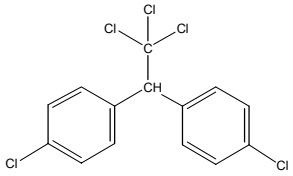
DICHLORODIPHENYLTRICHLOROETHANE; (DDT)

CAS No. 50-29-3

First Listed in the *Fourth Annual Report on Carcinogens*



CARCINOGENICITY

Dichlorodiphenyltrichloroethane (DDT) is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (IARC 1974, 1987, 1991). When administered orally in the diet or by stomach tube, DDT induced hepatomas in mice and rats of both sexes, and lymphomas and lung carcinomas and adenomas in mice. When administered by subcutaneous injection, DDT induced liver tumors in mice of both sexes (IARC 1974, 1987, 1991). DDT administered orally to hamsters resulted in an increase in adrenocortical adenomas. Oral administration studies have been conduced using the DDT metabolites, 1,1-dichloro-2,2-bis(*p*-dichlorodiphenyl)ethylene (DDE) and 1,1-trichloro-2,2-bis(*p*-dichlorodiphenyl)ethylene (TDE); these metabolites are also present as contaminants of technical-grade DDT. TDE caused an increase in liver, lung, and thyroid tumors in male mice, male and female mice, and male rats, respectively. DDE induced liver tumors in mice of both sexes and an increased incidence of neoplastic liver nodules in male and female hamsters (IARC 1991). Administration of technical grade DDT, TDE, and *p,p′*-DDE in the diet provided no evidence for the carcinogenicity of DDT in mice and rats (NCI 1978).

There is inadequate evidence for the carcinogenicity of DDT in humans (IARC 1974, 1987, 1991). Epidemiological studies are available on the cancer risks associated with exposure to DDT; however, due to exposure to multiple pesticides and the small size of the study groups, it is not possible to draw definitive conclusions from these studies (IARC 1991).

PROPERTIES

DDT is the common name for the technical product consisting of 65% to 80% *p,p′*-DDT. Technical DDT is a white amorphous powder that is odorless or may have a slight aromatic odor. Other components of technical grade DDT included *o,p′*-DDT (15% to 21%), *p,p′*-TDE (up to 4%), 1-(*p*-chlorophenyl)-2,2,2-trichloroethanol (up to 1.5%), and traces of *o,o′*-DDT and bis (*p*-chlorophenyl) sulfone. Up to 1% *m,p′*-DDT may be present in some technical DDT. DDT will not ignite easily, but it will burn and subsequently produce poisonous gases (ATSDR 2000, HSDB 2001, NTP 2001).

p,p′-DDT and *o,p′*-DDT occur as colorless crystals or white powders with weak aromatic odors (ATSDR 2000). They are very soluble in fats and most organic solvents, but both are insoluble in water. *p,p′*-DDT can dehydrochlorinate at temperatures above its melting point and in organic solvents in the presence of alkali or organic bases. It is sensitive to ultraviolet light. *p,p′*-DDT is incompatible with ferric chloride and aluminum chloride and can react with strong oxidizing materials (HSDB 2001, NTP 2001).

USE

DDT was first used in the U.S. as an insecticide in 1939. From 1946 to 1972, DDT was one of the most widely used insecticides in the world. Its usage peaked in the 1960s, and it was banned for the vast majority of uses in the U.S. in 1972. DDT is currently used in the U.S. only under Public Health Service supervision for public health emergencies and by the U.S. Department of Agriculture or U.S. military for health quarantine. Formerly, DDT was used for the control of insect pests such as the pink boll worm on cotton, codling moth on deciduous fruits, Colorado potato beetle, and the European corn borer. In the public health field, DDT was used to control malaria, typhus, body lice, and other vector diseases. DDT has also been used for mothproofing clothing. DDT is still used in many countries as an insecticide (ATSDR 2000, HSDB 2001).

PRODUCTION

Technical DDT was first synthesized in 1874, and by 1945 commercial production in the U.S. had begun. In 1962, 82 million kg (180.4 million lb) were produced in the U.S. for use on 334 agricultural commodities. In 1971, production was estimated in the U.S. to be 2 million kg (4.4 million lb). Currently, no companies in the U.S. manufacture DDT, but it is produced by companies in Mexico and China (ATSDR 2000, HSDB 2001). Chem Sources (2001) listed 15 U.S. suppliers for DDT.

DDT is no longer imported or exported into the U.S. The last year that DDT was imported into the U.S was 1972, with approximately 200 tons imported. In 1985, 303,000 kg DDT (666,600 lb) were exported by two producers (ATSDR 2000, HSDB 2001).

EXPOSURE

Despite the 1972 U.S. ban of DDT, human exposure to DDT occurs because of its extensive former use, its current use in some areas of the world, and the persistence of the compound and its metabolites in the environment. DDT has been detected in air, rain, soil, water, animal and plant tissues, food, and the work environment. Today, exposure to DDT and its metabolites is primarily from ingestion of small amounts in the diet, particularly from meat, fish, poultry, and root and leafy vegetables. The residue levels have declined and continue to decline, but because of the persistence of the chemical, low levels will be present for decades. A study of dietary DDT intake levels over the years reported that the daily intake of DDT for a 70 kg 16-year old male was estimated to be 6.5, 2.4, 1.5, and 0.97 pg for 1978-1979, 1979-1980, 1984-1986, and 1986-1991, respectively. DDT accumulates in fatty tissues and is usually found in higher concentrations in human milk than in cow's milk or other infant foods (ATSDR 2000).

REGULATIONS

DDT is regulated by EPA under the Clean Water Act (CWA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Food, Drug, and Cosmetic Act (FD&CA), Resource Conservation and Recovery Act (RCRA), and Superfund Amendments and Reauthorization Act (SARA). A reportable quantity (RQ) of 1 lb has been established under CERCLA and CWA. DDT is also regulated as a hazardous constituent of waste under RCRA. Tolerances for residues of DDT in or on

raw agricultural commodities have been established under FD&CA. In 1972, EPA canceled most DDT registrations under FIFRA.

ACGIH recommends a threshold limit value (TLV) at 14.5 mg/m^3. NIOSH has recommended that DDT exposure be limited to 0.5 mg/m^3 as a 10-hr time-weighted average (TWA). OSHA has established a permissible exposure limit (PEL) of 1 mg/m^3 as an 8-hr TWA. OSHA also regulates DDT under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table 64.

REFERENCES

ATSDR. Agency for Toxic Substances and Disease Registry. Toxicological Profile for DDT/DDD/DDE. Update. (Draft for Public Comment). Atlanta, GA: ATSDR, Public Health Service, U.S. Department of Health and Human Services. 2000. 433 pp.

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IARC. International Agency for Research on Cancer. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Some Organochlorine Pesticides. Vol. 5. 241 pp. Lyon, France: IARC, 1974.

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NTP. National Toxicology Program. NTP Chemical Repository. DDT. Last updated August 13, 2001. (http://ntp-server.niehs.nih.gov and search 50-29-3).