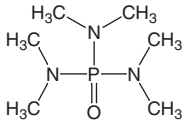
Hexamethylphosphoramide
CAS No. 680-31-9

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



Carcinogenicity

Hexamethylphosphoramide *is reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (CHIP 1982, IARC 1977, 1999). When administered by inhalation, the compound induced nasal tumors in rats of both sexes. Nasal epidermoid carcinomas were the predominant type of tumor observed; however, other nasal tumors included adenoid squamous carcinomas, papillomas, transitional carcinomas, and adenocarcinomas.

No adequate human studies of the relationship between exposure to hexamethylphosphoramide and human cancer have been reported (IARC 1977, 1999).

Properties

Hexamethylphosphoramide is a clear, colorless liquid with an aromatic odor. It is miscible with water and most organic liquids, except for high-boiling saturated hydrocarbons. Hexamethylphosphoramide does not hydrolyze in alkaline media, but hydrolyzes slowly in acids. When heated to decomposition, it emits toxic fumes of phosphorus oxides and nitrogen oxides. It will react violently with oxidizers, strong acids, or chemically reactive metals such as potassium, sodium, magnesium, and zinc (HSDB 2000).

Use

Hexamethylphosphoramide is used as a solvent for polymers, a selective solvent for gases, a polymerization catalyst, a stabilizer against thermal degradation in polystyrene, an additive to polyvinyl and polyolefin resins to protect against degradation by ultraviolet light, a solvent in organic and organometallic reactions in research laboratories, a de-icing additive for jet fuels, a rodenticide, and a processing solvent for aromatic polyamide fiber. Formerly, the major U.S. producer of the chemical used it only as a processing solvent for aromatic polyamide fiber (CHIP 1982, IARC 1977, 1999). Hexamethylphosphoramide also has been tested as a chemosterilant for insects; however, carcinogenicity data led to discontinuance of testing and there is no indication that this chemical will ever be registered by EPA under FIFRA. It has also been tested as a flame retardant, but there is no indication that it is used commercially for this purpose (CHIP 1982).

Production

The Chem Sources USA directory identified one producer of an unspecified volume and 19 suppliers of hexamethylphosphoramide in 1986 (Chem Sources 1986). More recent data indicated 17 U.S. suppliers (Chem Sources 2001). EPA reported that two companies were producing the chemical in 1982, but no production volume was reported (CHIP 1982). The 1979 TSCA Inventory identified three U.S. producers and one importer of hexamethylphosphoramide in 1977. No production volume is specified. No data on imports or exports were available.

Exposure

The primary routes of potential human exposure to hexamethylphosphoramide are inhalation, ingestion, and dermal contact. In the air, it exists solely in the vapor phase. If released to soil or water, it may leach rapidly in soil and sediments. It degrades rapidly with photochemically produced hydroxyl radicals (HSDB 2000). Workers involved in the production of hexamethylphosphoramide, in its use as a solvent or chemical additive, and in the packaging of consumer products may be exposed to this chemical. NIOSH (1975) estimated that up to 90% of an estimated 5,000 people who worked in U.S. laboratories that used this compound may have been exposed. The National Occupational Exposure Survey (1981-1983) indicated that 700 total workers, including 51 women, potentially were exposed to hexamethylphosphoramide in the workplace (NIOSH 1984). EPA reported that data pertaining to disposal sites of wastes indicate a potential for release of detectable quantities of the compound into the soils, drainage water, and well waters in proximity to these sites (CHIP 1982). Release of hexamethylphosphoramide into the air and water from production and processing activities has been documented (CHIP 1982); however, data on current releases are not available. The U.S. EPA's Toxics Release Inventory (TRI) did not contain any data on this compound.

Regulations

EPA

Clean Air Act
NESHAP: Listed as a Hazardous Air Pollutant (HAP)
Comprehensive Environmental Response, Compensation, and Liability Act
Reportable Quantity (RQ) = 1 lb
Emergency Planning and Community Right-To-Know Act
Toxics Release Inventory: Listed substance subject to reporting requirements

Guidelines

NIOSH

Listed as a potential occupational carcinogen

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