DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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March 7, 2002

The Honorable Jessie Hill Roberson
Assistant Secretary for Environmental Management
Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0113

Dear Ms. Roberson:

The staff of the Defense Nuclear Facilities Safety Board (Board) has been conducting reviews associated with the packaging, storage, and inspection of depleted uranium materials at the Department of Energy's (DOE) defense nuclear facilities. The Board's staff recently conducted such a review at the Savannah River Site (SRS). The results of that review are provided as an enclosure to this letter. The staff's review revealed that although DOE and its contractor are aware of deficiencies in the storage conditions of this material at SRS, little progress has been made in addressing the potential safety issues which were first identified in October 1998.

The Board is concerned that proper attention is not being afforded to the storage of these hazardous materials. If some of this depleted uranium is needed by DOE for future use, the Board believes that DOE needs to identify and protect the material in a consistent and appropriate manner and that the facilities and containers that store these materials ought to be properly maintained or upgraded to provide adequate containment, ensure the health and safety of workers and the public, and protect the environment. It appears, however, that a significant amount of the approximately 22,000 metric tons of material at SRS could be declared surplus. If so, DOE needs to develop and execute a final disposition plan for the material in a timely manner. Such action would be in keeping with Environmental Management's resolve to reduce risks rather than continuing to just manage them.

Therefore, the Board requests that you examine the issues outlined in the enclosed report and, pursuant to 42 U.S.C. § 2286b(d), provide a report to the Board within 120 days of receipt of this letter that provides us your appraisal of the situation and your plans for addressing the risks the current storage state entail.

Sincerely,

John T. Conway
Chairman

c: Mr. Mark B. Whitaker, Jr.

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

January 14, 2002

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: J. Shackelford and W. Andrews

SUBJECT: Depleted Uranium Storage, Savannah River Site

This report presents observations of the staff of the Defense Nuclear Facilities Safety Board (Board) regarding depleted uranium storage at the Savannah River Site (SRS). The report also presents the staff's observations on the lack of standards or guidance on the part of the Department of Energy (DOE) and the contractor with regard to the packaging, inspection, and storage of these materials. These observations were developed during a site visit by staff members W. Andrews, F. Bamdad, C. Coones, J. Deplitch, and J. Shackelford.

Depleted Uranium Inventories. There are more than 22,000 metric tons of depleted uranium material at SRS. The chemical forms of the material include uranium trioxide, metal, and solutions. The materials are stored using a wide variety of methods in facilities of various design and quality across the site. A summary of the inventory is provided in the table below.

Chemical Form	Inventory (kg)	Facilities
Uranium Trioxide	19,500,000	F-Area (Buildings 221-22F, 221-21F, 221-12F, 730-F, 728-F), Building 714-7N, Building 105-R
Metal	2,600,000	M-Area (Buildings 330-M, 331-M)
Solutions	200,000	F-Area and H-Area

Packaging and Storage. As mentioned previously, the approach and adequacy of the storage of depleted uranium at SRS varies from facility to facility. The limited amount of depleted uranium solution on site is held in tanks and appears to be adequately stored and monitored. The storage of the solid material varies depending on its physical form. The quality of the storage conditions is mixed across the site. The majority of the oxide is stored in 55-gallon drums that are arranged in three-tiered, tightly packed storage arrays with supporting wooden timbers separating the tiers. While most of the containers are in reasonable condition, many of the 36,000 drums show signs of long-term and currently active corrosion. Metal stored in M-Area is packaged in either cardboard boxes or wooden crates. No evidence of corrosion was observed; however, these methods of packaging have resulted in significant combustible loading. This

increased loading would contribute significantly to a building fire. Such a fire could result in toxicological consequences that challenge evaluation guidelines at the site boundary. The following sections provide representative, specific commentary on the observed storage conditions.

The physical storage conditions in F-Area vary widely. The inventory in this area is housed primarily in two relatively modern storage buildings (221-21F, 221-22F) and two somewhat older buildings (728-F, 730-F). A number of drums in building 221-22F have extensive external corrosion. Although the site could not provide information regarding the historical storage of these drums, it appears that a number of them may have been stored outside in the past. Additionally, while the general area and transient combustible loading in Buildings 221-21F and 221-22F appears to be low, a number of oxidizing agents are also stored in these buildings.

The storage conditions in Buildings 728-F and 730-F are much worse than in the 221 buildings. The former structures are older and exhibit significantly more external corrosion than the other buildings. A number of the building supports have been attacked by corrosion and are in need of repair. In contrast with some of the other areas, a number of drums are sitting directly on the floor (instead of being supported by a wooden slat arrangement). In those areas where the wooden slats have been used, a number of them have rotted and failed. The rotting timbers have been compromised to the point that they cannot support the weight of the second and third-tier drums, and therefore a significant number of drums are tilting. In general, the drums in these buildings exhibit a significantly higher incidence of external corrosion than those in other storage areas. Facility personnel indicated that they were in the process of evaluating whether the drums in these facilities should be moved to more favorable locations, or whether the existing facilities could be upgraded in a cost-effective manner.

