[DNFSB LETTERHEAD]

November 6, 1996

The Honorable Alvin L. Alm
Assistant Secretary for Environmental Management
Department of Energy
Washington, DC 20585-0113

Dear Mr. Alm:

Since accepting Defense Nuclear Facilities Safety Board (Board) Recommendation 94-1, the Department of Energy has decided to transfer and stabilize defense spent nuclear fuel. The Board is interested in seeing these processes proceed in a safe and expeditious manner.

Members of the Board staff recently reviewed the plans of both the Savannah River Site and Idaho National Engineering Laboratory to transfer spent fuel. These operations require moving massive casks now in spent fuel storage basins, where a cask drop might cause structural damage and significant water inventory loss. The reviews indicate that several basic measures that could prevent a drop and mitigate its damage have not been considered. This and other handling issues are described in the enclosed reports. Addressing these issues in a timely manner could reduce the possibility of a cask drop and its adverse consequences.

These reports are provided for your review and use. If you need any additional information on this matter, please let me know.

Sincerely,

John T. Conway
Chairman

c:
Mr. Mark B. Whitaker, Jr.

Enclosures (2)

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

August 15, 1996

MEMORANDUM FOR:	G. W. Cunningham, Technical Director
COPIES:	Board Members
FROM:	Dominic S. Napolitano
SUBJECT:	Handling of Spent Nuclear Fuel at the Savannah River Site (SRS), Trip Report for August 5-7, 1996.

1. **Purpose**

   This report discusses handling and processing of defense spent nuclear fuel at SRS. Observations presented here are the result of an August 5-7, 1996, site visit by Defense Nuclear Facilities Safety Board (Board) staff members Dominic Napolitano and Donald Wille. This report does not address vulnerabilities identified in the *DOE Spent Fuel Vulnerability Assessment*, which focuses on spent fuel storage. Since that document was published, decisions have been made to move the stored fuel. This report examines the safety of fuel handling operations.

2. **Summary**

   Canyon utilization plans for stabilizing defense fuel at SRS have changed. As a result of H-Canyon restart delays, F-Canyon needs to stabilize more defense fuel. Consequently, there could be a delay in using F-Canyon for off-site material, if required.

   During stabilization operations, defense spent fuel will be retrieved from the K-, L-, and P-Basins. Board staff have four concerns with this activity. First, there is no assurance that make-up water will be available after a design basis accident. Second, crane rope is corroded, and the fatigue life of some cranes is not known. Third, a qualified rigger is not present during critical cask lifts. Fourth, although fuel is being removed from the basins, significant quantities of activated scrap metal will remain.

   A Basis for Interim Operation for L-Basin was approved by the Department of Energy (DOE) on August 8, 1996. It concludes that the worst-case design basis accident is draining of all the water from the basin. Calculations indicate that this occurrence would be safe for the public since drinking water limits would not be exceeded. Consequently, safety-related systems are not credited. However, Board staff note that this occurrence would not be safe for workers. The fuel would be uncovered, and area dose rates would be very large.

3. **Background**

   Consistent with Board Recommendation 94-1, SRS will stabilize its defense fuel—Mark 31 targets and Mark 16/22 bundles—using Canyon processes. Mark 31

processing is scheduled to resume in F-Canyon during August 1996 and end in January 1997. Mark 16/22 processing is scheduled to start in F-Canyon during May 1997, switch to H-Canyon in September 1998, and be completed in April 2000. SRS is also preparing to accept foreign research reactor fuel in L-Basin. The aggressive 94-1 schedule and foreign fuel program will require a significant number of fuel cask movements. Board staff are concerned about these operations since a cask drop accident could significantly delay the 94-1 schedule and release radioactive material.

4. **Discussion**

The following are highlights of the observations made by Board staff.

Canyon Processing Schedule (Mark 16/22). The Westinghouse Savannah River Company (WSRC) stated that personnel resources available at the Canyons are limited and may be further reduced. According to WSRC, these limitations have caused a 1-year delay in H-Canyon restart. Presently, H-Canyon is scheduled to start up in September 1998; the original Canyon Utilization Plan presented to the Board stated that H-Canyon would come on line in September 1997. F-Canyon will compensate for the H-Canyon holdup by continuing to dissolve Mark 16/22 bundles. Thus, there is potential for delay in using F-Canyon for off-site material, if required.

Retrieval of Fuel in the Basins. Spent fuel shipments to the Canyons will come primarily from the K- and L-Basins. The cask cranes are 1950s vintage, designed with a safety factor of 5. Both were load tested in 1991-1992 to 125 percent of their rated loads. Based on NUREG-0612 statistics, Board staff estimate the probability of a cask drop during 94-1 activities at about 2 percent. In the event of a cask drop, WSRC expects that 150 gpm would leak from the basin. Since this is a high-probability event, Board staff looked at areas where WSRC could improve its safety margin. These areas are listed below:

- ***There is no assurance that make-up water will be available after an accident***—If a cask drop or seismic event should cause a leak, basin water is supposed to be replaced by raw untreated water from the Emergency Service Water system. However, this line is not tested regularly, it has not been used for more than a year, and it is not seismically qualified.

