DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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May 20, 2002

The Honorable Everet H. Beckner
Deputy Administrator for Defense Programs
National Nuclear Security Administration
U. S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0104

Dear Dr. Beckner:

The staff of the Defense Nuclear Facilities Safety Board (Board) recently reviewed the packaging, storage, and disposition plans for inactive nuclear materials at the Department of Energy's (DOE) Los Alamos National Laboratory (LANL) and Lawrence Livermore National Laboratory. As a result, the Board would like to bring to your attention certain of these inactive nuclear materials that require stabilization and repackaging for safe interim and long-term storage. Many require decisions regarding paths forward for ultimate disposition.

The Board has followed DOE's management of nuclear materials for many years. Eight years ago, the Board issued Recommendation 94-1, *Improved Schedule for Remediation in the Defense Nuclear Facilities Complex*, identifying the need for DOE to stabilize and package unstable nuclear materials for long-term storage or disposition. Whether through recent redesignation of material as inactive, generation of inactive material as a byproduct of mission work, or receipt of additional material from other sites, significant quantities of inactive nuclear materials continue to be stored at laboratory facilities that are near capacity.

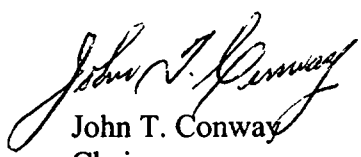
The requirements of DOE's nuclear materials management directive—DOE Order 5660.1B, *Nuclear Materials Management*—as they apply to inactive materials are not being fully met. Many of the inactive materials lack adequate physical or radiological characterization, some packaging is insufficient for extended storage, and plans for reuse or disposal of many items are incomplete. Limited storage space at the laboratories is already affecting safety in the nuclear weapons complex. As an example, the lack of available storage space precludes LANL from accepting shipment of problematic pits from the Pantex Plant, three years after storage concerns were identified. Sound management practices dictate that inactive nuclear materials should be stabilized or dispositioned safely and promptly to reduce site risks and avoid recurrence of the acute problems that led to issuance of Recommendation 94-1.

The Board is aware of some recent progress in addressing inactive material at LANL since the staff review. However, the Board believes more aggressive action is needed to improve management of the inventory of inactive nuclear materials at the nuclear weapons laboratories to ensure that the health and safety of workers, the public, and the environment are protected. Therefore, the Board requests that NNSA examine the issues outlined in the enclosed

report and, pursuant to 42 U.S.C. § 2286b(d), provide a report within 120 days of receipt of this letter of the steps to be implemented to ensure that the requirements of DOE Order 5660.1B are fulfilled and that measures are taken to improve the safe management of inactive nuclear materials at sites managed by NNSA. Specific issues this report should address include the following:

- Evaluation of the adequacy of existing characterization information to support storage and disposition decisions.
- A process to ensure that practicable disposition paths are identified for all existing inactive materials, as well as new materials generated or brought on site.
- Evaluation of the appropriateness of storage systems presently used for inactive materials.
- Identification of sites/facilities for long-term storage of inactive materials awaiting permanent disposition and plans to ensure that certification and availability of all required shipping containers are being pursued aggressively and integrated across secretarial offices.
- A protocol to ensure that inactive materials being held for potential future use are periodically evaluated for continuing need and that the bases are documented.
- Development of a long-term strategy for disposition of surplus sealed actinide sources.

Sincerely,



John T. Conway
Chairman

c: The Honorable Jessie Hill Roberson
Mr. Mark B. Whitaker, Jr.

Enclosure

02-1152

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

April 30, 2002

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: T. L. Hunt

SUBJECT: Review of Inactive Nuclear Materials Management at Department of Energy Nuclear Weapons Laboratories

This report documents a review by the staff of the Defense Nuclear Facilities Safety Board (Board) of the management of inactive nuclear materials[1] by the Department of Energy (DOE), National Nuclear Security Administration (NNSA) and the contractors at Los Alamos National Laboratory (LANL) and Lawrence Livermore National Laboratory (LLNL). The overall objective of the staff's review was to assess NNSA's management of nuclear materials that no longer have a programmatic mission and are not part of an ongoing stabilization program. The staff examined LANL's and LLNL's inventory of nuclear materials and the plans for its use, continued storage, or disposition. The staff also evaluated configuration and packaging protocols and assessed conditions or weaknesses that could lead to unnecessary or increased radiation exposure to workers and the public, as well as a higher potential for the release of radioactive materials to the environment.

Background. Maintaining unnecessary nuclear material in DOE's inventory at the nuclear weapons laboratories presents a safety and health liability. Since much of the material is not in a physical or chemical form—or containers—amenable to long-term storage, the inactive material creates a potential for workers, the public, and the environment to be exposed unnecessarily to radiological and toxicological hazards. Although there are hazards associated with handling, processing, and dispositioning this material, the health and safety vulnerabilities will only increase with time as the materials and current containment systems degrade.

