animal feed range from 0.01-150 ppb
Maximum permissible level in bottled water = 0.00005 mg/L

OSHA

Acceptable Peak Exposure = 50 ppm (maximum duration = 5-minutes)
Ceiling Concentration = 30 ppm
Permissible Exposure Limit (PEL) = 20 ppm

Guidelines

NIOSH

Ceiling Recommended Exposure Limit = 0.13 ppm (15 minute exposure)
Immediately Dangerous to Life and Health (IDLH) = 100 ppm
Recommended Exposure Limit (time-weighted-average workday) = 0.045 ppm
Listed as a potential occupational carcinogen

References

ATSDR. 1992. Toxicological Profile for 1,2-Dibromoethane (Final Report). NTIS Accession No. PB93-110740. Atlanta, GA: Agency for Toxic Substances and Disease Registry. 170 pp.

ChemSources. 2001. Chemical Sources International, Inc. http://www.chemsources.com.

HSDB. 2001. Hazardous Substances Data Base. National Library of Medicine. http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB.

IARC. 1977. Some Fumigants, the Herbicides 2,4-D and 2,4,5-T, Chlorinated Dibenzodioxins and Miscellaneous Industrial Chemicals. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans, vol. 15. Lyon, France: International Agency for Research on Cancer. 354 pp.

IARC. 1987. Overall Evaluations of Carcinogenicity. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans, Supplement 7. Lyon, France: International Agency for Research on Cancer. 440 pp.

IARC. 1999. 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. 1589 pp.

ITA. 2001. Subheading 290330: Fluorinated, Brominated, or Iodinated Derivatives of Acyclic Hydrocarbons. International Trade Administration. U.S. Department of Commerce. http://www.ita.doc.gov/td/industry/otea/Trade-Detail/.

NCI. 1978. Bioassay of Dibromoethane for Possible Carcinogenicity. Technical Report Series No 86. DHEW (NIH) Publication No. 78-1336. Bethesda, MD: National Institute of Health. 64 pp.

NTP. 1982. Carcinogenesis Bioassay of 1,2-Dibromoethane (CAS no. 106-93-4) in F344/N Rats and B6C31F Mice (Inhalation Studies). Technical Report Series No 210. NIH Publication No. 82-1766. Research Triangle Park, NC and Bethesda, MD: National Toxicology Program. 163 pp.

TRI99. 2001. Toxic Chemical Release Inventory 1999. Data contained in the Toxic Chemical Release Inventory (TRI). National Library of Medicine. http://www.epa.gov/triexplorer/.