

4. PRODUCTION, IMPORT, USE, AND DISPOSAL

4.1 PRODUCTION

HMX is produced by the nitration of hexamine with ammonium nitrate and nitric acid in an acetic acid/acetic anhydride solvent at 44°C. The raw materials are mixed in a two-step process and the product is purified by recrystallization. This is a modification of the Bachmann Process used to produce RDX, another explosive. The yield of HMX is about 55-60%, with RDX as an impurity. RDX produced by the Bachmann Process usually contains about 8-12% HMX as an acceptable byproduct (Army 1984a, 1989; EPA 1986, 1988).

HMX is currently produced at only one facility in the United States, the Holston Army Ammunition Plant in Kingsport, Tennessee. Estimated production volume of HMX was about 30 million pounds annually between 1969 and 1971. No estimates of current production volume were located, but it is estimated that its use is increasing (Army 1984a, 1989; EPA 1986).

Processing may occur at load, assemble, and pack (LAP) facilities operated by the military (Army 1984a; EPA 1988). There were 10 facilities engaged in LAP operations in the United States in 1976 (Army 1984a).

4.2 IMPORT/EXPORT

No information was located regarding import or export of HMX in the United States. Export of this chemical is regulated by the U.S. State Department (see Table 7-1) (Department of State 1992).

4.3 USE

HMX is used to implode fissionable material in nuclear devices to achieve critical mass and as a component of plastic-bonded explosives, solid fuel rocket propellants, and as burster chargers in military munitions (EPA 1988). The use of HMX as a propellant and in maximum-performance explosives is increasing (Army 1989). Data on quantities of HMX currently consumed for these uses were not located.

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4.4 DISPOSAL

Wastes from explosive manufacturing processes are classified as hazardous wastes by EPA. Generators of these wastes must conform to EPA regulations for treatment, storage, and disposal (see Chapter 7). The waste water treatment sludges from processing of explosives are listed as hazardous wastes by EPA based only on reactivity (EPA 1986). Waste water treatment may involve filtering through activated charcoal, photolytic degradation, and biodegradation (EPA 1988). Rotary kiln or fluidized bed incineration methods are acceptable disposal methods for HMX-containing wastes.

At the Holston facility, waste waters are generated from the manufacturing areas and piped to an industrial water treatment plant on site. Following neutralization and nutrient addition, sludge is aerobically digested and dewatered. It was estimated that the facility generates a maximum of 3,800 tons (7.6 million pounds) of treated, dewatered sludge annually. Based on demonstration by Holston that this sludge is nonhazardous, the EPA proposed granting a petition to exclude the sludge from hazardous waste control (EPA 1986). HMX is not listed on the Toxics Release Inventory (TRI) database, because it is not a chemical for which companies are required to report discharges to environmental media.