

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

5.1 PRODUCTION

Aldrin was first synthesized in the United States as a pesticide in 1948 (EPA 1986d). Aldrin and dieldrin have not been produced in the United States since 1974 (Sittig 1985). It is not known how much aldrin and dieldrin are presently stored in the United States.

Aldrin and dieldrin are included on the most recent Toxics Release Inventory (TRI99) as reportable chemicals when released or transferred from TRI99 facilities (TRI99 2001). EPA received one TRI99 form from Safety Keen (Deer Park) Inc. located in Deer Park, Texas. This facility performed the waste treatment of aldrin and reported no other uses. There was no other information available from the TRI99 database concerning aldrin or dieldrin.

Aldrin was manufactured by the Diels-Alder condensation of hexachlorocyclopentadiene with bicyclo[2.2.1]-2,5-heptadiene. The final condensation reaction was usually performed at approximately 120 EC and at atmospheric pressure. Excess bicycloheptadiene was removed by distillation. The final product was usually further purified by recrystallization (Sittig 1980). In 1967, the composition of technical-grade aldrin was reported to be as follows: 90.5% hexachlorohexahydrodimethanonaphthalene (HHDN); 3.5% other polychlorohexahydrodimethanonaphthalene compounds (isodrin); 0.6% hexachlorobutadiene; 0.5% octachlorotetrahydromethanoindene (chlordan); 0.5% octachlorocyclopentene; 0.3% toluene; 0.2% hexachlorocyclopentadiene; 0.1% HHDN di-adduct; <0.1% hexachloroethane; <0.1% bicycloheptadiene; and 3.6% other compounds (IARC 1974a).

Dieldrin was manufactured by the epoxidation of aldrin. The epoxidation of aldrin was obtained by reacting it either with a peracid (producing dieldrin and an acid byproduct) or with hydrogen peroxide and a tungstic oxide catalyst (producing dieldrin and water) (Sittig 1980). Peracetic acid and perbenzoic acid were generally used as the peracid acid (HSDB 2001b). When using a peracid, the epoxidation reaction was performed noncatalytically or with an acid catalyst such as sulfuric acid or phosphoric acid. When using hydrogen peroxide, tungsten trioxide was generally used as the catalyst (Sittig 1980). Dieldrin contained not <85% by weight HEOD and not >15% by weight of insecticidally related compounds (Clayton and Clayton 1994).

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

5.2 IMPORT/EXPORT

Before the 1974 near-total ban by EPA on aldrin and dieldrin use, aldrin and dieldrin were not imported into the United States. Aldrin was imported from Shell International (Holland) for formulation and limited use in the United States from 1974 to 1985, except when imports were temporarily ceased in 1979 and 1980. Between 1981 and 1985, an estimated 1–1.5 million pounds of aldrin were imported annually. EPA reports that aldrin has not been imported since 1985 (EPA 1986d). No information could be found that explicitly provided information about dieldrin importation.

No information could be found regarding the exportation of aldrin or dieldrin.

5.3 USE

Aldrin and dieldrin are active against insects by contact or ingestion (Hayes 1982). Thus, their primary use was for the control of termites around buildings, corn pests by application to soil and in the citrus industry (EPA 1980a). Other past uses included general crop protection from insects; timber preservation; and termite-proofing of plastic and rubber coverings of electrical and telecommunication cables, and of plywood and building boards (Worthing and Walker 1983). In 1966, aldrin use in the United States peaked at 19 million pounds, but by 1970, use had decreased to 10.5 million pounds. During this same period (1966–1970), annual dieldrin use dropped from 1 million to 670,000 pounds. These decreases were attributed primarily to increased insect resistance to the two chemicals, and to the development and availability of more effective and environmentally safer pesticides (EPA 1980a).

In 1970, the U.S. Department of Agriculture canceled all uses of aldrin and dieldrin based on the concern that these chemicals could cause severe aquatic environmental change and are potentially carcinogenic (EPA 1980a). Early in 1971, EPA initiated cancellation proceedings for aldrin and dieldrin, but did not order the suspension of aldrin and dieldrin use. In 1972, under the authority of the Federal Insecticide, Fungicide, and Rodenticide Act as amended by the Federal Pesticide Control Act of 1972, an EPA order lifted the cancellation of aldrin and dieldrin use in three cases: subsurface ground insertion for termite control; dipping of nonfood plant roots and tops; and moth-proofing in manufacturing processes using completely closed systems (EPA 1980a, 1986d). In 1974, these last two registered uses were voluntarily abandoned by the registrant, Shell Chemical Company (EPA 1986d). The final registered use of aldrin and dieldrin as termiticides was voluntarily canceled by the Scallop Corporation (part of the Shell Chemical Company) on May 15, 1987 (EPA 1989a). Chapman Chemical Company, however, still used

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

aldrin as the active ingredient in their termiticide formulation ALDREC. Chapman's failure to disclose the exact formulation of ALDREC to the EPA forced the EPA to cancel all use of the compound on February 21, 1989. Since this time, all uses of aldrin and dieldrin have been canceled (EPA 1990b).

5.4 DISPOSAL

Aldrin and dieldrin are classified as hazardous wastes (EPA 1988a, 1990c). Subtitle C of the Resource Conservation and Recovery Act of 1976 (RCRA) creates a comprehensive program for the safe management of hazardous waste. Section 3004 of RCRA requires owners and operators of facilities that treat, store, or dispose of hazardous waste to comply with standards established by EPA that are "necessary to protect human health and the environment" (EPA 1987h).

The Chemical Manufacturers Association recommends disposing of aldrin and dieldrin by incineration (HSDB 2001b). Incineration by rotary kiln (at 820–1,600 EC), liquid injection (at 877–1,038 EC), and fluidized bed (at 450–980 EC), with residence times of seconds for gases and liquids and hours for solids, is recommended (HSDB 2001a). Aldrin and dieldrin are often mixed with vermiculite, sodium bicarbonate, or a sand-soda ash mixture prior to incineration (OHM/TADS 1990a). The incineration of these chemicals emits highly toxic fumes of hydrogen chloride and chlorinated breakdown products (HSDB 2001a). Thus, incinerators used for disposal of aldrin and dieldrin must have an acid scrubber and an after-burner (OHM/TADS 1990a). Also, prior to incineration, local air and fire authorities must be contacted (OHM/TADS 1990a, 1990b).

Another recommended disposal method for aldrin and dieldrin is burying the chemicals in landfills. Contaminated material should be buried 8–12 feet underground in an isolated area away from water supplies, with a layer of clay, a layer of lye, and a second layer of clay beneath the wastes (OHM/TADS 1990a). Gravity filtration of solids, followed by dual-media filtration of the liquids, followed by activated carbon adsorption (100–300 pounds of carbon per pound of soluble material) is also an approved disposal method (OHM/TADS 1990b). Finally, disposal of small amounts of aldrin and dieldrin can be accomplished through degradation by active metals (sodium or lithium) in liquid ammonia (HSDB 2001b; Sittig 1985).

