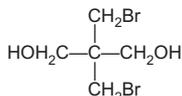


## 2,2-BIS(BROMOMETHYL)-1,3-PROPANEDIOL (TECHNICAL GRADE)

CAS No. 3296-90-0

First Listed in the *Tenth Report on Carcinogens*



### CARCINOGENICITY

The flame retardant 2,2-bis(bromomethyl)-1,3-propanediol, technical grade (BBMP), is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity from studies in experimental animals, which indicates there is an increased incidence of malignant tumor formation at multiple tissue sites in rats and mice. Two year dietary studies of BBMP in F344 rats showed significantly increased incidences of neoplasms of the skin, subcutaneous tissue, mammary gland, Zymbal gland, oral cavity, esophagus, forestomach, small and large intestines, mesothelium, urinary bladder, lung, thyroid gland, and seminal vesicle and in the incidence of mononuclear cell leukemia in males, and an increase in the incidence of neoplasms of the oral cavity, esophagus, mammary gland, and thyroid gland in females. Similar studies in B6C3F<sub>1</sub> mice found increased incidences of neoplasms of the Harderian gland, lung, and kidney in males and neoplasms of the Harderian gland, lung, and subcutaneous tissue in females (NTP 1996, Dunnick *et al.* 1997).

A study in which BBMP was administered in the feed to male F344 rats for three months, followed by maintenance on a control diet for up to two years, found neoplasms at the same sites as in the two-year study of male F344 rats described above. However, this study found higher incidences of neoplasms of the oral cavity, forestomach, small intestine, large intestine, lung, Zymbal gland, thyroid gland, and mesothelium than did the two-year study; these neoplasms were considered to be related to BBMP exposure (NTP 1996, Dunnick *et al.* 1997).

No published case reports or epidemiological studies of human cancer and exposure to BBMP were found (IARC 2000).

### OTHER INFORMATION RELATING TO CARCINOGENESIS OR POSSIBLE MECHANISMS OF CARCINOGENESIS

BBMP has been shown to be mutagenic in bacterial and mammalian test systems, under special conditions. BBMP is mutagenic in *Salmonella typhimurium* strains TA100 and TA1535 only when tested in the presence of metabolic activation (30% S9 liver homogenate from induced hamsters) (Zeiger *et al.* 1992). In cultured Chinese hamster ovary cells, BBMP induces chromosomal aberrations only in the presence of metabolic activation, and it does not induce sister chromatid exchange with or without activation. Male and female mice exposed to BBMP under various conditions showed significant increases in the frequency of micronucleated erythrocytes (NTP 1996).

No available data suggest that mechanisms thought to account for BBMP's induction of tumors in experimental animals would not also operate in humans.

## **PROPERTIES**

The flame retardant BBMP (FR-1138) is a technical-grade mixture of approximately 78% 2,2-bis(bromomethyl)-1,3-propanediol, 6% 2,2-bis(hydroxymethyl)-1-bromo-3-hydroxypropane, 7% 2,2-bis(bromomethyl)-1-bromo-3-hydroxypropane, less than 1% pentaerythritol, and 8% dimers and structural isomers (NTP 1996).

BBMP is a white solid with a slight musty odor. It is very resistant to dehydrobromination. The hydroxyl groups are reactive sites that allow polymerization. These hydroxyl groups readily react with organic acids or epoxides to form esters and with isocyanates to form urethanes. BBMP also can react with aldehydes and ketones to form cyclic acetals or ketals, or with phosphorus oxyhalides to form cyclic phosphates or phosphites (NTP 1996).

## **USE**

BBMP is used as a flame retardant in unsaturated polyester resins, for molded products, and in the production of rigid polyurethane foam. It also is used as a chemical intermediate for pentaerythritol ethers and other derivatives used as flame retardants (HSDB 2001, NTP 1996).

## **PRODUCTION**

In 1999, one U.S. facility was producing BBMP (HSDB 2001). U.S. production in 1977 and 1979 was estimated at more than 2,300 kg (5,000 lb) (HSDB 2001). In 1983, the U.S. Environmental Protection Agency (EPA) estimated annual BBMP production to be 3 to 4 million lb (EPA 1983, cited in NTP 1996). EPA included BBMP on its list of high production volume chemicals, indicating that it was manufactured in or imported into the United States in amounts of at least 1 million lb/year (EPA 1990).

## **EXPOSURE**

BBMP may enter the environment as dust and through wastewater (NTP 1996). It is expected to remain in water for long periods of time (EPA 1983). The primary routes of human exposure to BBMP are inhalation and dermal contact. Occupational exposure to BBMP may occur in industries where it is used as a flame retardant in unsaturated polyester resins, in molded products, and in rigid polyurethane foam (NTP 1996).

## **REGULATIONS**

The EPA regulated BBMP under the Toxic Substances Control Act (TSCA).

The Occupational Safety and Health Administration regulates BBMP under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table 23.

## REFERENCES

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