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

4.1 PRODUCTION

HCCPD may be produced commercially by chlorination of cyclopentadiene or dechlorination of octachlorocyclopentene. In the chlorination process, cyclopentadiene is mixed with alkaline hypochlorite and HCCPD is recovered by fractional distillation. The maximum yield of product is about 75%, with impurities including lower chlorinated cyclopentadienes. The dechlorination process involves thermal dechlorination of octachlorocyclopentene at 470-480 °C and yields a product of greater than 90% purity. Technical grade HCCPD usually contains impurities, which may include hexachlorobenzene, octachloropentene, hexachlorobutadiene, tetrachloroethylene, hexachloro-3-cyclopentane- 1 -one, PCBs, and mirex, depending on the production method used. The commercial product currently available has a minimum purity of 97% (Abdo et al. 1984; EPA 1991a; HSDB 1998; WHO 1991).

The only current commercial producer of HCCPD is the Velsicol Chemical Company in Memphis, TN (SRI 1997). Because current production of HCCPD is limited to one producer, information on the current production volume of HCCPD is not available (EPA 1984b, 1991a). Estimates of past production, based on production volumes of chlorinated cyclodiene pesticides, indicate that production volume for HCCPD was about 50 million pounds per year (22,680 metric tons per year) in the early 1970s and dropped to 8-15 million pounds per year (3,600-6,800 metric tons per year) in the late 1970s due to regulatory restrictions on the use of many of the organochlorine pesticides using HCCPD as a chemical intermediate (EPA 1984b, 1991a; Lu et al. 1975; Nubbe et al. 1995). HCCPD was a key intermediate in the production of chlorinated cyclodiene pesticides, including aldrin, dieldrin, endrin, chlordane, heptachlor, kepone, endosulfan, pentac, isodrin, and mirex (EPA 1984b). Only two of these pesticides, endosulfan and pentac are currently registered for use in the United States. It was estimated that 8,300 metric tons (18 million pounds) of HCCPD were produced in 1983 (EPA 1984b, 1991a; SRI 1992). No more recent information on production volumes was located.

Table 4-l lists the facilities in each state that manufacture or process HCCPD, the intended use, and the range of maximum amounts of HCCPD that are stored on site. The data listed in Table 4-l are derived from the Toxics Release Inventory (TR196 1998). Only certain types of facilities were required to report. Therefore, this is not an exhaustive list.

Table 4-1. Facilities That Manufacture or Process HCCPD

FACILITY	LOCATION [a]	RANGE OF MAXIMUM AMOUNTS ON SITE IN POUNDS	ACTIVITIES AND USES
OCCIDENTAL CHEMICAL CORP.	NIAGARA FALLS , NY	100,000 - 999,999	REACTANT
MORTON INTL. INC.	WEST ALEXANDRIA , OH	10,000 - 99,999	REACTANT
VELSICOL CHEMICAL CORP.	MEMPHIS , TN	1,000,000 - 9,999,999	PRODUCE , ON-SITE USE/PROCESSING , SALE/DISTRIBUTION , REACTANT
BASF CORP.	BEAUMONT , TX	10,000 - 99,999	REACTANT

Source: TRI96 1998

[a] Post Office state abbreviations used

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

4.2 IMPORT/EXPORT

No information on historic or current import or export volumes of HCCPD was located.

4.3 USE

The principal end use for HCCPD is as a key intermediate in the production of chlorinated cyclodiene pesticides, including aldrin, dieldrin, endrin, chlordane, heptachlor, kepone, endosulfan, pentac, isodrin, and mirex. Technical grade chlordane, for example, has been reported to contain impurities of HCCPD up to 1% (Dorough and Ranierei 1984; Lu et al. 1975). Rand et al. (1982a) also reported that HCCPD was present as a contaminant in several cyclodiene pesticides at concentrations of up to 1%. It is also used as an intermediate in the manufacture of flame retardants such as Dechlorane Plus and chlorendic anhydride and, to a lesser extent, in the manufacture of nonflammable resins, polyester resins, pharmaceuticals, unbreakable plastics, acids, esters, ketones, fluorocarbons, and dyes. It has previously been used as a biocide (Bell et al. 1980; Cole 1954; EPA 1984b, 1991a; HSDB 1998; Stevens 1979; Verschueren 1983; WHO 1991).

4.4 DISPOSAL

HCCPD and waste containing HCCPD are classified as hazardous wastes by EPA. Generators of waste containing this contaminant must conform to EPA regulations for treatment, storage, and disposal (see Chapter 7, Regulations and Advisories). HCCPD is a potential candidate for fluidized bed incineration at a temperature range of 450-980 °C and residence times of seconds for liquids and gases, and longer for solids. It is also a potential candidate for rotary kiln incineration at a temperature range of 820-l ,600 °C and residence times of seconds for liquids and gases, and hours for solids. HCCPD is also a candidate for liquid injection incineration at a temperature range of 650-1,600 °C and a residence time of 0.1-2 seconds (EPA 198 1 b). Rotary kiln or fluidized bed incineration methods are acceptable disposal methods for these wastes. HCCPD can be incinerated after mixing with a combustible fuel; however, this mixture should be completely combusted to prevent the formation of phosgene, and an acid scrubber is necessary to remove the halogen acids produced (HSBD 1998; IRPTC 1985; WHO 1991).

HCCPD can also be buried in specially designated chemical landfills. However, HCCPD should not be disposed of in the same area of a landfill as organic solvents to prevent potential migration (leaching) of

HCCPD from the disposal site into groundwater (Chou and Griffin 1983; Chou et al. 1981; WHO 1991). Deep well underground injection may also be used as a disposal method (HSDB 1998; WHO 1991). In 1996, 250 pounds (0.1 metric tons) were released from manufacturing and processing facilities via underground injection (TR196 1998).

According to the TRI, about 45,000 pounds (20.4 metric tons) and 56,882 pounds (25.8 metric tons) of HCCPD were transferred off-site to landfills and/or to treatment and disposal facilities in 1990 and 1996, respectively (see Section 5.2) (TR190 1992; TR196 1998). In addition, about 900 pounds (0.4 metric tons) and 1,580 pounds (0.7 metric tons) were discharged to publicly owned treatment works (POTWs) in 1990 and 1996, respectively (TR190 1992; TR196 1998).