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OPERABLE UNIT 4 VITRIFICATION PILOT PLANT PROGRAM JUNE 1994

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OPERABLE UNIT 4
VITRIFICATION PILOT PLANT PROGRAM

Operable Unit 4
Vitrification Pilot Plant Schedule

Phase I
Pilot Vitrification Facility Construction Implementation: June 1994

Pilot Vitrification Facility Design Completion: November 1994

Pilot Vitrification Facility Construction Completion: February 1995

Pilot Vitrification Facility Operation Implementation (surrogate material): March 1995

Phase II
Pilot Vitrification Facility Operation Implementation (bentonite, K-65 and Silo 3 materials): August 1995

Considered an innovative technology, vitrification is the U.S. Department of Energy's and the U.S. Environmental Protection Agency's preferred alternative for stabilizing the moist, radium-bearing residues of Fernald's Operable Unit 4 Silos 1 and 2, as well as the dried, cold metal oxides of Silo 3.

The vitrification technology consists of heating the residues to sufficient temperatures to induce the formation of glass-like mass. The mobility (leachability) of the constituents of concern in the K-65 and Silo 3 residues would be greatly reduced, and the stabilized waste form would have a greatly reduced radon emanation rate. Another major advantage of vitrification would be reduction of waste volume, which would reduce disposal costs. Vitrification has already proven effective for converting low-level waste into a stable, durable form. To better define final remediation costs and design, Operable Unit 4 is preparing for pilot-scale treatability testing for vitrification.

Phase I of the pilot-scale treatability study will encompass design, construction and operation of a 1-metric-ton (1.1-ton) capacity pilot-scale facility. Vitrification and waste retrieval technologies will be demonstrated using bentonite and surrogate materials, the pilot-scale vitrification facility and Silo 4, which is empty and will serve as a test bed. Waste retrieval will include hydraulic mining and material handling demonstrations, enlargement of the center manway of Silo 4 and equipment support and deployment in Silo 4. Phase I will include a demonstration of the hydraulic mining process with up to 900 metric tons (1,000 tons) of non-radioactive, surrogate material, which will consist of silty sands (or washed soil), bentogrout and water to be placed in Silo 4.

Before a portion of the non-radioactive surrogate material is fed to the vitrification furnace, a stream containing trace amounts of metals and sulfates will be added to more closely simulate the K-65 material. About 20-30 metric tons (22-33 tons) of surrogate material will be needed for adequate demonstration. The pilot-scale vitrification facility is expected to operate three months.

During **Phase II**, equipment and processes for vitrifying K-65 and Silo 3 material will be demonstrated. The Silo 3 material will be mixed with K-65 material and vitrified to test glass formulations. About 20 metric tons (22 tons) of K-65 material and 10 metric tons (11 tons) of Silo 3 material will be required. The final glass product will be sampled at several process points to ensure it meets required specifications.

For more information, please call DOE Operable Unit 4 Branch Chief Randi Allen, 513-648-3102.

Operable Unit 4
Bench-scale Treatability Study Findings

During the Operable Unit 4 bench-scale treatability study, glass formulations were developed for four different mixtures of bentogrout, K-65 and Silo 3 material.

Findings of the Operable Unit 4 bench-scale study included:

- A reduction in the radon emanation of about 500,000 times.
- Initial waste volume was reduced by 50-68 percent.
- Durability of the treatability study glasses was comparable to durability of glasses developed for high-level radioactive waste.
- The vitrified residue was nonhazardous. Previous tests found untreated K-65 and Silo 3 materials hazardous.
- Lead concentrations in leachate from the glass were reduced several hundred times relative to untreated K-65 material; arsenic was reduced about 100 times in Silo 3 material. Cadmium, chromium and selenium were reduced to less than or near less than detection limits.
- Leaching of radionuclides from the treatability study glass was well within the acceptable range.

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