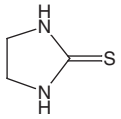
Ethylene Thiourea
CAS No. 96-45-7

Reasonably anticipated to be a human carcinogen
First Listed in the *Fourth Annual Report on Carcinogens* (1985)



Carcinogenicity

Ethylene thiourea is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (IARC 1974, 1987, 2001). When administered in the diet, ethylene thiourea induced thyroid follicular cell carcinomas in rats of both sexes, and thyroid follicular cell neoplasms, hepatocellular neoplasms, and adenomas of the pars distalis of the pituitary gland in both sexes of adult B6C3F_1 mice (NTP 1992). When administered by gavage for three weeks followed by dietary administration, ethylene thiourea induced hepatomas in mice of both sexes (IARC 1974).

There is inadequate evidence for the carcinogenicity of ethylene thiourea in humans (IARC 2001). One study of workers exposed at some time to the compound in rubber manufacturing companies reported no cases of thyroid cancer. Statistically, however, less than one case of cancer would have been expected in the group (IARC 1987).

Properties

Ethylene thiourea occurs as white to pale green needle-like crystals with a faint amine odor. It is soluble in hot water, slightly soluble in methanol, ethanol, ethylene glycol, pyridine, acetic acid, and naphtha, and insoluble in acetone, ether, chloroform, and benzene. When heated to decomposition, ethylene thiourea emits toxic fumes of nitrogen oxides and sulfur oxides. Ethylene thiourea is available in the United States as crystals, as a powder, as an 80% dispersion of the powder in oil, or encapsulated in a matrix of compatible elastomers (HSDB 2000).

Use

Ethylene thiourea is used primarily as an accelerator for vulcanizing polychloroprene (neoprene) and polyacrylate rubbers. Neoprene rubbers are used almost exclusively in industrial applications (e.g., for mechanical and automotive products), in wire and cable production, in construction, and in adhesives. Polyacrylate rubbers are used in products such as seals, o-rings, and gaskets for automotive and aircraft applications. Ethylene thiourea is used in the manufacture of ethylenebisdithiocarbamate pesticides, such as amobam, maneb, mancozeb, metiram, nabam, and zineb. Ethylene thiourea is also used in electroplating baths, as an intermediate in antioxidant production, in dyes, pharmaceuticals, and synthetic resins (IARC 1974, 2001, Sax 1987).

Production

Commercial production of ethylene thiourea was first reported in the United States in 1951 (IARC 1974). The 1979 TSCA Inventory identified two companies producing 550,000 lb of ethylene thiourea in 1977 and five companies importing 110,000 lb (TSCA 1979). Commercial production was last reported in 1980 when a single company had an implied production of >1,000 lb (USITC 1981). No producers or current production volumes were identified for ethylene thiourea in the United States (SRI 1997). However, Chem Sources (2001) identified seven current U.S. suppliers. No recent data on imports or exports could be found; however, the United States exported approximately 13.8 million lb of rubber-processing accelerators, activators, and vulcanizing agents in 1985, and more than 18.3 million lb in 1984 (USDOC Exports 1985, 1986). In 1985, the United States imported nearly 10.6 million lb of products used chiefly as rubber-processing chemicals, and in 1984, over 925,000 lb were imported (USDOC Imports 1985, 1986).

Exposure

The primary routes of potential human exposure to ethylene thiourea are inhalation, ingestion, and dermal contact. The risk of potential occupational exposure to the compound is greatest for workers involved in the manufacture of rubber and rubber products. The National Occupational Exposure Survey (1981-1983) indicated that 7,403 total workers, including 1,363 women, potentially were exposed to ethylene thiourea in the workplace (NIOSH 1984). The National Occupational Hazard Survey, conducted by NIOSH from 1972 to 1974, estimated that 3,500 workers were potentially exposed to ethylene thiourea during the manufacture of rubber products (NIOSH 1976). Since the commercial product used to vulcanize rubber is in an elastomer matrix, the potential for the formation of fine dust dispersions in workplace air is small (NIOSH 1978). Although the curing of rubber converts ethylene thiourea to other compounds, trace amounts of ethylene thiourea are still present in the cured products. The results of a test on a specific neoprene stock indicated that 0.01 mg unchanged ethylene thiourea/inch^2 of surface could be extracted by water at 57°C over a period of 7 days. Consumer products containing neoprene include shoes and closures for containers (e.g., aerosol dispensers) (IARC 1974).

Potential exposure also occurs during the manufacture, formulation, and application of fungicides and insecticides produced from ethylene thiourea. Residues of the compound have been found in 28 different commercial ethylenebisdithiocarbamate products. Treatment of kale and lettuce with maneb at a rate of 1.09 kg active ingredient/acre resulted in initial residues of 0.6 mg/kg ethylene thiourea, which decreased to undetectable levels within 7 days after application. Concentrations of ethylene thiourea from 0.018 to 0.044 mg/kg have been detected on apples sold for human consumption (IARC 1974). Ethylene thiourea can also be formed when food containing the pesticide is cooked (NIOSH 1978).

EPA's Toxic Chemical Release Inventory (TRI) estimated that 6,493 lb of ethylene thiourea were released to the environment from nine facilities that produced, processed, or used the chemical in the United States in 1999. Annual releases varied from 2,750 lb to 22,715 lb between 1988 and 1999 (TRI99 2001).

Regulations

EPA

Clean Air Act
- NESHAP: Listed as a Hazardous Air Pollutant (HAP)

Comprehensive Environmental Response, Compensation, and Liability Act
- Reportable Quantity (RQ) = 10 lb

Emergency Planning and Community Right-To-Know Act
- Toxics Release Inventory: Listed substance subject to reporting requirements

Resource Conservation and Recovery Act
- Listed Hazardous Waste: Waste codes in which listing is based wholly or partly on substance - U116
- Listed as a Hazardous Constituent of Waste

Guidelines

NIOSH

Listed as a potential occupational carcinogen

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