

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

### 4.1 PRODUCTION

Endrin is a stereoisomer of dieldrin produced by the reaction of vinyl chloride and hexachloro-cyclopentadiene to yield a product which is then dehydrochlorinated and condensed with cyclopentadiene to produce isodrin. This intermediate is then epoxidized with peracetic or perbenzoic acid to yield endrin. An alternative production method involves condensation of hexachloro-cyclopentadiene with acetylene to yield the intermediate for condensation with cyclopentadiene (EPA 1985e; IARC 1974).

Endrin is no longer manufactured in the United States. Velsicol Chemical Company, Memphis, Tennessee, was the producer of endrin until the final voluntary cancellation of registration with the Office of Pesticide Programs in 1991 (Bishop 1984, 1985, 1986; EPA 1983e; USDA 1995). It is estimated that 2.345 million kg (5.1-9.9 million pounds) of endrin were sold in the United States in 1962, while less than 450,000 kg (990,000 pounds) were produced in 1971 (IARC 1974). More recent estimates of domestic production of endrin could not be found (HSDB 1995). As with many toxic chemicals, information on production or use of pesticides is often proprietary, and quantitative estimates of production of endrin are virtually impossible to obtain (Bason and Colbom 1992). Chemical manufacturers in the United States however, can legally produce pesticides for export that are currently banned or not registered for use in the United States (FASE 1996). No information on the production of endrin was available from the Toxic Release Inventory (TRI) because endrin is not one of the chemicals that facilities are required to report (EPA 1995a).

Endrin aldehyde and endrin ketone were never commercial products, but occurred as impurities of endrin or as degradation products (EPA 1985e; IARC 1974; SRI 1987). While commercial preparations of solid endrin were typically 95-98% pure, the following chemicals (in addition to endrin aldehyde and endrin ketone) have been found as trace impurities: aldrin, dieldrin, isodrin, heptachloronorbornadiene, and heptachloronorbornene (HSDB 1995). The active ingredient would often be mixed with one or more organic solvents for application in a liquid form. Carriers included xylene, hexane, and cyclohexane (HSDB 1995; Zabik et al. 1971).

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### 4.2 IMPORT/EXPORT

Data on historic imports and exports of endrin are sparse. The most recent data that could be located indicate that about 21,000 kg (46,000 pounds) of endrin were imported into the United States in 1972 (IARC 1974). No information on export volumes of endrin was located. Recently, however, the Foundation for Advancements in Science and Education reported that almost 75% of the 750,000 tons of pesticides the United States exported from 1992 to 1994 lacked chemical-specific information (FASE 1996). Many of the exported pesticides were organochlorine pesticides which had been banned for use in the United States.

### 4.3 USE

Endrin was first used as an insecticide, rodenticide, and avicide beginning in 1951 to control cutworms, voles, grasshoppers, borers, and other pests on cotton, sugarcane, tobacco, apple orchards, and grain (EPA 1979e; HSDB 1995). It was also used as an insecticide agent on bird perches (EPA 1985f). Unlike aldrin/dieldrin, with which it has many chemical similarities, endrin apparently was never used extensively for termite-proofing or other applications in urban areas (Blus et al. 1989; HSDB 1995). Endrin's toxicity to nontarget populations of raptors and migratory birds was a major reason for its cancellation as a pesticide agent (Blus et al. 1989). (EPA 1979f; USDA 1995). Except for use as a toxicant on bird perches, which was canceled in 1991, all other uses of endrin in the United States were voluntarily canceled by the manufacturer in 1986 (Bishop 1984, 1985, 1986; EPA 1983e; USDA 1995). It has been estimated that 6,250 kg (13,780 pounds) of endrin were used annually in the United States prior to 1983 (Gianessi 1986). Since endrin may still be used as a pesticide agent in foreign countries, residues on imported food items are still of some concern (FDA 1990, 1991, 1992; Hundley et al. 1988) (see Section 5.4.4). Both the EPA and FDA revoked all food tolerances for endrin in 1993 (USDA 1995).

### 4.4 DISPOSAL

Because endrin and endrin aldehyde are listed as hazardous substances, disposal of wastes containing these compounds is controlled by a number of federal regulations (see Chapter 7). Land disposal restrictions apply to wastes containing endrin or endrin aldehyde (EPA 1986d, 1987b). Chemical treatment (reductive dechlorination) or incineration are possible disposal methods (HSDB 1995; IRPTC

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1985). Past disposal methods included land disposal (EPA 1987c; Sittig 1980). In general, disposal methods for endrin residues or endrin-containing wastes are similar to those for wastes containing aldrin/dieldrin (HSDB 1995). No information was found in the available literature on regulations or methods for the disposal of endrin ketone.

No information was found in the available literature on the amounts of endrin, endrin aldehyde, or endrin ketone disposed of in the United States by any method.

