

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

### 4.1 PRODUCTION

Ethion is the FMC Corporation trademark name for the active ingredient O,O,O',O'-tetraethyl S,S'-methylene bis (phosphorodithioate) (SRI 1997; Tomlin 1994). This insecticide is produced commercially by reacting dibromomethane with O,O-diethyl hydrogen phosphorodithioate in ethanol under controlled pH conditions (HSDB 1998). The FMC Corporation, the only U.S. manufacturer of this chemical, produces ethion at its Agricultural Chemical Group in Baltimore, Maryland (SRI 1991, 1992, 1993, 1995, 1996, 1997).

Ethion production in the United States for 1972 was estimated to be 1.36 million kg (2.97 million pounds) (HSDB 1998). No more recent production estimates for ethion were located. As with many toxic chemicals, especially those whose production or use involves proprietary information, quantitative estimates of production are virtually impossible to obtain (Bason and Colborn 1992).

No current information is available from the Toxics Release Inventory (TRI) database on facilities that manufacture or process ethion, the intended use, or the range of maximum amounts of ethion that are stored on-site because ethion is not one of the chemicals that facilities were required to report (EPA 1995e).

### 4.2 IMPORT/EXPORT

No historic or recent estimates are available on the volume of ethion imported into the United States (HSDB 1998). No information was located on either past or current volumes of ethion exported from the United States. Data on past and/or current import and export volumes are not adequate to assess trends in import and export volumes of this pesticide. While the import and export volume for pesticides as a group are often available, the data are not typically broken down by individual pesticide (Bason and Colborn 1992).

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**4.3 USE**

Ethion is an organothiophosphate member of the organophosphate pesticide family that was first registered for use in the United States in 1965 (EPA 1989b, 1989d). This pesticide was first developed as a nonsystemic insecticide and acaricide for use on fruit trees, including citrus fruits (grapefruit, lemons, limes, oranges, tangelos, and tangerines), other fruit trees (apples, apricots, cherries, nectarines, peaches, pears, plums, and prunes), nut trees (almonds, chestnut, filberts, pecans, and particularly walnuts), fiber crops (cotton), and seed and forage crops (alfalfa, corn, and sorghum). as well as a wide variety of fruits and vegetables (beans, cucumbers, eggplants, grapes, melons, onions, peanuts, peppers, pimentos, summer squash, strawberries, and tomatoes) (EPA 1989b, 1989d). Ethion is used in conjunction with petroleum oils on dormant trees to kill eggs and scale insects (HSDB 1998). It is also used for control of aphids, spider mites, scale insects, thrips, lepidopterous larvae, leafhoppers, maggots, suckers, and soil-dwelling insects on a wide variety of food, fiber, and ornamental crops, including grapes, fruits, vegetables, and nuts (Farm Chemicals Handbook 1993; Tomlin 1997). Other uses include applications as a topically applied pesticide agent on livestock to control biting flies and other insects or skin parasites, such as ticks (EPA 1989b, 1989d).

With the steady elimination of older organochlorine pesticides from the market, the use of ethion and other organophosphates has replaced many of the functions once filled by organochlorine pesticides (Mosha et al. 1990a, 1990b, 1991). In addition to its registered applications in agriculture, ethion is also used in terrestrial nonfood crops (Bermuda grass, junipers, ornamental evergreens, pine trees, lawns, ornamental turf, and ornamental plants), in greenhouse nonfood crops including ornamental plants, and in domestic outdoor uses associated with domestic dwellings and lawns (EPA 1989b, 1989d; Farm Chemicals Handbook 1993). The methods of application for ethion include: ground and aerial foliar applications, furrow treatments by ground equipment, and seed treatments (EPA 1989b, 1989d). Several different types of ethion formulations are produced including: an emulsifiable solution (500 g/L), wettable powders (25%), dusts (2, 3, and 4%), emulsifiable concentrates (4 and 8 lbs/gal), granules (5 and 10%), and seed treatments (EPA 1989b; 1989d; Farm Chemicals Handbook 1993; Tomlin 1997).

