

**TOXAPHENE**  
**CAS No. 8001-35-2**

First Listed in the *Second Annual Report on Carcinogens*

## **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 wettable 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 U.S. 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 U.S. in the early to mid 1970s.

Agricultural records show that more than 34 million lb/year of toxaphene were used in the U.S. between 1966 and 1979. This volume declined to 6.6 million lb in 1982. By 1989, toxaphene was no longer used in the U.S. (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 U.S. for export to these countries (ATSDR 1996).

## PRODUCTION

Commercial production of toxaphene in the U.S. 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 U.S. 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 U.S. Toxaphene was not included in the EPA's TSCA Inventory (1979), and no environmental releases were reported in EPA's Toxic 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  $\mu\text{g}/\text{kg}$  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  $\mu\text{g}/\text{kg}$  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 regulates toxaphene under the Clean Water Act (CWA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), Food, Drug, and Cosmetic Act (FD&CA), Resource Conservation and Recovery Act (RCRA), Safe Drinking Water Act (SDWA), and Superfund Amendments and Reauthorization Act (SARA). Under the CWA, EPA published a water quality criteria document for the protection of human health. EPA has established a reportable quantity (RQ) of 1 lb for toxaphene under CWA and CERCLA. A rebuttable presumption against registration (RPAR) has been issued under FIFRA. Tolerances for residues of toxaphene in or

on raw agricultural commodities have been established under FD&CA. Under the SDWA, EPA established a maximum contaminant level (MCL) of 0.005 mg/L and has proposed a maximum contaminant level goal (MCLG) of 0 mg/L. Under SARA, EPA has added toxaphene to its list of toxic chemicals with a general threshold amount set at 500 or 10,000 lb/yr.

The American Conference of Governmental Industrial Hygienists (ACGIH) recommends a threshold limit value (TLV) at 0.5 mg/m<sup>3</sup> with a ceiling of 1 mg/m<sup>3</sup>. NIOSH recommends that toxaphene be regarded as a potential occupational carcinogen. OSHA has set a permissible exposure limit (PEL) for toxaphene of 0.5 mg/m<sup>3</sup> as an 8-hr time-weighted average (TWA) with a STEL of 1 mg/m<sup>3</sup>. The potential for exposure by skin absorption was noted. OSHA also regulates toxaphene under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table 179.

## REFERENCES

ATSDR. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Toxaphene. Atlanta, GA: ATSDR, Public Health Service, U.S. Department of Health and Human Services. 1996. 231 pp. NTIS Accession No. PB97-121057.

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

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

TRI99. Toxic Chemicals Release Inventory 1999. Data contained in the Toxic Chemical Release Inventory (TRI). Available from the U.S. Environmental Protection Agency Office of Environmental Information, <http://www.epa.gov/triexplorer/reports.htm>, 2001.

TSCA. Toxic Substances Control Act, Chemical Substance Inventory, 1979: public record.