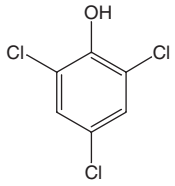
2,4,6-Trichlorophenol
CAS No. 88-06-2

Reasonably anticipated to be a human carcinogen
First Listed in the *Third Annual Report on Carcinogens* (1983)



Carcinogenicity

2,4,6-Trichlorophenol is *reasonably anticipated to be a human carcinogen* based on limited evidence for the carcinogenicity of combined exposures to polychlorophenols, including 2,4,6-trichlorophenol, in humans and sufficient evidence for the carcinogenicity of 2,4,6-trichlorophenol in experimental animals. Several cohort studies of workers involved in chemical manufacture of chlorophenols and in leather tanneries and sawmills where chlorophenols were used indicated a relationship between exposure to chlorophenols and the incidences of soft tissue sarcomas and non-Hodgkin's lymphomas. However, it was not possible to exclude the possible confounding effects of tetrachlorodibenzo-*p*-dioxin (TCDD) present in the chlorophenols or other chemicals in the work environment. Case-control studies have examined the association of non-Hodgkin's lymphoma, thyroid cancer, nasopharyngeal cancer, colon cancer, and liver cancer with chlorophenol exposure (IARC 1979, 1982, 1987, 1999).

When administered in the diet, 2,4,6-trichlorophenol increased the incidences of leukemias or lymphomas in male rats and hepatocellular carcinomas and adenomas in mice of both sexes (NCI 1979, IARC 1999).

Properties

2,4,6-Trichlorophenol occurs as yellow to pinkish orange flakes or colorless crystals, with a strong phenolic odor. It is slightly soluble in water and soluble in acetone, benzene, carbon tetrachloride, diacetone alcohol, diethyl ether, denatured ethanol, methanol, pine oil, Stoddard solvent, toluene, and turpentine (IARC 1979, 1999). In the United States, 2,4,6-trichlorophenol is available in aqueous formulations that may contain dioxins and dibenzofurans as impurities (IARC 1979, NTP 2001). This chemical is stable at temperatures up to its melting-point (69°C). It reacts with sodium carbonate to form the sodium salt; the hydroxyl group reacts with metals and amines to form ethers, esters and salts. Further, the aromatic portion undergoes substitution reactions such as nitration, alkylation, acetylation, and halogenation, and it is decomposed by strong oxidizing agents (IARC 1979). 2,4,6-Trichlorophenol does not readily ignite, but contact with metals may form flammable hydrogen gas. When heated to decomposition, 2,4,6-trichlorophenol emits toxic and corrosive fumes of hydrochloric acid or other toxic gases (HSDB 2001).

Use

2,4,6-Trichlorophenol has been used primarily in various pesticide formulations and as a wood preservative. These have included fungicides, glue preservatives, insecticides, bactericides, and as an antimildew agent for textiles (IARC 1979). Most uses of 2,4,6-trichlorophenol have been cancelled in the United States; however, it continues to be used in the synthesis of some fungicides (HSDB 2001).

Production

Commercial production of 2,4,6-trichlorophenol in the United States was first reported in 1950. An undisclosed quantity was produced in 1974, the last year that production was reported (IARC 1979). In 1975, production of the compound was discontinued by the only U.S. manufacturer because of the high cost of removing toxic impurities of chlorinated dibenzo-*p*-dioxins. 2,4,6-Trichlorophenol is no longer produced in the United States (HSDB 2001); however, Chem Sources (2001) identified 12 current U.S. suppliers of 2,4,6-trichlorophenol. Reported U.S. imports totaled 2,200 lb, 600 lb, and 550 lb in 1976, 1978, and 1980, respectively (IARC 1979, HSDB 2001). The International Trade Administration (ITA 2001) listed U.S. imports and exports of pentachlorophenol and 2,4,5-trichlorophenol but no values were listed for 2,4,6-trichlorophenol in 2000.

