

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

July 27, 1995

MEMORANDUM FOR: G.W. Cunningham, Technical Director**COPIES:** Board Members**FROM:** Larry Zull**SUBJECT:** Trip Report - Review of Low-Level Waste and OU-4 Vitrification Pilot Plant at Fernald

1. **Purpose:** This trip report documents a May 17-18, 1995 visit to the Fernald Environmental Management Project (FEMP) site to review the Low-Level Waste (LLW) management program, the Operable Unit 4 (OU-4) Vitrification Pilot Plant, and other on-going activities. Defense Nuclear Facilities Safety Board (Board) staff members Mark Sautman, Randall Robinson, and Larry Zull participated in the reviews.
2. **Summary:**
 - a. The FEMP has an integrated waste management program which has been successful in characterizing, repackaging, and shipping low-level waste off-site. However, many waste drums continue to be stored outside where exposure to moisture can corrode the drums.
 - b. High levels of radon are expected to occur during the transfer of material from Silos 1, 2, and 3 to the OU-4 Vitrification Pilot Plant. A secondary confinement will be placed around Silo 3 to prevent airborne releases during material retrieval testing, and the Radon Treatment System for Silos 1 and 2 will be upgraded. Also, gamma radiation exposures will result from the handling, interim on-site storage, and transport of the vitrified gem containers, but no As Low As Reasonably Achievable (ALARA) review of these activities has been performed.
 - c. Potentially pyrophoric uranium metal chips, turnings, and fines are stored in forty-eight vented drums on a covered pad outside of Plant 5. There is currently no scheduled date for performing pyrophoricity testing, but this may be done when the drums are moved this summer. If the material were found to be pyrophoric, FEMP currently would not be able to oxidize the material on-site.
3. **Background:** The FEMP is an environmental cleanup and remediation project whose mission is to demolish a former uranium metals processing plant and clean up the site.

Radioactive materials on-site include various forms of uranium and thorium, and substantial quantities of radon-emitting residual feed material. In September 1994, the Board's staff

reviewed the safety of uranium and thorium storage at the FEMP. The current trip is the staff's first review of the low-level waste program. The radon-emitting feed material in Silos 1, 2, and 3 will be processed by the OU-4 Vitrification Pilot Plant for off-site shipment. The staff previously reviewed the pilot plant in February 1995.

4. Discussion: The Board's staff heard presentations from Department of Energy (DOE) and Fernald Environmental Restoration Management (FERMCO), held technical discussions, and toured the OU-4 Vitrification Pilot Plant facilities.

a. Low-Level Waste (LLW): There is no high-level or transuranic waste at the FEMP site, only low-level and mixed waste. Waste characterization is performed by one organization, Waste Programs Management. This arrangement is efficient because it avoids the inconsistencies that sometimes arise at other sites when multiple organizations characterize waste. FERMCO plans to characterize the remaining 22,000 containers of legacy LLW within the next two years. The increasing use of off-site facilities for characterization should speed up the effort to ship the legacy waste off-site. Fernald currently disposes of LLW at the Nevada Test Site (NTS), mixed waste at Envirocare's Utah facility, and recycled metal at two commercial facilities. LLW shipments to NTS have been capped at the same level as, as was shipped in 1994 (22,000 yd³), until NTS's Environmental Impact Statement is completed.

1. On-Site Consolidation - FERMCO continues to consolidate containers of LLW stored throughout the site into a few buildings and pads. Unfortunately, this consolidation is not designed to eliminate the outside storage of LLW drums. Exposure to moisture, especially standing water on the lid, can lead to increased corrosion of the drums. Since May 1, 1995, liquid mixed wastes are being consolidated on-site before being shipped to the Oak Ridge K-25 facility for incineration. Another project, the Removal Action 9 stabilization project, involves the cement stabilization of 1,500 drums of heavy metal-contaminated mixed waste to allow shipment to NTS.
2. On-Site Disposal - The upcoming Record of Decision (ROD) for OU-2 (sludge ponds, flyash, etc.) is proposing on-site disposal of LLW. The RODs for OU-3 (former production area) and OU-5 (environmental media) are also expected to recommend on-site disposal of the expected 2.4 million cubic yards of low-level contaminated soils and debris from site cleanup activities. The OU wastes to be disposed on-site have low concentrations of radionuclides. The average U-238 concentrations in OU-2 and OU-5 are 72 and 77 ppm, respectively; the average background level is 3.6 ppm U-238. Preliminary responses from DOE-Headquarters (DOE-HQ), Environmental Protection Agency, and local citizen groups have been favorable.