- ***Corrosion is evident along the entire length of the K-Basin cask crane's wire rope and the fatigue life of basin cranes is not known***—Board staff were not able to view the L-Basin crane rope, but were told its condition is similar. American Society of Mechanical Engineers (ASME) B30.2-1990 identifies excessive corrosion on wire rope as a hazard. WSRC stated that the rope is adequate based on visual inspection by site riggers. However, as noted in the Construction Safety Association of Ontario's *Rigging Manual,* visual inspection gives a poor indication of the extent of degradation since corrosion often begins inside the rope. A more rigorous inspection includes examining the rope core. If the core is corroded, the cranes' safety factor may be much less than WSRC believes.

Additionally, the safety factor of 5 is based on static load. It does not include fatigue considerations as is required for contemporary cranes designed to *Crane Manufacturers Association of America Specification No. 70.* Since the cranes have experienced extensive use and will be used more frequently now than during production periods, an estimate of their remaining fatigue life would provide valuable safety information. A crane manufacturer that specializes in extending crane life could perform an inspection and determine the potential for fatigue.

- ***A qualified rigger is not present during fuel cask lifts***—Fuel cask lifts are critical and pre-engineered. However, a crane operator, who has only Incidental Rigger Training, performs both the rigging and crane movement. This seems to contradict the SRS *Hoisting and Rigging Manual,* which states that a rigger shall ensure (1) the rigging equipment has the required capacity and is in good condition, (2) the rigging equipment is per procedure, and (3) the load path is clear.

- ***Although fuel is being removed from the basins, significant quantities of activated scrap metal will remain***—Besides fuel, the basins store buckets of highly radioactive scrap metal. These buckets are suspended by rope and corroding wire cables. In contrast with the fuel, no plan of action has been formulated for retrieval of this material.

L-Basin Safety Documentation. Significant modifications were made to the L-Basin following the *DOE Spent Fuel Vulnerability Assessment.* These modifications included (1) successful sludge cleanup, (2) substantial water chemistry improvement, (3) modifications to the crane travel path, and (4) new racks for storing foreign fuel. In addition, new seismic and structural analyses have been initiated and will be completed in fiscal year 1997. Results of the site-wide seismic spectra activity, expected in December 1996, will be considered in this effort. Board staff intend to review these analyses.

A Basis for Interim Operation for L-Basin received DOE approval on August 8, 1996. Its accident analysis is predicated on the postulated release of all the basin water. This event is credible since the L-Basin emergency make-up water is not tested regularly and is nonseismic. The Basis for Interim Operation concludes that if all the water entered the public drinking supply, federal drinking water limits would not be violated. Therefore, no safety-related systems are credited. However, Board staff note that this occurrence would not be safe. The fuel would be uncovered, allowing high area dose rates. Moreover, fuel shipments would be suspended, and stored fuel would be very difficult to retrieve.

5. **Future Staff Actions**

The above issues have been brought to the attention of DOE-SR and WSRC. Resulting work and the activities at L-Basin will be monitored closely by Board staff.

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

August 28, 1996

MEMORANDUM FOR:	G. W. Cunningham, Technical Director
COPIES:	Board Members
FROM:	Dominic S. Napolitano
SUBJECT:	Handling of Spent Nuclear Fuel at the Idaho National Engineering Laboratory (INEL), Trip Report for August 19-23, 1996.

1. **Purpose**

This report discusses handling and processing of spent nuclear fuel at INEL's Idaho Chemical Processing Plant (ICPP). Observations are the result of an August 20-22, 1996, site visit by Defense Nuclear Facilities Safety Board (Board) staff members Russell Green, Dominic Napolitano, and Donald Wille and outside expert David Boyd.

2. **Summary**

INEL is consolidating its spent fuel inventory to fulfill a state agreement. This activity involves extensive spent fuel cask movements that raise possible nuclear safety concerns. A cask drop is a high-probability and often a high-consequence event. As an example, based on NUREG-0612 statistics, Board staff estimate the probability of a drop during the entire 603 south basin retrieval operation to be between 0.6 and 9 percent. Such an accident can cause a massive quantity of water to be lost from the basin. Board staff are concerned about two general issues:

- INEL engineers did not know whether cask operations meet basin design limits. They were unaware of the location of basin pipes. A pipe struck by a cask could drain the basin. In addition, the engineers did not know whether the casks are bounded by design calculations or could cause structural damage to the pool.

- Special lifting devices, such as the cask yokes used for operations, may not meet industry standards. Those standards specify different design safety factors for critical and noncritical lifts. INEL devices are designed to the lesser noncritical factors. However, no analysis was provided to Board staff showing that a cask drop is safe and thus noncritical. If drops are considered unsafe, INEL's special lifting devices cannot meet industry standards unless redesigned.