Exposure

The primary routes of potential occupational exposure to 2,4,6-trichlorophenol are inhalation and dermal contact. The general population may be exposed to 2,4,6-trichlorophenol through ingestion of contaminated food or water and inhalation of contaminated air (IARC 1999, HSDB 2001). The risk of potential occupational exposure to 2,4,6-trichlorophenol is greatest for workers involved in wood preservation or the production of chlorophenols and chemicals made from chlorophenols (ATSDR 1999, HSDB 2001). The National Occupational Exposure Survey (1981-1983) indicated that 851 total workers, including 187 women, were potentially exposed to 2,4,6-trichlorophenol in the workplace (NIOSH 1984). The National Occupational Hazard Survey, conducted by NIOSH from 1972 to 1974, estimated that 110 workers were possibly exposed to 2,4,6-trichlorophenol in the workplace. Worker exposure was primarily in hospitals and in the leather tanning and finishing industry (NIOSH 1976), as well as in the pulp and wood industry (HSDB 2001). According to NCI (1979), substantial exposure of the general population is questionable; however, residues may be present throughout the environment since it was widely used as a pesticide.

2,4,6-Trichlorophenol can form when industrial wastewater containing phenol or certain aromatic acids is treated with hypochlorite or during the disinfection of drinking water sources. Investigators have detected trichlorophenol (unspecified isomers) in river water samples, landfill leachate samples, chemical plant effluent water samples, sewage treatment plant effluent samples, tap water samples, and in ambient air (ATSDR 1999, HSDB 2001). EPA's Toxic Chemical Release Inventory (TRI) listed five industrial facilities that reported environmental releases of 2,139 lb of 2,4,6-trichlorophenol in 1999 (TRI99 2001). Environmental releases reported to the TRI declined by almost 99% from 1988 to 1990, but releases showed little change from 1990 to 1999.

Regulations

EPA

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

Clean Water Act
- Effluent Guidelines: Listed as a Toxic Pollutant
- Water Quality Criteria: Based on fish/shellfish and water consumption = 1.4 µg/L; based on fish/shellfish consumption only = 2.4 µg/L

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
- Characteristic Toxic Hazardous Waste: TCLP Threshold = 2.0 mg/L
- Listed Hazardous Waste: Waste codes in which listing is based wholly or partly on substance - F027, K043, K099, K105
- Listed as a Hazardous Constituent of Waste

REFERENCES

ATSDR. 1999. Toxicological Profile for Chlorophenols. NTIS Accession No. PB91-181545. Atlanta, GA: Agency for Toxic Substances and Disease Registry. 119 pp.

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. 1979. Some Halogenated Hydrocarbons. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans, vol. 20. Lyon, France: International Agency for Research on Cancer. 609 pp.

IARC. 1982. Chemicals, Industrial Processes and Industries Associated with Cancer in Humans. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans, Supplement 4. Lyon, France: International Agency for Research on Cancer. 292 pp.

IARC. 1987. Overall Evaluations of Carcinogenicity. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans, Supplement 7. Lyon, France: International Agency for Research on Cancer. 440 pp.

IARC. 1999. Re-evaluation of Some Organic Chemicals, Hydrazine, and Hydrogen Peroxide. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Humans, vol. 71. Lyon, France: International Agency for Research on Cancer. 1589 pp.

ITA. 2001. Subheading 290810: Derivatives of Phenols or Phenol-Alcohols Containing only Halogen Substituents and their Salts. International Trade Administration. U.S. Department of Commerce. http://www.ita.doc.gov/td/industry/otea/Trade-Detail/.

NCI. 1979. Bioassay of 2,4,6-Trichlorophenol for Possible Carcinogenicity (CAS No. 88-06-2). Technical Report Series No 155. DHEW (NIH) Publication No. 79-1711. Bethesda, MD: National Institutes of Health. 131 pp.

NIOSH. 1976. National Occupational Hazard Survey (1972-74). Cincinnati, OH: Department of Health, Education and Welfare.

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.

TRI99. 2001. Toxic Chemical Release Inventory 1999. Data contained in the Toxic Chemical Release Inventory (TRI). National Library of Medicine. http://www.epa.gov/triexplorer/.