DOE Order 5660.1B, *Management of Nuclear Materials*, is cited in both the LANL and LLNL contract. The Order outlines DOE's objectives for the management of inactive nuclear materials. These include characterizing the materials properly as to quantity and chemical and physical forms, processing the materials for long-term safe storage, and making acceptable facilities available for long-term storage. The Order also states that sound materials management policies minimize nuclear materials stored on site or held in user programs that are

[1] DOE Order 5660.1B defines inactive nuclear material as material not currently being used. The term is used to define material that is not in active use, but is being held as a national resource or for potential future programmatic use by DOE. The term is also used to define material that is not currently in active use and not being held for potential future use; it is ultimately destined for disposition/discard, although it is not classified as waste.

not needed for near-term mission accomplishment. The Order requires that inactive nuclear materials be identified and handled promptly. Other stated objectives of the Order are to implement a program to prepare plans for disposition of nuclear materials, including operation of processing and storage facilities, and to provide justification for continued storage of materials being retained for potential future use.

DOE requires its field offices to assess the status of their contractor-held inventory of accountable nuclear materials annually, report on the use of each material, and ascertain whether it is still required to support programmatic needs. The nuclear materials of interest for the purpose of the staff's reviews include various isotopes of plutonium, uranium, thorium, neptunium, americium, and curium. All of these elements are represented in the inactive material inventories of both laboratories. The materials exist in metal, oxide, residue, solution, and other forms.

Observations. LANL and LLNL continue to house substantial inventories of inactive nuclear materials that represent a potential hazard to workers, the public, and the environment. The Office of Infrastructure, Facilities, and Construction at LANL tracks more than 20,000 accountable items. Of this total, about one-third have been declared inactive. The Nuclear Materials Management group at LLNL tracks more than 5,000 accountable items, with more than half declared inactive. As with the materials originally recognized in the Board's Recommendations 94-1, *Improved Schedule for Remediation in the Defense Nuclear Facilities Complex*, and 97-1, *Safe Storage of Uranium-233*, it is not clear how some of the hundreds of kilograms of inactive nuclear material at LANL and LLNL will eventually be dispositioned for the long term. Existing inactive special nuclear materials and other actinides may require treatment for conversion to forms more suitable for safe interim storage, long-term storage, or off-site shipment. Although some of the inactive materials at the laboratories are part of the ongoing Recommendation 94-1 and 97-1 stabilization programs, no stabilization or disposition paths have been identified for numerous other items.

As a general practice—in accordance with DOE requirements—sites should attempt to minimize the quantity of unneeded nuclear material retained in storage. There is a potential for materials not being used for programmatic needs to be neglected or inadequately managed. Delays in stabilizing and repackaging materials not in forms amenable to long-term storage or off-site shipment, and deferral of dispositioning of unneeded inactive materials could give rise to needless hazards for workers, the public, and the environment. An integral component of any site plan to address storage space constraints is removal of unneeded materials. The following issues and concerns that limit DOE's ability to manage its inventory of inactive nuclear material safely and properly—organized by the applicable DOE Order 5660.1B requirement—were noted by the Board's staff during the reviews.

Sound materials management policies minimize [inactive] nuclear materials stored onsite (Chapter V.1).

There were few indications at the facilities visited by the Board's staff that the laboratories were successfully minimizing the quantity of nuclear materials stored on site which are not needed for near-term mission accomplishment. In many instances, active and inactive

materials are commingled in storage and managed similarly. Storing unneeded material in vaults that are accessed regularly for mission work or in unshielded areas contributes to additional worker dose and does not coincide with As Low As Reasonably Achievable (ALARA) dose objectives. Additionally, since inactive material may not be as well characterized, stabilized, or packaged, the surveillance and maintenance programs for active materials may be inadequate for inactive materials.

Nuclear material storage systems located at Technical Area (TA)-18 and TA-55 at LANL are presently near capacity. Some material previously kept in TA-18 vaults has been moved to trailer storage. There is a significant inventory of material stored in the work areas of TA-55 because of vault space limitations—limitations that have the potential to affect emergent programs. The Chemistry and Metallurgy Research Facility was recently downgraded from a safeguards and security Category I to a Category III facility, and its vault therefore may be of limited use in resolving storage issues within LANL and NNSA-wide.

Limited storage space at TA-55 is already affecting safety in the nuclear weapons complex. The Pantex Plant currently has a particular set of 18 Type 81 and Type 96 pits that, because of their condition, cannot be placed in adequate storage containers (AL-R8 Sealed Inserts) at Pantex. An investigative report developed by LANL in March 1999 recommended that these pits be sent to LANL to be disassembled. A February 2002 occurrence report identified further potential inadequacies in the safety analysis associated with storing these pits at Pantex. Lack of storage space still precludes LANL from accepting shipment of all these pits, three years after the problem was identified.

The vaults and other storage locations at LLNL—including freezers, safes, and shelves—are also near capacity, and the situation is expected to worsen as programmatic activities and the accompanying inventory of special nuclear materials increase. The number of unneeded inactive items on site continues to grow, in large part because LLNL has had difficulty shipping material off site in recent years. LLNL expects to receive more plutonium for programmatic use in the near future, but receipt of this material could be problematic because of the limited availability of storage space.

