

[DNFSB LETTERHEAD]

May 2, 1995

MEMORANDUM FOR: G.W. Cunningham, Technical Director

COPIES: Board Members

FROM: Larry Zull, Fernald Program Manager

SUBJECT: Trip Report - Review of UNH Project and CRU-4
Vitrification Pilot Plant at Fernald

1. Purpose: This trip report documents a February 23-24, 1995 visit to the Fernald site to review the status of the Uranyl Nitrate Hexahydrate (UNH) Neutralization Project, Unit-4 (CRU-4) Vitrification Pilot Plant, and other on-going activities. Defense Nuclear Facilities Safety Board (Board) staff members Randall Robinson, Andrew Stadnik, and Larry Zull participated in the reviews.
2. Summary:
 - a. The UNH Neutralization project has been in violation of an Ohio Environmental Protection Agency (OEPA) Order to begin neutralization/removal of the UNH since January 17, 1995. The UNH project has not been able to begin the neutralization because of equipment problems. An independent design review of the UNH system equipment identified several design, procurement, and installation problems which are being addressed by corrective action plans. Contractor and Department of Energy (DOE) Operational Readiness Reviews (ORRs) must also be performed before UNH neutralization operations can begin. The latest Fernald Environmental Restoration Management Company (FERMCO) and DOE schedule shows UNH processing beginning by July 20, 1995.
 - b. The CRU-4 Vitrification Pilot Plant, currently under construction, will demonstrate the retrieval and vitrification of residues from previous uranium processing operations. Carbon filters are used in the off-gas treatment system to reduce radon emissions; however, other technologies, such as cryogenics, can reduce radon emissions to near zero. A planned follow-on full-scale vitrification facility may release twenty times as much radon as the pilot plant. FERMCO may want to consider cryogenic technology to reduce radon emissions from a future full-scale plant.
3. Background:
 - a. The purpose of the UNH Neutralization Project is to neutralize 200,000

gallons of acidic UNH contained in 18 tanks at the Fernald site, and ship the resulting radioactive materials to the Nevada Test Site. The contractor, FERMCO, designed a system to neutralize and process the UNH material for off-site shipment to the Nevada Test Site. However, design and operational problems, including a cracked piping weld, were identified during system Operability Testing in December 1994. Testing and operations were then suspended by FERMCO while an independent design review of the UNH system was performed. The UNH project is currently in violation of an OEPA Order to begin neutralization/removal of the UNH by January 17, 1995.

- b. The CRU-4 Vitrification Pilot Plant program will demonstrate the retrieval and vitrification of residues from uranium processing operations in the 1950's. The residues, which contain high-activity concentrations of radionuclides (including radium and thorium) and cold metal oxides, are contained in Silos 1, 2, and 3. The vitrification pilot plant is a one metric ton (2,200 lbs) per day facility to process the residues. The CRU-4 Vitrification Pilot Plant program will be conducted in two phases. Phase I will demonstrate operation with non-radioactive surrogate materials, while Phase II will involve the vitrification of actual silo residues. Concurrent FERMCO and DOE Readiness Assessments for Phase I operations are scheduled to begin July 3, 1995.
4. Discussion: The Board staff review consisted of DOE and FERMCO presentations, technical discussions, a tour of the UNH Neutralization project facilities, and a tour of the CRU-4 Vitrification Pilot Plant facilities.
 - a. UNH Neutralization Project:
 1. The FERMCO independent design review of the UNH project concluded that: (1) certain piping systems were unnecessarily constrained, which could potentially result in stresses exceeding code allowables; (2) secondary confinement piping, required by DOE Order 6430. 1A, was only partially incorporated in the design, and not formally waived prior to construction of the piping system; (3) the single case of weld failure was attributed to poor weld quality due to improper fit-up, tightly butted root faces, and extensive lack of penetration; (4) the double diaphragm pumps were installed and tested without adequate engineering justification, and the installation did not comply with the mounting details; (5) schedule constraints drove the installation and testing of the double diaphragm pumps prior to establishment of a revised instrumentation/control design; and (6) purchase order records lacked complete documentation, and field changes were not controlled. Corrective actions to address these concerns included

inspections of other piping welds, and replacement of the double diaphragm pumps with progressive cavity pumps.

