

## 5. PRODUCTION, IMPORT/EXPORT, USE, AND DISPOSAL

Figures relating to the production, import/export, use, and disposal of a pesticide generally refer to those of the active ingredient. In the case of DDT, the active ingredient is *p,p'*-DDT. Most DDT production can be assumed to have been technical grade material that included 15–21% of the nearly inactive *o,p'*-DDT, up to 4% of *p,p'*-DDD, and up to 1.5% of 1-(*p*-chlorophenyl)-2,2,2-trichloroethanol (Metcalf 1995).

### 5.1 PRODUCTION

Technical DDT is made by condensing chloral hydrate with chlorobenzene in concentrated sulfuric acid. It was first synthesized in 1874, but it was not until 1939 that Müller and his coworkers discovered its insecticidal properties. Production of DDT in 1971 in the United States was estimated to be 2 million kg. This represented a sharp decline from the 82 million kg produced in 1962, and from the 56 million kg produced in 1960. At the peak of its popularity in 1962, DDT was registered for use on 334 agricultural commodities and about 85,000 tons were produced (Metcalf 1995). Production then declined and by 1971, shortly before it was banned in the United States, production had dipped to about 2,000 tons. The cumulative world production of DDT has been estimated as 2 million tons. As of January 1, 1973, all uses of DDT in the United States were canceled except emergency public health uses and a few other uses permitted on a case-by-case basis (Meister and Sine 1999). Currently, no companies in the United States manufacture DDT (Meister and Sine 1999). DDT is presently produced by companies in Mexico and China (Meister and Sine 1999). *p,p'*-DDD has been used as an insecticide, but is no longer produced commercially. It was prepared by condensing dichloroacetaldehyde with chlorobenzene (Budavari et al. 1996). No past production figures are available for this chemical, and there are no indications that production was ever very high. *o,p'*-DDD (Mitotane) is produced by Bristol, Meyer, Squibb under the brand name Lysodren<sup>®</sup> for use as a chemotherapy drug for adrenal gland cancer (PDR 1999). DDD and DDE are degradation products formed by dehydrohalogenation of DDT.

Analytical studies have shown that DDT compounds, including *p,p'*-DDT and *p,p'*-DDE, may be contaminants in technical grades of the insecticide, dicofol (Risebrough et al. 1986). In addition, another DDT-related impurity in dicofol, 1,1,1,2-tetrachloro-2,2-bis(*p*-chlorophenyl)ethane, has been shown to degrade to *p,p'*-DDE.

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**5.2 IMPORT/EXPORT**

DDT was last imported into the United States in 1972, when imports amounted to 200 tons. Although the use of DDT was banned in the United States after 1972, it was still manufactured for export. In 1985, there were two producers of DDT in the United States, and in that year, 303,000 kg of DDT were exported (HSDB 1988). Presently, there are no producers of DDT in the United States, and therefore, there are no exports of DDT.

**5.3 USE**

DDT is a broad spectrum insecticide that was very popular due its effectiveness, long residual persistence, low acute mammalian toxicity, and low cost (Metcalf 1989). DDT was first used as an insecticide starting in 1939 and widely used until about 1970 (Van Metre et al. 1997). Its usage peaked in the United States in the early 1960s. During World War II, it was extensively employed for the control of malaria, typhus, and other insect-transmitted diseases. DDT has been widely used in agriculture to control insects, such as the pink boll worm on cotton, codling moth on deciduous fruit, Colorado potato beetle, and the European corn borer. In 1972, 67–90% of the total United States consumption of DDT was on cotton; the remainder was primarily used on peanuts and soybeans. DDT has been used extensively to eradicate forest pests, such as the gypsy moth and spruce budworm. It was used in the home as a mothproofing agent and to control lice. The amount of DDT used in U.S. agriculture was 27 million pounds in 1966 and 14 million pounds in 1971 (Gianessi and Puffer 1992). Since 1973, use of DDT in the United States has been limited to the control of emergency public health problems. In some regions of the world where malaria is endemic, such as South Africa, Swaziland, and Madagascar, DDT is sprayed onto the interior surfaces of homes to decrease the incidence and spread of the disease by controlling mosquitoes (Attaran et al. 2000; Roberts et al. 1997). Not only is DDT a contact toxin for mosquitoes, it is also a contact irritant and repellent. As such, DDT has been shown to be effective in controlling malaria by not only limiting the survival of the mosquito, but also decreasing the odds of an individual being bitten within the sprayed homes. *p,p'*-DDD was also used as an insecticide. *o,p'*-DDD (Mitotane) is used medically in the treatment of cancer of the adrenal gland (PDR 1999). DDE has no commercial use.

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**5.4 DISPOSAL**

Under current federal guidelines, DDT and DDD are potential candidates for incineration in a rotary kiln at 820–1,600 EC. Disposal of DDT formulated in 5% oil solution or other solutions is mainly by using liquid injection incineration at 878–1,260 EC, with a residence time of 0.16–1.30 seconds and 26–70% excess air. Destruction efficiency with this method is reported to be >99.99%. Multiple-chamber incineration is also used for 10% DDT dust and 90% inert ingredients at a temperature range of 930–1,210 EC, a residence time of 1.2–2.5 seconds, and 58–164% excess air. DDT powder may be disposed of by molten salt combustion at 900 EC (no residence time or excess air conditions specified). A low temperature destruction method involving milling DDT with Mg, Ca, or CaO is under development on a laboratory scale (Rowlands et al. 1994). Landfill disposal methods are rarely used at the present time.

