

BACKGROUND INFORMATION ON ETHYLENE DIBROMIDE

Office of Occupational Health Surveillance and Biometrics

National Institute for Occupational Safety and Health

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ETHYLENE DIBROMIDE

Summary

A preliminary report from the National Cancer Institute (NCI) indicates that ethylene dibromide (EDB) is carcinogenic in laboratory rodents. Ethylene dibromide is a synthetic organic chemical with several industrial uses. Because of the potential risk of exposure in the work environment, the National Institute for Occupational Safety and Health (NIOSH) is alerting the occupational health community to these findings.

Introduction

In a memorandum of alert dated October 16, 1974, the Associate Director for Carcinogenesis of the National Cancer Institute (NCI) informed the DHEW Committee to Coordinate Toxicology and Related Programs of the possible carcinogenicity of ethylene dibromide. Subsequently, NIOSH was informed by the NCI of the preliminary findings in bioassay which suggest a strong carcinogenic activity of ethylene dibromide in both rats and mice producing squamous cell carcinomas of the stomach.

Background

Ethylene dibromide* is a colorless, heavy, nonflammable liquid with a sweet odor. The odor is detectable at 10ppm.(1) It is slightly soluble in water and miscible with most solvents. It has a vapor pressure of 17.4mm and a boiling point of 131°C.(2)

In 1921, the antiknock properties of tetra-alkyl lead compounds were discovered. To prevent the deposition of lead, a substance capable of reacting with the lead to aid its removal from the engine cylinder was needed. Ethylene dibromide was found to be such a substance. Today, the

*Synonyms: 1,2 dibromoethane; glycol dibromide, ethane; 1-2 dibromo; ethylene bromide.

primary uses of EDB are in antiknock compounds for gasoline and in fumigants for grains, fruits, and vegetables. It is also used as a soil fumigant for the control of nematodes. It is used less frequently in fire extinguishers, gauge fluids, and as a special solvent and catalyst in organic synthesis.(3,4) About 300 million pounds are produced annually in this country.(5) Approximately 50 percent of this is used in fuel additives(6); much of the remainder is used in fumigants. When commercially fumigated grains were sampled from storage bins and analyzed for residues of organic fumigants, EDB was found in a range less than 0.01 to 6.10 ppm. The lower volatility of EDB resulted in disproportionately higher residues relative to other commonly used, more volatile compounds.(7)

Ethylene dibromide is strongly absorbed by wheat and wheat products. There is very little decomposition of the EDB or reaction with these materials at ordinary temperatures. On heating, a substantial proportion of the absorbed EDB undergoes decomposition to ethylene glycol and inorganic bromide.(8)

Toxicity

Human:

Direct contact with EDB causes irritation and injury to the skin and eyes. Exposure to the vapor has caused the development of respiratory tract inflammation along with anorexia and headache with recovery after discontinuance of exposure. Weakness and rapid pulse have been associated with EDB exposure as well as cardiac failure leading to death.(9)

Oral ingestion of EDB has led to liver necrosis and kidney tubular damage. Other symptoms which may be encountered following ingestion include excitement, tinnitus (ringing in the ears), and severe protracted vomiting.(10,11)

To date, there have been no published reports of any association between EDB and cancer in humans.

Animal:

In laboratory rodents, the vapor of EDB has caused depression of the central nervous system, pulmonary irritation, and renal and hepatic damage.(12,13)

Oral administration of EDB to hens adversely influenced the production, size, and fertility of eggs.(14) The semen from bulls given oral doses of EDB had low density and the spermatozoa had poor motility. Oligospermia and degeneration of the spermatozoa were observed.(15) The spermicidal action of EDB is not direct but occurs during the process of spermatogenesis.(16) In addition, EDB has been shown to have mutagenic potential.(17,18)

The National Cancer Institute tested EDB by gastric intubation in both sexes of M5AFS(OM) rats and C57BL-C3H mice. Among the animals treated with 40 mg/kg body weight of EDB administered in corn oil five times per week (for varying lengths of time 12 to 473 days); 70 of the 92 rats (76 percent) and 82 of the 94 mice (87 percent) developed squamous cell carcinomas of the stomach. No stomach tumors were observed among 22 untreated rats and 39 untreated mice.*

*Unpublished preliminary report issued by the NCI, 1974. Requests for further information should be directed to the NCI, Bethesda, Maryland.

Stomach cancers were observed as early as ten weeks after initiation of EDB treatment. The tumor originated in the forestomach, invaded locally, and eventually metastasized throughout the abdominal cavity. No squamous cell carcinomas were observed in controls. (19,20)

Permissible Occupational Exposure

The current Occupational Safety and Health Administration, Department of Labor, Standard for EDB is 20 ppm as an 8 hour time weighted average; 30 ppm as an acceptable ceiling; and 50 ppm as a maximum peak with 5 minutes duration, based on the 1970 ANSI Z.37.31 Standard. (13)

Occupational Exposure

Estimated Numbers of Workers Exposed to
Ethylene Dibromide by Industry*

<u>Industry</u>	<u>No. Exposed</u>
Fumigators and Exterminators	8,897
General Merchandising	110
Chemical Manufacturing	76
Petroleum Products Manufacturing	<u>28</u>
TOTAL	9,111**

*Projections based on preliminary data from the National Occupational Hazard Survey, Hazard Surveillance Branch, Office of Occupational Health Surveillance and Biometrics, NIOSH. This does not include exposures to trade name products.

**Does not include approximately 650,000 persons employed in service stations with potential exposure to leaded gasoline.

Producers and Suppliers

The following is a list of the major producers and suppliers of ethylene dibromide in the United States.

<u>Producer</u>	<u>Location</u>
Bromet Co. (Ethyl Corp.)	Magnolia, Arkansas
Dow Chemical	Baycity, Michigan
Dow Chemical	Magnolia, Arkansas
Great Lakes Chemical Co.	El Dorado, Arkansas
Houston Chemical Co.	Beaumont, Texas
Michigan Chemical Co.	El Dorado, Arkansas

TOTAL Consumption @ 330 million lbs./yr.

Source: Chemical Economics Handbook, Stanford Research Institute, Menlo Park, California, 1972

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