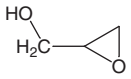
Glycidol
CAS No. 556-52-5

Reasonably anticipated to be a human carcinogen
First Listed in the *Seventh Annual Report on Carcinogens* (1994)



Carcinogenicity

Glycidol is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (NTP 1990, IARC 2000). Two-year studies were conducted with mice and rats that were administered glycidol by gavage. Male rats showed increased incidences of mesotheliomas of the tunica vaginalis, fibroadenomas of the mammary gland, gliomas of the brain, and neoplasms of the forestomach, intestine, skin, Zymbal gland, and thyroid gland. Female rats had increased incidences of fibroadenomas and adenocarcinomas of the mammary gland, gliomas of the brain, neoplasms of the oral mucosa, forestomach, clitoral gland, and thyroid gland, and leukemia. Male B6C3F_1 mice had increased incidences of neoplasms of the harderian gland, forestomach, skin, liver, and lung. Female B6C3F_1 mice had increased incidences of neoplasms of the harderian gland, mammary gland, uterus, subcutaneous tissue, and skin. Other neoplasms that may be related to the administration of glycidol were fibrosarcomas of the glandular stomach in female rats and carcinomas of the urinary bladder and sarcomas of the epididymis in male mice (NTP 1990).

No adequate human studies of the relationship between exposure to glycidol and human cancer have been reported (IARC 2000).

Properties

Glycidol is a slightly viscous, colorless liquid that boils at 160°C. Its molecular weight is 74.1, and its specific gravity is 1.115 at 20°C/4°C. It is soluble in water, alcohol, ether, acetone, and benzene. At 25°C, the vapor pressure is 0.9 mm Hg and the vapor density is 2.15. Glycidol is incompatible with strong oxidizers and nitrates. (IARC 2000, HSDB 2001).

Use

In the 1950s, glycidol was used solely for research purposes; however, by the late 1970s, glycidol became widely used as a chemical intermediate in the pharmaceutical industry. Currently, glycidol is used as a stabilizer in the manufacture of vinyl polymers and natural oils, and as an intermediate in the synthesis of glycerol, glycidyl ethers, and amines. It also is used as an alkylating agent, demulsifer, dye-leveling agent, and for sterilizing milk of magnesia (IARC 2000, HSDB 2001). The glycidol structure is present in two commercially important groups of derivatives, glycidyl ethers and glycidyl esters, neither of which is prepared directly from glycidol. Glycidyl ethers are prepared on a commercial scale in a closed system. The end product is a mixed ether, one component of which is the glycidyl group. Glycidyl esters are prepared by reacting the sodium salt of the appropriate carboxylic acid with epichlorohydrin. Both types of derivatives are used almost exclusively as diluents in epoxy resins (NTP 1990). Glycidol also falls into the generalized category of chiral epoxides. These chiral epoxides or glycidols can be used as reagents in a number of pharmaceutical and fine chemical applications. They include pesticides and herbicides, flavors and fragrances, chiral polymers, and liquid crystals (ARCO 1990).

Production

One domestic producer and 18 suppliers of glycidol were reported (IARC 2000, Chem Sources 2001). No recent production data were found. In the past, more than 10 million lb of glycidyl compounds were produced or imported annually into the United States (NTP 1990).

Exposure

The primary routes of potential human exposure to glycidol are inhalation, eye and dermal contact, and ingestion. Occupational exposure may occur through inhalation. The National Occupational Exposure Survey conducted by NIOSH from 1981 to 1983 estimated that in 88 facilities, covering 10 occupations, 4,871 workers, including 579 women, were potentially exposed to glycidol (NIOSH 1984, IARC 2000). This estimate was derived from observations of the actual use of the compound (78% of total observations) and the use of trade name products known to contain the compound. Glycidol is moderately irritating to the skin and mucous membranes; however, if absorbed through the skin, it can cause central nervous system stimulation, followed by depression (Budavari 1996).

Regulations

OSHA

Permissible Exposure Limit (PEL) = 50 ppm (150 mg/m^3)

Guidelines

ACGIH

Threshold Limit Value - Time-Weighted Average Limit (TLV-TWA) = 2 ppm

NIOSH

Recommended Exposure Limit (REL) = 25 ppm (75 mg/m^3)
Immediately Dangerous to Life and Health (IDLH) = 150 ppm

REFERENCES

ARCO. 1990. Product Literature: Chiral Glycidols, Epoxy Alcohols. ARCO Chemical Company.

Budavari, S., ed. 1996. The Merck Index. 12th ed. Whitehall, NJ, Merck & Company, Inc.

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. 2000. Some Industrial Chemicals. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans, vol. 77. Lyon, France: International Agency for Research on Cancer. 529 pp.

NIOSH. 1984. National Occupational Exposure Survey (1981-83). Cincinnati, OH: U. S. Department of Health and Human Services. http://www.cdc.gov/noes/noes3/empl0003.html.

NTP. 1990. Toxicology and Carcinogenesis Studies of Glycidol (CAS No. 556-52-5) In F344/N Rats and B6C3F1 Mice (Gavage Studies). Technical Report Series No 374. NIH Publication No. 90-2829. Research Triangle Park, NC: National Toxicology Program. 229 pp.