DEFENSE NUCLEAR FACILITIES SAFETY BOARD

May 28, 1996

MEMORANDUM FOR:	G.W. Cunningham, Technical Director
COPIES:	Board Members
FROM:	Donald J. Wille
SUBJECT:	Savannah River Site - Review the Status of the Spent Nuclear Fuel Activities - Trip Report (May 15-16, 1996)

1. **Purpose:** This report documents a review of the status of the Spent Nuclear Fuel activities at the Savannah River Site (SRS) K-Basin, L-Basin, and the Receiving Basin for Off-Site Fuel (RBOF) by the Defense Nuclear Facilities Safety Board's (Board) technical staff, Donald J. Wille, Kent Fortenberry, and Lisa Stiles on May 15-16, 1996.
2. **Summary:** There is a potential safety issue with Mark 31 targets loaded in three shipping casks on rail cars awaiting shipment to the F-Canyon for processing. The Mark 31 targets are subject to corrosion and may generate flammable concentrations of hydrogen over an extended period of time. The three casks were loaded prior to the completion of a formal calculation by Westinghouse Savannah River Corporation (WSRC) of the estimated time to reach a flammable mixture. The calculation did not include the temperature effects on the corrosion rate. The Board's staff has evaluated the calculation and considered the effect of temperature on the corrosion rate of the fuel. The Board's staff concludes that there is not an immediate safety issue and sufficient time is available for the planned return of the casks to a basin for venting of any hydrogen buildup. However, there is a remaining safety issue that an Unreviewed Safety Question (USQ) may exist that has not been evaluated and that should be treated as a possible change to the Authorization Basis for the transportation activity.
3. **Background:** The irradiated Mark 31 targets stored in the L-Basin will be shipped on site to the F-Canyon for reprocessing. The first shipment of 288 Mark 31 targets was loaded into a shipping cask on March 3, 1996. Due to a concern raised in early March 1996 over the seismic capability of the F- and H-Canyons, the Secretary of Energy has suspended the shipment of any new irradiated material to the F-Canyon for reprocessing.
4. **Discussion:** The 288 Mark 31 targets loaded into the shipping casks on March 3, 1996, were not shipped to the F-Canyon due to the suspension of receipt of any new irradiated material at the F-Canyon. The length of the suspension was unknown and the loaded shipping cask was stored on a rail car outside L-Basin. At that time, WSRC was concerned that extended storage of the irradiated Mark 31 targets under water in the cask may result in a flammable condition of hydrogen in the air space caused by corrosion of the exposed uranium metal in the targets and radiolysis of the water. WSRC made a preliminary evaluation, which is not documented, that a conservative estimate of the time to reach a flammable mixture of hydrogen was two months. On that basis, the shipping cask was returned to the L-Basin on April 15, 1996, (6 weeks after loading) for sampling of the cask water and venting of the gas space in the cask. The current authorization basis for the transportation activity apparently does not address the allowable length of time that irradiated material can be stored in the cask,

but only addresses criticality and heat load issues.

During mid-April, a total of three shipping casks were loaded with Mark 31 targets and stored on rail cars on site awaiting shipment to F-Canyon when the suspension is lifted. WSRC took this action because the L-Basin cask handling crane would be unavailable due to modifications for about two months. Having Mark 31 targets available in casks could potentially reduce further impact on the commitments made in response to Board Recommendation 94-1. To provide a formal basis for the extended period of storage in the casks, WSRC developed a calculation of hydrogen generation in the cask and determined that a flammable mixture is obtained in the cask after 387 days of storage. This calculation was issued on April 30, 1996, and is the basis for venting the three casks in a storage basin on site after two months of storage.

The Board's staff has evaluated the reference calculation, which does not include any temperature effect on the corrosion rate of the Mark 31 targets. Although the decay heat (about 4 watts per target) is small, the casks are stored outside on rail cars enclosed in a RadCon bag and covered by a tarpaulin, and some increase in temperature can be expected. The Board's staff considered the effect of the water temperature reaching 100·C and the associated increase in corrosion rate of the fuel. This approach results in an estimated time to reach a flammable mixture of about 145 days. The WSRC plan to vent the three casks under water in a basin after 60 days of storage appears to mitigate the safety issue associated with extended storage.

However, a potential safety issue remains with the lack of a USQ screening by WSRC that would have resulted in a review and evaluation of the process by DOE-SR office. The extended storage condition apparently is not analyzed in the existing Authorization Basis and the WSRC calculation is clearly addressing the safety question of extended storage for Mark 31 targets. The initiation of a USQ process by WSRC with the Department of Energy - Savannah River Site (DOE-SR) review and approval, as appropriate, is warranted by this recent experience. This approach also would support a potential need to ship other spent fuel currently in storage basins at SRS that exhibit much higher corrosion rates than the Mark 31 targets.

Reference: WSRC Calculation, "Hydrogen Generation in a CD Cask Containing Mark 31 A Slugs," X-CLC-G000002, dated April 30, 1996.

5. **Future Staff Actions:** The Board's staff plans to review the following: Results of actions taken by the DOE-SR office to assess the appropriate handling of the potential safety issue for extended storage of irradiated fuel and targets in shipping casks on site.