

4. PRODUCTION, IMPORT, USE AND DISPOSAL

4.1 PRODUCTION

Ethylene oxide is a major industrial chemical and is one of the 25 highest production volume chemicals in the United States. There was a gradual increase in the production volume of ethylene oxide in recent years from 1,906,800 kkg (metric tons) in 1973 to a peak of 2,610,500 kkg in 1979, and then a gradual decrease to 2,172,530 kkg in 1987.

Ethylene oxide is produced by 12 chemical companies in the United States in four states; one plant is in Illinois, one in Delaware, four in Louisiana, and six in Texas. The manufacturers of ethylene oxide are also the major users and distributors of the compound.

In the United States, all ethylene oxide is produced by the direct oxidation of ethylene by air or oxygen in the presence of a silver oxide catalyst. Another commercial production method, reaction of ethylene chlorohydrin with potassium hydroxide or calcium oxide, was phased out by 1980 (EPA 1985a; SRC 1982; SRI 1984, 1988; USITC 1988; WHO 1985).

4.2 IMPORT

Imports of ethylene oxide are relatively small, with amounts increasing from 1982 to 1984 from 4,300 kkg to 5,600 kkg. Exports of ethylene oxide increased substantially over the same period, from 1,500 kkg in 1982 to 11,200 kkg in 1984 (SRI 1984).

4.3 USE

Over 99% of the ethylene oxide produced in the United States is used as a chemical intermediate for the production of various chemicals, while less than 1% is used as a sterilant or fumigant. Ethylene oxide is used captively by manufacturers to produce ethylene glycol (64% of ethylene oxide consumption), non-ionic surfactants (11%), glycol ethers (7%), higher glycols (10%), ethanolamines (7%), and miscellaneous chemicals (1%), including choline, polyether polyols, and hydroxyethyl starch. These chemicals are found in antifreeze, textiles, detergents, solvents, polyurethane foam, medicinals, adhesives, and other products.

Relatively small amounts of ethylene oxide are used as a fumigant, a sterilant for food (spices) and cosmetics, and in hospital sterilization of surgical equipment and plastic devices that cannot be sterilized by steam. At one time, ethylene oxide was used in the production of acrylonitrile, but that process was discontinued in 1966 (EPA 1984a, 1985a; NIOSH 1981; SRC 1982; SRI 1984; WHO 1985).

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4.4 DISPOSAL

Because ethylene oxide is listed as a hazardous substance, disposal of wastes containing this compound is controlled by a number of federal regulations (see Chapter 7). Restrictions are proposed for land disposal of ethylene oxide.

The production processes for ethylene oxide do not generate solid wastes and the waste waters are treated or recycled. The production process is a closed system; however, vent gases and fugitive emissions may contain some ethylene oxide. Waste gases may be removed from the air by scrubbers. Wastes containing ethylene oxide may be incinerated by rotary kiln or fluidized bed incineration methods (EPA 1989; HSDB 1988; SRC 1982; WHO 1985).