

D1. VITRIFICATION OF LOW-LEVEL RADIOACTIVE WASTE

Vitrification involves converting materials into glass or glass-like substances, usually by a thermal process performed using glass melter equipment. For many years, vitrification has been used to process highly radioactive wastes; however, until recently, the technology had not been applied to low-level radioactive waste. EPRI investigated the applicability of vitrification technology for processing LLW as part of its goal of helping utilities reduce the costs of maintaining low-level waste.

The project has adopted a three-phase program to demonstrate the application of vitrification technology to LLW. First, investigate the technical issues via laboratory tests, including characterization of dry active wastes, ion-exchange resins and liquid wastes. The team then studied glass formulations for dry active waste, ion-exchange resins, and steam generator cleaning solutions. Finally, they designed a glass melter for the vitrification process and reviewed applicable regulatory issues. Some key points in each area:

- (1) The waste characterization effort investigated physical characteristics, chemical composition variability, behavior during thermal treatment, ash content, and off-gas characterization for dry active waste and ion-exchange resin, including decontamination resin. the decontamination resins were considered a worst case due to the high activity loading.
- (2) Several glass formulation have been developed for dry active waste, ion-exchange resins, and cleaning solvent.
- (3) Extensive studies, evaluation, and testing performed to date clearly show that destruction of the waste form is accomplished by placing the waste on a molten glass surface; the resultant ash is then dissolved in the glass. A joule-heated bottom-drain melter design has been chosen, which includes a water-cooled shell to protect the melter's ceramic liner.
- (4) It has been determined that on-site (power plant) demand work can be performed under a 10 CFR 50.59 review. An air permit is also required to vitrify LLW at a nuclear power plant with a temporary modular installation.

The potential benefits of vitrification for the treatment of LLW are the potential for large volume reductions in connection with most waste streams, flexibility in processing a wide diversity of waste streams, and inherent stability of the secondary waste when considering final disposal or long-term storage.

For more, "Vitrification of Low-level Radioactive Waste," EPRI TR-105912, Final Report, January 1996.