Fernald is proposing that Comprehensive Environmental Response, Compensation, and Liability Act documentation be accepted in place of Performance Assessment (PA) required by DOE Order 5820.2A, *Radioactive Waste Management*. The estimated risk to the public from the disposal facility is expected to satisfy the 25 mrem/year dose to any member of the public from all environmental pathways performance objective that a PA would have to meet. Fernald hopes to have a decision from DOE-HQ on this issue by June 1995. Construction of the LLW facility is scheduled to begin in Spring 1997.

- b. OU-4 Vitrification Pilot Plant: The prefabricated pilot plant building is a temporary structure that meets the general design criteria of DOE Order 6430.1A. The pilot plant building is categorized as a Hazard Category 3 (low hazard) non-reactor nuclear facility. The pilot plant has only four systems which are necessary to prevent unacceptable risk to site workers: the melter, the carbon bed vessel system, the radon monitors, and the Silo 3 surge bin. Construction of the pilot plant is progressing, with completion expected by September 1995.

1. Pilot Plant Emissions - The pilot plant melter off-gas will contain radon-222, uranium and thorium decay radioisotopes, and other non-radioactive off-gas products. The melter off-gas is treated to meet emissions standards and to limit radon release using two carbon beds, High Efficiency Particulate filters, and an exhaust stack. One carbon bed is planned to be in operation, with the second bed in reserve. If radon levels should increase during operations, the feed to the furnace could be decreased, or the second carbon bed could be brought on-line. With the pilot plant operating, total radon concentrations at the site boundary are expected to be well within the 3.0 pCi/l limit given in DOE Order 5400.5.

The highest radon levels are expected to occur during the removal and transfer of materials from the silos to the pilot plant. A secondary confinement will be placed around Silo 3 to prevent airborne releases. Silo 3 will be used to test the initial retrieval of materials from the silos. The existing Radon Treatment System, which reduces radon emissions from Silos 1 and 2, will be upgraded for pilot plant operations.

2. Worker Dose Monitoring - FERMC0 plans to provide 25 percent of pilot plant workers with real-time radon monitors which alert at 10 percent Derived Air Concentration (DAC) and alarm at the DAC. At least one worker in each group will have a monitor. Other monitoring to be used at the facility includes active and passive gas monitors, permanent and portable working level monitors, a SO_x monitor, a continuous alpha air/isokenetic monitor, and a grab measurement monitoring cell.

3. Gamma Radiation from Vitrified Glass - The vitrified glass, which consist of 80% silo material and 20% additives, will be placed in concrete containers with a wall thickness of 5 inches. The calculated individual container dose rates on contact and at 2 meters are 72 mrem/hr and 10 mrem/hr, respectively, from gamma radiation. In the container storage area contact and 2 meter dose rates are expected to be 90 mrem/hr and 43 mrem/hr, respectively. A significant man-rem exposure is expected to result from the handling and transport of the vitrified material containers. However, an ALARA review of the handling, interim on-site storage, and transport of the containers has not been performed.
- c. Storage of Potentially Pyrophoric Material: Four drums of thorium, previously believed to be potentially pyrophoric, have recently been tested and found not to be pyrophoric. There are, however, an additional 48 drums of uranium metal chips, turnings, and fines that are also considered potentially pyrophoric. Unlike the drums of thorium that were stored with an inert argon atmosphere in an Operational Safety Requirement-monitored storage area, the vented drums of uranium are stored on a covered pad outside of Plant 5. The uranium metal may have been oxidized by air or water entering the drum through the vent. Testing the uranium for pyrophoricity has not been scheduled, but this may be done when the drums are moved this summer. If the material were found to be pyrophoric, FEMP would not be able to oxidize the metal on-site.