3. **Background**

The Department of Energy (DOE) intends to remove all spent fuel from INEL by 2035. Presently, INEL is consolidating its spent fuel inventory in the 666 Basin and two dry storage facilities—the Irradiated Fuel Storage Facility and the 749 vaults.

4. **Discussion**

The following text highlights observations made by Board staff.

Fuel Cask Handling at the ICPP. Many spent fuel transfers occur at the ICPP. Board staff are concerned that INEL and DOE staff are unaware of important design and operational details needed to ensure safe cask handling.

Basin Design: INEL personnel did not know whether cask operations are within basin design limits. This is illustrated by three areas of knowledge deficiency.

First, cask engineers could not say whether pipes are located under the cask path in the 666 basin. However, system engineers not involved in cask operations told the Board staff that a recirculation return line is under the path. A break in this line could cause total Basin drainage. The DOE Idaho Field Office stated they believe siphon holes were added to the line during construction; these holes would prevent drainage. However, no evidence was provided to confirm the existence of the holes, which can be validated by field observation.

Second, cask engineers stated that the 666 Basin floor is designed for a 65-ton cask drop. Cask drop analysis is dependent on both weight and cask geometry. The engineers did not know what geometry was assumed in the calculations. Thus, they could not know whether operations are within design limits. Additionally, they did not know whether the design calculations examined structural pool damage or only local floor damage. If structural damage was neglected, one cannot know whether a drop near the pool corner can induce leakage.

Third, there is no cask drop analysis for the 603 Basin. Consequently, INEL does not know whether its make-up water capacity is sufficient for accident conditions. Additionally, engineers expressed concerned that a cask drop on a particular wall could result in 2-ft drop in pool level. Yet no one has corrected this simple problem by limiting the cask lift height. Board staff observed a lift in which there were no procedural limits on how high the operator could raise the cask.

Lifting Equipment: INEL personnel did not know essential information on certain critical lifting equipment. This information is needed to estimate the fatigue life of cranes. Old cranes not built to a design code might have limited service lives. The quality of cranes and yokes varies between the two ICPP basins. The 666 Basin is a new facility that came on line in 1984. Its cranes meet industry standards, including *The Crane Manufacturers Association of America Specification No. 70* , and its cask equipment meets American National Standards Institute (ANSI) N14.6. In contrast, the 603 Basin is much older (1954). INEL engineers did not know the design standards or the safety factors on the 603 cranes which will be used frequently until December 2000. A detailed inspection by a crane manufacturer could give important safety information regarding the cranes' fatigue life.

Additionally, the design of special lifting devices for cask may be inadequate relative to industry standards. INEL uses the *DOE Hoisting and Rigging Manual*, which

requires that cask yokes be designed to ANSI N14.6. This standard requires two different safety factors for critical and noncritical lifts. INEL contractors use the lesser, noncritical requirements. They justify this interpretation by stating that any basin drainage resulting from a cask drop is not a safety concern because no off-site release should result. The DOE Idaho Field Office has disagreed, stating that a drop that causes gross basin water loss is unsafe. No analysis was presented showing the occurrence is safe. Consequently, if a cask drop is viewed as unsafe, special lifting devices must be designed with higher safety factors to meet ANSI N14.6.

Operations: INEL does not require a qualified rigger to be present at pre-engineered critical lifts. A crane operator is expected to complete the rigging by following an engineered drawing. However, crane operators are not necessarily trained in rigging. The presence of a rigger increases the safety margin. Errors in rigging specifications do occur, and sometimes rigging equipment is in poor condition. Board staff observed a 603 lift in which crane operators were given a very simplistic rigging drawing that was outdated and inconsistent. In this case, the operators found the problem. Other lifts are more demanding, and a qualified rigger has a significantly greater chance of finding problems.

In addition, transfer routes for cask shipments are not specified in a procedure. Current practice for fuel shipments entering the ICPP is to drive a truck over the shortest route to the 666 Basin. The traditional route takes the casks past chemical tanks and oxygen dewars and over utilities and chemical trenches. INEL has not considered using another route that would avoid these hazards.

Operations at the Irradiated Fuel Storage Facility. Canning operations at the dry storage facility are planned to begin soon. Yet there is no solid technical basis for these activities. Before storage, fuel must be treated to eliminate pyrophoric hydrides. However, the treatment process has not been formally designed. It relies on diffusion rates for uranium oxide rather than the compound of concern, uranium hydride. Additionally, the calculations used have never been independently reviewed or approved.

Seismic Concerns at the Irradiated Fuel Storage Facility. The facility racks and canisters meet the seismic requirements of DOE Order 5480.28 and DOE-STD-1020, but the facility structure does not. INEL will strengthen the structure to eliminate critical seismic overstresses. The project is targeted for completion in fiscal year 1997.

5. **Future Staff Actions**

These issues have been brought to the attention of the DOE Idaho Field Office. Documentation is being requested for further staff review.