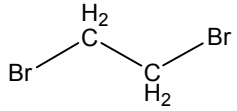
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)
CAS No. 106-93-4
First Listed in the *Second Annual Report on Carcinogens*



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, benzene, gasoline, and most organic solvents. 1,2-Dibromoethane is nonflammable, and under most conditions, is quite stable. On exposure to light, the colorless liquid turns brown, indicating slight decomposition. When heated to decomposition, 1,2-dibromoethane emits toxic fumes of carbon monoxide, carbon dioxide, and hydrogen bromide gas. It reacts as an alkylating agent and liberates bromide (IARC 1999, HSDB 2001, NTP 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 limiting 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

EPA regulates 1,2-dibromoethane under the Clean Air Act (CAA), Clean Water Act (CWA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Food, Drug, and Cosmetic Act (FD&CA), and Resource Conservation and Recovery Act (RCRA). Under CAA, 1,2-dibromoethane has been listed among substances that are potential human health hazards and for which specific technologies are defined. A reportable quantity (RQ) of 1,000 lb has been established under CWA. EPA has set a RQ of 1 lb under CERCLA. Under FD&CA, EPA has announced a policy compliance guide for residues of 1,2-dibromoethane on processed grain. EPA has issued a notice of Rebuttable Presumption Against Registration (RPAR) for 1,2-dibromoethane under FIFRA, and it has been deleted from listing as a fumigant. Under RCRA, EPA subjects the chemical's waste products, off-specification batches, and spill residues to handling and reporting and record-keeping requirements. Under the Safe Drinking Water Act (SDWA), EPA has set a maximum contaminant level goal (MCLG) of zero (0 mg/L) and a maximum contaminant level (MCL) of 0.00005 mg/L for 1,2-dibromoethane.

FDA has established tolerances and action levels for 1,2-dibromoethane residues on food and feed.

ACGIH has noted the potential for 1,2-dibromoethane to be absorbed through the skin. NIOSH has set the recommended exposure limit (REL) of 0.045 ppm as a 10-hr time-weighted average (TWA), with a ceiling exposure (15 min) of 0.13 ppm in the workplace. OSHA adopted a permissible exposure limit (PEL) of 20 ppm as an 8-hr TWA, with a 30-ppm ceiling and 50-ppm maximum peak for 5 minutes in an 8-hr time period. OSHA also regulates 1,2-dibromoethane under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table 59.

REFERENCES

ATSDR. Agency for Toxic Substances and Disease Registry. Toxicological Profile for 1,2-Dibromoethane. (Final Report). Atlanta, GA: ATSDR, Public Health Service, U.S. Department of Health and Human Services. 1992. 170 pp. NTIS Accession No. PB93-110740.

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

HSDB. Hazardous Substances Data Bank. Online Database produced by the National Library of Medicine. Ethylene Dibromide. Profile last updated August 8, 2001. Last review date, November 7, 1991.

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

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

IARC. International Agency for Research on Cancer. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Re-evaluation of Some Organic Chemicals, Hydrazine, and Hydrogen Peroxide. Vol. 71. 1589 pp. Lyon, France: IARC, 1999.

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

NCI. National Cancer Institute. Carcinogenesis, Technical Report Series No. 86. Bioassay of 1,2-Dibromoethane for Possible Carcinogenicity (CAS No. 106-93-4). DHEW (NIH) Publication No. 78-1336. 64 pp. National Institutes of Health, Bethesda, MD, 1978.

NTP. National Toxicology Program. Technical Report Series No. 210. Carcinogenesis Bioassay of 1,2-Dibromoethane (CAS No. 106-93-4) in F344 Rats and B6C3F$_1$ Mice (Inhalation Study). NIH Publication No. 82-1766. 163 pp. National Toxicology Program, Research Triangle Park, NC, and Bethesda, MD, 1982.

NTP. National Toxicology Program. NTP Chemical Repository. Ethylene Dibromide. Last updated August 13, 2001. (http://ntp-server.niehs.nih.gov and search 106-93-4).

TRI99. Toxic Chemical Release Inventory 1999. Data contained in the Toxic Chemical Release Inventory (TRI). Available from the U.S. Environmental Protection Agency Office of Environmental Information, http://www.epa.gov/triexplorer/reports.htm, 2001.