Estimated ethion use in the United States was 0.32 million kg (0.70 million pounds) in 1974 (HSDB 1998). Estimated ethion use in the United States increased slightly to 1.255 million pounds (0.570 million kg) of the active ingredient in the early 1980s (Gianessi 1986). This volume appears to have remained steady through the late 1980s as EPA (1989d) estimated that between 1.2 and 1.5 million

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pounds (0.55–0.68 million kg) of active ingredient of ethion were used in the United States annually. By 1992, the estimated annual use of ethion by agriculture was 868,218 pounds (USGS 1992). No more recent information on ethion use was located in the literature.

With respect to its use application in 1974, 70% of the ethion applied was used as an insecticide and acaricide on citrus fruit and 30% was used on other fruit and nut crops and cotton (HSDB 1998). In a study of use application, EPA (1989d) estimated that from 86 to 89% of the ethion used in the United States was applied to citrus crops, and the remaining 11–14% was applied to cotton, a variety of fruit and nut trees, and vegetables. No more recent information on use applications for this pesticide was located.

#### 4.4 DISPOSAL

Ethion is listed as a toxic substance under Section 313 of the Emergency Planning and Community Right to Know Act (EPCRA) under Title III of the Superfund Amendments and Reauthorization Act (SARA) (EPA 1995a, 1995b). Disposal of wastes containing ethion is controlled by a number of federal regulations (see Chapter 7).

There are two primary recommendable methods for the disposal of ethion and ethion-containing wastes including hydrolysis with subsequent disposal in a landfill and incineration by a variety of methods in a unit with effluent scrubbing (EPA 1981; IRPTC 1985). Ethion undergoes rapid chemical hydrolysis under alkaline (>pH 8) conditions (Dierberg and Pfeuffer 1983; IRPTC 1985). IRPTC (1985) recommends that ethion or ethion-containing wastes be mixed with excess calcium oxide or sodium hydroxide and sand or other adsorbent in a pit or trench at least 0.5 m deep in a clay soil. Sodium hydroxide (or sodium carbonate) can also be added to the mixture to help speed the reactions when calcium oxide is used as the primary alkali agent. The amount of calcium oxide or sodium hydroxide used depends on the amount of pesticide to be disposed of and, to some extent, the concentration of active ingredient in the pesticide, and the actual chemical nature of the active ingredient. A practical guideline, in the absence of specific directions, is to use an approximate volume or weight of alkali from 50 to 100% that of the pesticide. For dilute formulations, such as a 1% solution or dust formulations of ethion, the amount of calcium oxide or sodium hydroxide can be reduced by one-half. For very concentrated ethion formulations (over 80% active ingredient), the amount of calcium oxide or sodium hydroxide can be doubled, but the concentrate should be mixed first with water (or soapy water) before reaction with the alkali. For safety, a preliminary test should be conducted in which very small amounts

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of ethion and alkali are mixed to ensure that the mixture does not react too vigorously. For added safety, sizable quantities of ethion can be disposed of in several smaller batches, rather than all at once (IRPTC 1985).

For ultimate disposal, large amounts of ethion residuals can be incinerated in a unit with effluent gas scrubbing (IRPTC 1985) or by fluidized bed, rotary kiln, or liquid injection incineration (EPA 1981). Ethion is a potential candidate for fluidized bed incineration at a temperature range of 450–980 EC and residence times of seconds for liquids and gases and longer for solids. Ethion is also a potential candidate for rotary kiln incineration at a temperature range of 820–1,600 EC and residence times of seconds for liquids and gases and hours for solids. Ethion is also a potential candidate for liquid injection incineration at a temperature range of 650 to 1,600 EC and a residence time of 0.1–2 seconds (EPA 1981).

Currently, empty pesticide containers should be triple-rinsed with water and then transferred to a proper hazardous waste disposal facility. On February 11, 1994, the EPA proposed container design requirements for nonrefillable and refillable pesticide containers. This Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) authorized action also includes standards on pesticide removal from containers before disposal, standards for containment of bulk pesticide containers, and procedures for container refilling operations (EPA 1994). No information was located on past or current volumes of ethion or ethion-contaminated wastes disposed of by any of the disposal method described. Facilities involved in the production or processing of ethion are not required to report the amount of ethion wastes disposed of by any disposal method (EPA 1995e).