

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

September 28, 1995

MEMORANDUM: G. W. Cunningham, Technical Director

COPIES: Board Members

FROM: Lisa Stiles

SUBJECT: Review of Spent Nuclear Fuel Activities at Idaho National Engineering Laboratory

1. **Purpose:** This report documents a review of spent nuclear fuel (SNF) activities at the Idaho National Engineering Laboratory (INEL) conducted on September 12-14, 1995 by L. Stiles and K. Fortenberry.
2. **Summary:** The Defense Nuclear Facilities Safety Board's (Board's) staff notes that SNF activities at INEL are on or ahead of schedule for all major commitments. Preparations for interim wet and dry storage are underway and plans for future transition to permanent or long-term storage are being developed. A current problem in basin CPP-666 is the presence of microbially induced corrosion (MIC). This problem could significantly impact wet storage of aluminum material in the basin.
3. **Background:** In response to environmental questions raised by the State of Idaho concerning the shipment and storage of Fort St. Vrain SNF at the Idaho Chemical Processing Plant (ICPP), a court order was issued June 28, 1993, which mandated that all spent fuel be removed from basin CPP-603 by December 31, 2000. In addition, in response to Board's Recommendation 94-1, DOE has committed to (1) removing SNF from aging storage facilities with no future mission, (2) eliminating SNF facility safety vulnerabilities, and (3) placing INEL SNF in cost effective and regulatory compliant dry storage facilities until the SNF can be moved to the final national repository. To accomplish these objectives, future interim storage of SNF at INEL will primarily consist of wet storage at CPP-666, and storage in dry, vented, canisters placed at the Irradiated Fuel Storage Facility (IFSF) or at other dry storage locations, such as CPP-749. As the date (most likely the year 2036) for removing all SNF from INEL approaches, fuel will be transitioned to sealed "road ready" casks awaiting removal from the site to permanent or long-term disposition.

Currently, INEL stores SNF of the following types: (1) zirconium-clad Navy and commercial fuel, (2) aluminum-clad fuel, (3) stainless steel-clad fuel, (4) irradiated and unirradiated graphite fuel, and (5) miscellaneous inactive nuclear materials (MINM). These fuels are stored wet, dry, or in experimental casks.

4. **Discussion:**

To date, court order and Recommendation 94-1 milestones have been completed before or as scheduled. The most recent milestone, to complete the second set of 189 fuel transfers from the North and Middle CPP-603 basins, due by December 31, 1995, was completed September 11, 1995. Transfer of the remaining 244 fuel canisters from

the North and Middle basins has been initiated and completion is due by December 31, 1995. The complete transfer of all fuels from the South basin is scheduled to begin in August 1996, and is to be completed by December 31, 2000.

Though less than optimal, water chemistry in basin CPP-603 is stable. Values for conductivity hover around 560 mS/cm, total activity concentration is about $3E-5$ mCi/mL, and pH levels fluctuate between 7.6 and 8.0. In contrast, water chemistry values at CPP-666 are comparable to those at commercial SNF storage pools. Conductivity values are below 2 mS/cm, the composite activity concentration is $5.4E-7$ mCi/mL, and pH is between 5.0 and 6.0.

Of greater concern in the CPP-666 basin is the occurrence of microbially influenced corrosion. Microorganisms tend to form biofilms on surfaces that lead to the formation of separated cathodic and anodic areas. These microorganisms break down a protective oxide layer which leaves areas anodic in relation to the remaining part of the element. The nature of MIC and the resulting local water chemistry promote pit growth along grain boundaries and matrix defects. Though the ultraviolet system at CPP-666 appears to remove microorganisms from the water, it has been ineffective for decreasing microbial presence on fuel surfaces.

As an example of problems experienced with MIC, a sealed aluminum dummy canister was inspected and basin water was found inside. The outside surface pits were very small and were not visible with an underwater camera. Even visual inspection at arms length revealed nothing more than minor corrosion pits. However, a nondestructive examination technique developed at INEL using ultrasonic transducers revealed that substantial subsurface corrosion originating from MIC had caused the breach of the 1/8 inch thick canister. INEL personnel are working in conjunction with the University of Montana to address this problem.