

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

5.1 PRODUCTION

Parathion is an organophosphorus insecticide produced commercially by the reaction of diethyl phosphorothionchloridate with sodium *p*-nitrophenate (HSDB 2013). Parathion is a liquid or wettable powder that was often dissolved in a hydrocarbon solvent before use (ATSDR 2011). In 1991, all of the technical parathion sold in the United States was produced by Cheminova Agro A/S, formulated at one location and sold under the Cheminova label. Two formulations were sold: parathion and ethyl methyl parathion emulsifiable concentrates (EPA 2000). Prior to 1991, parathion was also sold in the form of emulsion concentrates, wettable powders, granules, dusts, aerosols, and oil sprays (Farm Chemicals Handbook 1987).

Recent production estimates for parathion are not available, as this substance is no longer produced in the United States. As of 1991, parathion was registered as a restricted use insecticide and had been limited to use on nine crops. Due to the toxicity of this chemical, the production of manufacturing use products was cancelled effective as of September 2000. The production of most end use products was terminated as of December 31, 2002, with the last legal use of most of this chemical and its products effective on October 31, 2003 (EPA 2000). Even though the Drexel Chemical Company was no longer manufacturing or using parathion, it still had four products actively registered under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). On March 16, 2005, Drexel requested the cancellation of these four remaining products and this became effective on December 13, 2006 (EPA 2006b).

Beginning on January 1, 1995, parathion was listed as one of the newly added chemicals that manufacturing and processing facilities would be required to report under Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA) (EPA 2006). Table 5-1 lists the production year, number of facilities, the state where each facility is located, and the range (in pounds) for the company that reported the presence of bulk parathion in 2014 (TRI14 2015). Although manufacturers are required to report Toxics Release Inventory (TRI) data to satisfy EPA requirements, parathion has not been manufactured in the United States since 2002. The TRI data should be used with caution since only certain types of facilities are required to report (EPA 2005); however, this is expected to be an exhaustive list regarding parathion.

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

Table 5-1. Facilities that Processed Parathion in 2014

State ^a	Number of facilities	Minimum amount on site in pounds ^b	Maximum amount on site in pounds ^b	Activities and uses ^c
TX	2	1,000	99,999	8, 12

^aPost office state abbreviations used.

^bAmounts on site reported by facilities in each state.

^cActivities/Uses:

- | | | |
|--------------------------|--------------------------|-----------------------------|
| 1. Produce | 6. Impurity | 11. Chemical Processing Aid |
| 2. Import | 7. Reactant | 12. Manufacturing Aid |
| 3. Onsite use/processing | 8. Formulation Component | 13. Ancillary/Other Uses |
| 4. Sale/Distribution | 9. Article Component | 14. Process Impurity |
| 5. Byproduct | 10. Repackaging | |

Source: TRI14 2015 (Data are from 2014)

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

5.2 IMPORT/EXPORT

The import of technical parathion in the United States was prohibited as of September 2000 (EPA 2000). Internationally, parathion is subject to the Rotterdam Convention on Prior Informed Consent (PIC) procedure, which states that the export of this chemical can only take place with the prior informed consent of the importing party. This applies to all formulations of parathion, including aerosols, dustable powder, emulsifiable concentrate, granules, and wettable powders, with the only exception being capsule suspensions (WHO 2005).

5.3 USE

Parathion was first registered as a pesticide in 1948 (EPA 2000). It was used as a non-systemic insecticide to control sucking and chewing insects and mites in a wide variety of crops (Tomlin 2010). It was often repeatedly applied by fan or boom sprayers or by aircraft on a wide variety of orchard, row, and field crops (CDFA 1988). In 1991, due to emerging health and ecological concern posed by parathion, use sites were limited, and application and post-application practices were restricted in order to mitigate risk to workers exposed during and after application. Since 1991, parathion was a restricted use organophosphate insecticide and miticide limited to nine crops: alfalfa, barley, canola (rapeseed), corn, cotton, sorghum, soybeans, sunflowers, and wheat. In September 2000, some manufacturers began voluntarily cancelling parathion products registered under Section 3 of FIFRA. This started the termination of registration of most end use products effective December 31, 2002, with the last legal use of most of those products ending on October 31, 2003 (EPA 2000). The Drexel Chemical Company was authorized to manufacture parathion through 2003 and had four products actively registered under FIFRA through 2006. On March 16, 2005, Drexel requested the cancellation of these four remaining products and this became effective on December 13, 2006 (EPA 2006b).

U.S. Consumption of parathion in 1978 was reported to be 7.2 million pounds. This number increased to 8.6 million pounds in 1982 (HSDB 2013). No recent use estimates are available for parathion, as this substance can no longer be legally used in the United States without an EPA exemption. The State of California reported some parathion use since at least 2002, with annual quantities totaling 196, 25, <1, and 22 pounds for respective years 2011 through 2014, with the last use being for landscape maintenance and greenhouse and outdoor plants in containers. However, included in these reports was the disclaimer that statements of parathion use could be due to continued inaccurate annual reporting (CalEPA 2015).

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

5.4 DISPOSAL

Parathion is currently considered a toxic chemical under Section 313 of the Emergency Planning and Community Right-To-Know Act (EPA 2006). Since parathion is toxic and containers with parathion residue can explode upon heating, any containers or products containing parathion must be disposed of in accordance with State and Federal law (EPA 2000).

Parathion is a potential candidate for rotary kiln incineration, using a temperature range of 820–1,600°C and a residence time of seconds. It is also a potential candidate for fluidized bed incineration, with a 450–980°C temperature range, and liquid injection incineration with a temperature range of 650–1,600°C. Reverse osmosis has been investigated as a waste water treatment technology for the removal of parathion (HSDB 2013).

An aqueous solution of parathion was found to completely decompose during a 5-hour exposure to granular zero valence iron (Fjordboge et al. 2013), indicating that this method might be suitable for *in situ* environmental remediation.

Dilute waste parathion solutions may be disposed of by chemical or biological treatment, incineration, or in soil pits. Because of the large volume of water involved, incineration is not a preferred method. Adsorption of parathion onto media such as activated charcoal, as well as chemical and biological treatment methods, are feasible, but they require frequent monitoring and maintenance. Soil pits have the advantage of less maintenance, less cost, and the ability to reduce the volume of waste by water evaporation (Sanders and Seiber 1984).

No information was found on the past and present volumes of parathion or parathion-contaminated wastes disposed of by each disposal method.