

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

4.1 PRODUCTION

Disulfoton is produced commercially by a reaction of the sodium salt of O,O'-diethylhydrogen phosphorodithioate with 2-chloroethylthioethyl ether (VonRumker et al. 1974). Disulfoton is produced in the United States by a subsidiary of Bayer AG, Germany. Chemagro of Kansas City, Missouri, a subsidiary of Bayer AG, produced an estimated 5 million pounds of disulfoton in 1972 (VonRumker et al. 1974). Disulfoton production has declined in recent years as a result of restricted use due to its toxicity (EPA 1984b). In 1986, Mobay Corp., Kansas City, Missouri, produced over 2.1 million pounds of disulfoton in the United States (Goodrich et al. 1991). Since the annual use of disulfoton in the United States from 1989 to 1991 was 3.06 million pounds (Gianessi and Puffer 1992), the production volume during this period must have exceeded 3.1 million pounds. In 1994, Miles Inc., Agriculture Division, Kansas City, Missouri, a subsidiary of Bayer AG of Germany, produced disulfoton; however, information on current production volume is not available (SRI 1994).

4.2 IMPORT/EXPORT

In 1972, disulfoton was not imported into the United States, and the exports of disulfoton from the United States to other countries were negligible (VonRumker et al. 1974). Import/export data for disulfoton in recent years were not located; however, since the recent yearly consumption of disulfoton in the United States is substantially lower than the estimated yearly production capacity of 7 million pounds at the Kansas City plant (VonRumker et al. 1974), it is unlikely that disulfoton is being imported.

4.3 USE

Disulfoton is a systemic organophosphate insecticide/acaricide (i.e., it is absorbed and translocated by treated plants) effective for controlling a variety of harmful insects that attack many field and vegetable crops. As emulsifiable concentrates and in granular or pelleted/tableted forms, disulfoton is used to treat seeds and is applied to soils or plants. Disulfoton is also available in a ready-to-use liquid formulations (EPA 1984b). Disulfoton is used to protect small grains, sugar cane, sorghum, corn, cotton, Cole, root, seed, forage, and other field crops; some vegetable, fruit (strawberry,

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pineapple), and nut crops; and forest plantings, ornamental and potted plants (EPA 1984b; VonRumker et al. 1974). Agricultural uses account for most of its consumption; small quantities are used on home and garden plants and for other purposes, such as mosquito abatement (VonRumker et al. 1974; Warnick and Eldredge 1972). Use of disulfoton has declined since the early 1970s. In 1972, 4.9 million pounds of disulfoton were used for agricultural purposes, and only 0.1 million pounds were used in homes and gardens (VonRumker et al. 1974). Based on state usage data from 33 states for 1982, California use data for 1981, and the EPA Office of Pesticide Programs national survey of pesticide usage by urban applicators and nurseries, Gianessi (1986) estimated that 2.1 million pounds of disulfoton were used annually in agriculture during 1981 and 1982. The estimated annual agricultural use of disulfoton was 2.1 million pounds in 1986 (Goodrich et al. 1991) and 3.1 million pounds in 1989-1991 (Gianessi and Puffer 1992). The use of disulfoton in the production of corn, wheat, potatoes, and cotton accounted for the largest annual use during 1989-1991 (Gianessi and Puffer 1992).

4.4 DISPOSAL

The two preferable methods for disposing of wastes containing disulfoton are incineration and alkaline hydrolysis (HSDB 1994). For disposal of low-viscosity wastes (permitting atomization in the combustion chamber) containing disulfoton, liquid injection incineration at 650-1,600 °C and a residence time of 0.1-2 seconds are recommended. For the disposal of viscous and solid wastes, rotary kiln incineration at 820-1,600 °C and a residence time of seconds to hours, or fluidized bed incineration at 450-980 °C with a residence time of seconds or longer are recommended. The effluent gases from the incineration units should pass through scrubbers or other air pollution control devices (HSDB 1994). Alkaline hydrolysis leads to the complete degradation of disulfoton to non-toxic end products (alkaline salts of O,O-dimethylphosphorothioic acid and ethylthioethyl mercaptan). Disulfoton is resistant to hydrolysis in acid media (Sittig 1980). Acid hydrolysis produces essentially the same end products; however, the reaction rate is much slower (IRPTC 1985). Fifty percent hydrolysis at 70 °C requires 60 hours at pH 5, but only 7.2 hours at pH 9 (Sittig 1980). In the alkaline hydrolysis method, the waste should be subjected to hydrolysis with 6% potassium hydroxide in isopropanol under reflux for 30 minutes (IRPTC 1985) or 5% sodium hydroxide in ethanol for 3 hours (for 2%, 10%, and 50% granular formulations) (Dillon 1981). The hydrolyzed product should be adsorbed on vermiculite, then incinerated or disposed of in a landfill (IRPTC 1985).

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The EPA has proposed incineration as the best demonstrated available technology (BDAT) for treating organophosphorus nonwaste waters (waste containing >1% by weight total suspended solids and >1% by weight total organic carbon). EPA has demonstrated that rotatory kiln incineration at 1,000°C was satisfactory for attaining the proposed treatment standard of a maximum 0.1 mg/kg disulfoton in treated nonwaste waters (Berlow and Cunningham 1989).