2. In late January 1995, the seventh contractor program manager and management team were installed. The latest FERMCO and DOE schedule has been released, which shows UNH processing by July 20, 1995, and finishing in April 1996. Contractor and DOE Operational Readiness Reviews must be performed before UNH neutralization operations can begin.
- b. CRU-4 Vitrification Pilot Plant: The major design features of the Vitrification Pilot Plant were discussed by FERMCO. The Board staff reviews included discussion of radon emissions from the plant.
1. Radon Emission Limits: Radon-22 gas is generated as a result of the radioactive decay of the radium-bearing residues to be vitrified. The CRU-4 Vitrification Pilot Plant is a treatment plant, not an interim storage or disposal facility. Chapter IV in DOE Order 5400.5, Radiation Protection of the Public and the Environment, provides radon emission limits for interim storage and long-term management (disposal) facilities; however, there are no requirements for emissions from a treatment plant. The only radon emission limit applicable to the pilot plant is that the average annual radon concentration should not exceed 3 pCi/L above background at any location outside the site boundary. This limit include radon emissions from all on-site sources, including pilot plant operations. Compliance with the 3pCi/L limit will be determined by monitoring at various locations at the site boundary.
 2. Off-Gas Treatment System (OGTS): The purpose of the OGTS is to treat off-gas from the melter/furnace to meet emission standards, and to reduce radon emissions. Carbon filters are used in the OGTS to allow for decay (3.82 day half-life) of a portion of the radon-222 gas released during the vitrification process. Discussions with FERMCO revealed that the performance of the carbon filters may only be 85%, rather than the assumed design efficiency of 95%. An efficiency of only 85% will result in a radon concentration of 210 pCi/L from the stack during operations.

The purpose of the CRU-4 Vitrification Pilot Plant is to demonstrate that the design is workable as a full-scale industrial plant. Using the same carbon filter technology as the pilot plant, the follow-on full-scale vitrification plant could release twenty times as much radon as the pilot-plant. Other technologies, such as cryogenic systems, could reduce radon emissions to near zero.

FERMCO may want to consider other technology to further reduce radon emissions from the full-scale vitrification plant.

- c. Thorium Overpack Project: In this project, approximately 5,600 drums of thorium materials in Building 65 will be prepared for disposal by placing them in overpack containers suitable for off-site shipment to the Nevada Test Site. Planning for the overpack includes one independent design review and FERMCO and DOE ORRs. The project is scheduled to begin overpacking operations in November 1995, and finish in December 1996. The staff was provided a copy of the latest schedule, and a 90 percent draft of the Safety Analysis Report. The staff plans to conduct additional reviews as the project progresses.
 - d. Technical Management Plan: EM-423 has conducted two reviews to assess the DOE Fernald Area Office (DOE-FN) implementation of the Technical Management Plan (TMP). A TMP baseline assessment was performed in October 1994, and a UNH Project interim compliance assessment was performed in December 1994. The UNH assessment found that personnel appeared qualified, but required greater familiarity with the safety basis documentation and the Unreviewed Safety Question process. A better understanding of the TMP was also required. A corrective action plan was developed to address the findings. EM-423 plans to conduct another UNH assessment prior to the DOE ORR in June 1995. The Fernald Environmental Management Project Division, EM-423, has also developed a draft TMP for their activities. The EM-423 TMP compliments the Fernald Area Office TMP.
 - e. DOE FAR Manual: On December 2, 1994, DOE Secretary O'Leary issued a letter to DOE program office and field managers requesting acknowledgement of compliance with responsibilities in the "Manual of Functions, Assignments, and Responsibilities for Nuclear Safety", also known as the DOE FAR Manual. Many of the DOE-FN personnel interviewed by the staff were not aware of the FAR Manual or its contents.
5. Future Staff Actions: The staff intends to conduct additional reviews of the CRU-4 Vitrification Pilot Plant project design. her piping welds, and replacement of the double diaphragm pumps with progressive cavity pumps.