

APPENDIX A
INTERNATIONAL WASTE FORM PROGRAMS

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Many countries, including the United States, have been performing research and development on high-level waste immobilization for decades. France decided 20 years ago to vitrify all high-level waste generated in their nuclear power program, and to export equipment, plants, and technology. Many countries including Belgium, Germany, Japan, the Netherlands, Sweden, and Switzerland have contracted or reached agreements for France to reprocess their spent fuel and return the purified products plus a vitrified waste to them. The fact that France has a licensed and successfully operating vitrification process (AVM) weighs heavily on the selection of initial immobilization facilities in the European countries. As discussed below, many countries including Belgium, Germany, and the United Kingdom have purchased the French technology, but are also investigating other glass processes for possible later use.

Belgium. No decision has been reached as to whether the Belgian government will take over the decontaminated and decommissioned Eurochemic reprocessing plant. However, accumulated high-level waste will be vitrified in one of two facilities (high-level waste from processing highly enriched Materials Test Reactor fuels was separated from that produced from low-enriched oxide fuel and may be processed separately).

One process will be the French AVM technology (vitrification facilities at Marcoule); the other will utilize a joule-heated ceramic-lined melter designed by DWK (German fuel reprocessing company) to produce either glass beads in metal matrix (called PAMELA) or glass monoliths. Both projects are under construction and should start processing radioactive wastes in 1987 and in 1985, respectively.

France. Vitrification of high-level waste is well developed in France and still is being improved upon. PIVER, a hot pilot plant, operated from 1969 to 1973 at Marcoule, producing 12 MT of glass with batch pot calcination/melter technology. ATLAS, a half-scale prototype AVM, started up in 1978 and processed 4 m³ of high-level waste to verify off-gas treatment requirements. A full-scale AVM rotary calciner and inductively heated melter also started up in 1978 and has processed 230 m³ of high-level waste, yielding 108 MT of glass in 360-kg canisters (0.5 m in diameter by 1.0 m high). At the La Hague reprocessing center, three scaled-up AVM vitrification units (AVH) are being constructed and are scheduled to start up in mid-1986.

The French are currently storing the canistered waste in air-cooled vaults. Current thinking is to store the vitrified waste in surface vaults for about 50 years and then dispose of the waste in geologic repositories.

Germany. Originally, the Germans had planned a large spent fuel storage, reprocessing center, and waste disposal site at Gorleben, above salt domes proposed for geological disposal of vitrified waste. Political considerations have caused that plan to be abandoned, and now multiple strategies are being evaluated from direct disposal of spent fuel to construction of multiple, small reprocessing plants. Germany has accumulated some 65 m³ of high-level waste at the WAK pilot plant at Karlsruhe and is currently adapting the French AVM technology to German licensing requirements for vitrifying this waste. The Karlsruhe waste facility, called HOVA, should go into hot operation by 1986.

The Germans have been actively developing a liquid-fed, joule-heated melter over the past seven years. They will test this technology at Mol, Belgium (DWK is building the melter for Eurochemic waste vitrification), and may substitute it for the AVM technology when German reprocessing plants are finally authorized.

United Kingdom. Although the British have spent many years developing rising-pot vitrification processes (FINGAL, then HARVEST), the decision has been made to go with AVM technology at Windscale. A modest development program has been started on joule-heated melters for possible use in later years.

The British, like the French, have opted for several decades of interim surface storage of the vitrified waste before transferring it to geologic disposal.

Japan. The Japanese are committed to nuclear power and, therefore, to closing the fuel cycle within Japan. Initially, however, Japanese spent fuels will be reprocessed by BNFL (U.K.) and COGEMA (France). Japan has already achieved an active reprocessing pilot plant and plans to have a commercial plant operating by 1990. Significant progress has also been made in development of high-level waste vitrification. A vitrification pilot plant is planned for 1987 to take the high-level waste from the Tokai Mura fuel reprocessing plant. To date, an engineering test facility has demonstrated operation of two types of full-scale, joule-heated melters, and a mock-up test facility and (hot) chemical processing facility are expected to start operation in mid-1982.

The Japanese, like the French and British, favor interim surface storage of the vitrified waste before ultimate geologic or seabed disposal.