

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

### 4.1 PRODUCTION

Table 4-1 lists the facilities in each state that manufacture or process chlorophenol, the intended use, and the range of maximum amounts of chlorophenol that are stored on site. There are currently 4 facilities that produce or process chlorophenols in the United States. The data listed in Table 4-1 are derived from the Toxics Release Inventory (TRI 1996 1998). Only certain types of facilities were required to report. Therefore, this is not an exhaustive list.

The chlorinated phenols are manufactured by chlorination of phenol, or for the higher chlorinated phenols, the chlorination of lower chlorinated phenols at high temperatures (WHO 1989). The manufacture of the tetrachlorinated phenols requires a catalyst (e.g., iodine, ferric chloride). 2,4,5-TCP, 2,3,4,5-TeCP, and 2,3,5,6-TeCP have also been produced by the alkaline hydrolysis of hexachlorobenzene (WHO 1989). Both processes of chlorophenol production result in the formation of impurities. The impurities include polychlorinated dibenzo-p-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), polychlorinated phenoxyphenols, polychlorinated diphenyl ethers, polychlorinated benzenes, and polychlorinated biphenyls. Because the higher chlorinated phenols are produced at higher temperature, the contamination of the higher chlorinated phenols is greater than that of the lower chlorinated phenols (WHO 1989).

Recent data about the production of the chlorinated phenols are very limited. The Toxics Release Inventory has grouped all chlorophenols together for 1996 data. The BASF Corp. in Beaumont, Texas is the largest manufacturer or processor of chlorophenols with 100,000-999,000 pounds on site (TRI 1996 1998). 2,3,4,6-TeCP is not produced commercially in the United States (HSDB 1998). Pentachlorophenol, which generally contains about 4% tetrachlorophenols and 0.1% trichlorophenols (Kalliokoski and Kauppinen 1990), is also not produced in the United States (TRI 1996 1998). Additional data concerning the production of the chlorinated phenols were not available.

### 4.2 IMPORT/EXPORT

Recent data concerning the import/export of chlorophenols were not available. The latest year for which HSDB (1998) has United States import data on a given chlorophenol is listed below.

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**Table 4-1. Facilities that Manufacture or Process Chlorophenols**

State	Location <sup>a</sup>	Range of Maximum Amounts on Site in Pounds <sup>b</sup>	Activities and Uses <sup>c</sup>
KS	1	10,000 - 99,999	1, 4, 5
MI	1	0 - 99	1, 6, 7
NY	1	100 - 999	7, 11
TX	1	100,000 - 999,999	1, 5, 7

Lindross Source: TRIS96 1998

<sup>a</sup>Lindross Post office state abbreviations used

<sup>b</sup>Lindross Range represents maximum amounts on site reported by facilities in each state

<sup>c</sup>Lindross Activities/Uses:

- |                          |                             |
|--------------------------|-----------------------------|
| 1. Produce               | 8. Formulation Component    |
| 2. Import                | 9. Article Component        |
| 3. Onsite use/processing | 10. Repackaging             |
| 4. Sale/Distribution     | 11. Chemical Processing Aid |
| 5. Byproduct             | 12. Manufacturing Aid       |
| 6. Impurity              | 13. Ancillary/Other Uses    |
| 7. Reactant              |                             |

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

2-CP	1983	33,300 kg
4-CP	1975	33,900 kg
2,4-DCP	1977	500 kg
2,4,5-TCP	1981	216,000 kg
2,4,6-TCP	1980	250 kg

## 4.3 USE

All the chlorophenols have been used as biocides. The monochlorophenols have been used as antiseptics (HSDB 1998), although in this role they have largely been replaced by other chemicals (WHO 1989). Specifically, 4-CP has been used as a disinfectant for home, hospital, and farm uses (WHO 1989) and as an antiseptic in root canal treatment (Gurney and Lantenschlager 1982). 2,4-DCP has been used for mothproofing and as a miticide (WHO 1989), while the higher chlorophenols have been used as germicides, algicides, and fungicides.

The principal use of the monochlorophenols has been as intermediates for the production of higher chlorinated phenols (WHO 1989). The largest uses for 2,4-DCP and 2,4,5-TCP have also been used as an intermediate, especially in the production of the herbicides 2,4-dichlorophenoxyacetic acid (2,4-D) and 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) (WHO 1989). In the United States, 2,4-D is still in use, while 2,4,5-T was taken off the market in 1985. 2,4,6-TCP has been used as an intermediate in the production of higher chlorinated phenols especially 2,3,4,6-TeCP and pentachlorophenol (WHO 1989).

2,4,6-TCP and the tetrachlorophenols have also been used directly as wood preservatives (HSDB 1998). In this role, the tetrachlorophenols are generally used as a mixture and are applied to lumber in an aqueous solution (WHO 1989). Commercial pentachlorophenol, which is more frequently used as a wood preservative, also contains about 4% tetrachlorophenols and 0.1% trichlorophenols (Kalliokoski and Kauppinen 1990). North America and Scandinavia are the main regions of the world where chlorophenols have been used as wood preservatives. The use of these compounds has been banned in Sweden since 1978, and production was banned in Finland in 1984 (Kalliokoski and Kauppinen 1990).

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**4.4 DISPOSAL**

Chlorophenols are listed as toxic substances under Section 313 of the Emergency Planning and Community Right to Know Act (EPCRA) under Title III of the Super-fund Amendments and Reauthorization Act (SARA) (EPA 1995). Disposal of wastes containing chlorophenols is controlled by a number of federal regulations (see Chapter 7).

The recommended method of disposing of large amounts of higher chlorinated phenols is incineration, preferably after mixing with another combustible fuel (HSDB 1998). Necessary precautions include the assurance of complete combustion in order to prevent the formation of toxic phosgene gas and the use of an acid scrubber to remove any halo-acids produced upon combustion (Sittig 1985).