The inventory in M-Area is stored in two relatively modern buildings (330-M, 331-M). In contrast with the other site storage areas, most of this inventory is in the form of depleted uranium metal slugs (both clad and unclad). The slugs are stored in both cardboard boxes and wooden crates. A number of the wooden crates include an inner aluminum liner. The general storage conditions and outer surface of the storage containers in these areas seem to be quite good. However, the overall combustible loading in these two buildings is somewhat higher than in other storage facilities because of the method of packaging. In the fire hazard analysis for these areas, the facility assumed that a fire in either of the structures would take at least 2 hours to propagate through the building, even though neither building is equipped with internal fire barriers. Additionally, the analysis postulated that only a portion of the wooden boxes would be ignited in each phase of the "segmented burn analysis" that was proposed. The staff views these as extremely optimistic assumptions and requested the supporting technical bases. The facility's technical justification consists of an interoffice memorandum that documents the results of a building walkdown and includes no detailed calculations related to the combustible loading in the buildings.

Lack of a Final Disposition Plan for Depleted Uranium. There currently appears to be no leakage from the 36,000 drums of depleted uranium at SRS. However, since only a small percentage of the drums can be surveilled in their current configuration, one cannot be completely confident that none have leaked or are leaking. In addition, difficulties could arise in the handling

of those drums with extensive long-term or currently active corrosion, and such difficulties can be expected to increase as a function of time. The staff concludes that there is a need for a cost-effective final disposition plan for surplus depleted uranium at SRS. Such a plan ought to emphasize the minimization of handling and the elimination of radiological and toxicological hazards from the site.

Hazard Analysis of Depleted Uranium Storage Facilities. The staff determined that reasonably conservative assumptions were not always employed in the preparation of the hazard assessments for the facilities reviewed. In particular, the assumptions associated with the source term for various depleted uranium dispersal scenarios are, in some cases, at the low end of what would be considered a reasonable worst case. Additionally, while the hazard analyses address the radiological effects of depleted uranium dispersal, it appears that the toxicological impact was underestimated or neglected in a number of important scenarios. Consequently, scenarios could exist that have toxicological consequences with the potential to challenge the Emergency Response Planning Guide 2 guidelines at the site boundary.

DOE—Identified Deficiencies not Addressed in a Timely Manner. On August 25, 1998, resident staff of DOE's Savannah River Office of Environment and Health published a surveillance report related to the storage of depleted uranium at the site. The report identified a number of specific technical deficiencies, as well as issues related to a lack of planning and funding for the long-term disposition of the existing depleted uranium inventory. The following items are representative of the deficiencies identified in the report:

- Broken windows and age-related breaches in storage buildings that allow rain to collect and corrode the drums and rot the timbers upon which the drums are stored
- Drum corrosion and rotting of wooden supports, leading to a risk of storage array collapse
- Quarterly and annual inspections that do not include inspections for drum integrity
- Lack of access to observe the vast majority of the drums

In letters dated October 7, 1998, and March 26, 1999, the contractor made a number of commitments in response to above findings. While several of these commitments have been met, a number remain outstanding, as confirmed by the Board's staff during their walkdown of the storage facilities on December 5–6, 2001. In particular, the three facilities that were in the most significant state of disrepair have not been upgraded with new doors, roofing, and siding, nor has the ground around each of the facilities been appropriately graded in accordance with the commitments. In addition, although a long-term material management plan has been developed, it has yet to be executed. Currently, a few relatively minor initiatives are under way, but little progress has been made toward producing a viable long-term plan for the final disposition of the material.

Lack of Guidance or Standards for Long-Term Storage of Depleted Uranium. The contractor does not have an integrated and comprehensive approach to the packaging, storage, and inspection of depleted uranium materials. The existing SRS guidance governing such activities is

contained in a number of disparate documents. As a result, conditions related to the storage and inspection of the site inventory of these materials vary from facility to facility. It appears that this lack of a consistent approach is due primarily to the current lack of DOE policy-level guidance, standards, or directives governing the packaging, storage, and inspection of these materials. Such a standard should be tailored to the hazard of the material.

Inspection of Storage Containers. In general, the contractor conducts quarterly inspections of the depleted uranium oxide that is stored in 55-gallon drums and overpack containers. As noted above, the physical condition of the facilities used for storage varies widely and can generally be correlated with the age of the facilities (some of which date back to the late 1950s). The staff noted that the guidance associated with the drum inspections is superficial and requires only minimal documentation of the physical condition of the individual containers. Additionally, because of the tightly packed storage conditions, only those containers that are observable or that can be accessed, are routinely inspected. Consequently, the vast majority of the containers have never been inspected under this program and are unlikely ever to be assessed given the current situation.

The contractor has implemented a program to determine the remaining structural lifetime of the drums, as well as the relevant stresses applied to the drums, as a result of the long-term storage conditions. This program employs a limited sampling methodology that entails various external measurements and observations of a selected number of drums. The results of this ongoing drum assessment were not available for review during the staff's visit. The contractor indicated that the drum assessment project includes no destructive testing of the containers. As a result, the staff doubts whether the study can provide definitive results as to the long-term structural performance of the drums. Clearly, the most satisfying solution to the storage condition of these drums is to dispose of the material.