

## Toxaphene

### CAS No. 8001-35-2

*Reasonably anticipated to be human carcinogens*

First Listed in the *Second Annual Report on Carcinogens* (1981)

#### Carcinogenicity

Toxaphene is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (NCI 1979, IARC 1979, 1987). When administered in the diet, technical-grade toxaphene increased the incidences of hepatocellular carcinomas in mice of both sexes and thyroid follicular cell adenomas in rats of both sexes.

No adequate human studies of the relationship between exposure to toxaphene and human cancer have been reported (IARC 1979).

#### Properties

Toxaphene is a mixture of chlorinated camphenes that occurs as a waxy yellow or amber solid with a pleasant odor. It is practically insoluble in water (<1 to 3 mg/L), but is soluble in hexane, petroleum ether, chloroform, ethanol, and acetone (IARC 1979, HSDB 2001). The exact composition of the mixture is unknown, but it is known to contain at least 175 chlorinated terpenes with a total organic chloride content of 67 to 69% by weight (IARC 1979, HSDB 2001). When heated to decomposition, it emits toxic fumes of hydrochloric acid and other chlorinated compounds. Toxaphene formulations included wetttable powders, emulsifiable concentrates, dusts, granules, baits, oils, and emulsions (IARC 1979, ATSDR 1996).

#### Use

The EPA cancelled most of the pesticide registrations for toxaphene in 1982, and all uses were banned in 1990 (ATSDR 1996). Existing stocks of toxaphene could only be used in selected markets or on an emergency basis after 1982. After 1990, remaining stocks could not be sold or used in the United States. Toxaphene was used primarily as an insecticide for cotton; therefore, most of it was used in the southern states from Texas to Georgia. It was also used on other crops (e.g., corn, small grains, fruits, vegetables, and soybeans), to control ectoparasites on livestock, and to kill undesirable fish species in lakes and streams (ATSDR 1996, HSDB 2001). Toxaphene use increased as DDT was phased out, and toxaphene became the most heavily used pesticide in the United States in the early to mid 1970s.

Agricultural records show that more than 34 million lb/year of toxaphene were used in the United States between 1966 and 1979. This volume declined to 6.6 million lb in 1982. By 1989, toxaphene was no longer used in the United States (HSDB 2001). During the peak years, approximately 85% was used on cotton, 7% was used to control insect pests on livestock and poultry, 5% was used on other field crops, 3% was used on soybeans, and less than 1% was used on sorghum (IARC 1979). Toxaphene use continues in some countries, and it may be manufactured in the United States for export to these countries (ATSDR 1996).

#### Production

Commercial production of toxaphene in the United States began in 1947. Four U.S. companies produced toxaphene (IARC 1979, ATSDR 1996, HSDB 2001). An estimated 233,688 metric tons (approximately 514 million lb) were produced in the United States between 1964 and 1982. Between 25% and 35% of the annual production was exported. Peak production occurred in 1975 with 59.4 million lb, but production declined by more than 90% by 1982 (ATSDR 1996, HSDB 2001). Two U.S. companies continued to manufacture toxaphene in 1990, but no production data were available (ATSDR 1996). According to Chem

Sources (2001), there are 12 current suppliers of toxaphene in the United States. Toxaphene was not included in the EPA's TSCA Inventory (1979), and no environmental releases were reported in EPA's Toxics Release Inventory (TRI99 2001).

#### Exposure

The primary routes of potential human exposure to toxaphene are ingestion of contaminated food and water, dermal contact, and inhalation. In the past, persons with the greatest possible risk of exposure to toxaphene were manufacturers of toxaphene, cotton farmers, and pesticide applicators. The National Occupational Hazard Survey (NOHS), conducted by NIOSH (1976), estimated that 203 workers were exposed to toxaphene. No estimates are available on the number of people potentially exposed through past agricultural use and handling, but the number may be significant because toxaphene was an important agricultural pesticide in the 1970s.

Because of its environmental persistence, toxaphene may occur in air, food, soil, and water. In one study, 45% of the toxaphene applied to a sandy loam soil in 1951 was detectable 20 years later. In some instances, agricultural runoff has polluted local lakes and streams (IARC 1979). Furthermore, toxaphene levels in most environmental media have not shown significant declines since the 1970s and 1980s; therefore, people living near a hazardous waste site or land that was treated with toxaphene in the past may be exposed (ATSDR 1996). The FDA estimated that the average daily intake of toxaphene from 1986 to 1991 ranged from approximately 0.007 to 0.02 µg/kg b.w. per day. The highest intakes were for children 2 years of age. This value was similar to an overall estimated average intake of 0.003 µg/kg b.w. per day reported for 1971 to 1976. However, in a food survey conducted between 1981 and 1986, toxaphene was only detected in 14 out of 19,851 samples at an average concentration of 0.5 ppm. In another study, 14,592 samples of both domestically produced and imported foods from 79 countries were examined. Toxaphene was detected in less than half the samples, with less than 1% exceeding regulatory limits (HSDB 2001).

#### 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 = 0.00028 µg/L; based on fish/shellfish consumption only = 0.00028 µg/L

###### 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

Reportable Quantity (RQ) = 1 lb

Threshold Planning Quantity (TPQ) = 500 lb (solid in powder form particle size <100 microns, or solution or molten form); 10,000 lb (all other forms)

###### Federal Insecticide, Fungicide, and Rodenticide Act

Most registrations have been cancelled

###### Resource Conservation and Recovery Act

Characteristic Toxic Hazardous Waste: TCLP Threshold = 0.5 mg/L

Listed Hazardous Waste: Waste codes in which listing is based wholly or partly on substance - P123, K041, K098

Listed as a Hazardous Constituent of Waste

###### Safe Drinking Water Act

Maximum Contaminant Level (MCL) = 0.003 mg/L

##### FDA

Maximum permissible level in bottled water = 0.003 mg/L

##### OSHA

Permissible Exposure Limit (PEL) = 0.5 mg/m<sup>3</sup>

#### Guidelines

##### ACGIH

Threshold Limit Value - Time-Weighted Average Limit (TLV-TWA) = 0.5 mg/m<sup>3</sup>

Threshold Limit Value - Short Term Exposure Limit (TLV-STEL) = 1 mg/m<sup>3</sup>

##### NIOSH

Immediately Dangerous to Life and Health (IDLH) = 200 mg/m<sup>3</sup>  
Listed as a potential occupational carcinogen

#### REFERENCES

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