The management of inactive nuclear material includes proper characterization, processing of materials for long-term safe storage, and the availability of acceptable facilities for long-term storage (Chapter VI.1).

Characterization—Proper characterization of nuclear material in inventory is necessary to ensure safe storage and expedite the decision-making process for the handling of inactive nuclear materials. LLNL lacks the comprehensive knowledge about much of its inactive inventory that may be needed to facilitate safe management and disposition. For example, LLNL personnel discovered that 130 stored items consisted of pyrophoric uranium chips in December 2001. There is currently no protocol in place for prioritizing and beginning to characterize unneeded inactive material in support of the initiation of disposition actions. It would be beneficial to begin characterizing these materials, both to ensure safe storage and to facilitate disposition. Much of the characterization effort is necessary regardless of what disposition path and attendant characterization requirements are specified in the future.

LANL stores inactive items that contain more than one radioactive element and are difficult to characterize. Currently, there are no practical nondestructive assay technologies available at the laboratory to characterize some of these materials for disposition (e.g., items containing both plutonium and neptunium). Other material that has been stored in drums for many years is poorly characterized as to material form.

Material Processing—Much of the nuclear material at LLNL will require processing for conversion to stable forms suitable for long-term storage or disposition. Although LLNL has a plutonium stabilization and packaging system for handling Recommendation 94-1 material, other inactive plutonium needs some type of stabilization, as does most of the highly enriched uranium (possibly excluding larger metal items), and about one-third of the uranium-233 requires processing and consolidation. Comprehensive processing needs have not been identified for the suite of inactive nuclear materials, and there is an expressed need for new processing technologies at the site. Only minimal capabilities for processing LLNL's inventory of highly enriched uranium currently exist on site. LANL personnel noted to the Board's staff the challenges of processing enriched uranium contaminated with plutonium.

Receiver Sites—DOE needs to improve integration among sites to consolidate, where practicable, inactive materials at dedicated storage locations—instead of storage that is commingled with the active inventory—to improve safety, reduce the potential for environmental insult, and minimize cost. Receiver sites are not available to accept much of the material LANL no longer needs and would like to transfer off site. There is uncertainty regarding the long-term disposition of uranium, neptunium, and plutonium, for example. Although LANL has made a few shipments of enriched uranium to the Y-12 National Security Complex recently, management personnel at both laboratories identified a lack of receiver sites and unavailability of shipping containers as their major reasons for not shipping more inactive material off site in the past several years. Expanding the material handling and processing capabilities of existing and future receiver sites to allow for less stringent acceptance criteria could facilitate the movement of inactive material out of LANL and LLNL. Preserving existing capabilities at potential receiver sites will remain essential until the optimal disposition routes and associated facility requirements are defined.

Ensure inactive materials are identified properly and handled promptly (Section 8.i.12).

Inactive nuclear materials continue to be stored for many years in containers and facilities not designed for long-term storage. TA-18 stores about 30 drums of highly enriched uranium that have been retained with unknown or improper packaging and incomplete material characterization for approximately 40 years. TA-18 also stores highly enriched uranium fluoride and nitrate solutions in plastic bottles that are more than 10 years old. Many other inactive items at LANL continue to be stored indefinitely in slip-lid cans.

At LLNL, some materials are known to be stored in deficient packaging systems, including glass vials, cardboard containers, screw-lid cans with elastomer seals, and plastic bottles. Records are incomplete as to how materials are packaged within the metal canisters in

the Building 251 tube vaults. There continue to be some uncertainties with respect to plutonium materials and knowledge of packaging methods. There is also a general lack of knowledge regarding materials stored in drums. It has been many years since some of these materials have been inspected, and a reassessment of the inventory would be prudent, including opening and repackaging of some containers.

All inactive usable materials should [have a] rationale for continued storage and a final disposition plan (Chapter V.3.f).

DOE Order 5660.1B requires that the rationale for continued storage of all inactive materials be clearly identified. However, no documentation was presented to the staff at either LLNL or LANL to support retention of any inactive item categorized as having potential future use. Neither laboratory appears to implement the requirement to periodically justify retention of materials for surveillance or research work in current test plans, readiness reports, or similar documentation.

In accordance with the Order, the field offices have responsibility for ensuring that nuclear materials retained by the contractors are limited to what is needed to support approved programs. It was noted to the staff that the DOE Oakland Operations Office has few individuals with relevant experience in nuclear weapons design, and thus has not been involved in discussions with program representatives or scientists at LLNL about whether materials need to be retained for potential future use. The Board's staff understands that nuclear materials at NNSA's nuclear weapons laboratories may have potential future uses or archival or historical value even if there are no specific plans. Nevertheless, resolution of issues related to retention of materials would benefit from documentation using a periodic, verifiable process within the laboratories, together with the participation of DOE subject matter experts.

Conduct studies and prepare plans for disposition of nuclear materials including operation of processing and storage facilities (Section 7.d).

DOE Order 5660.1B requires that all inactive materials have a defined final disposition plan. Improvement is needed at both LLNL and LANL in the area of viable disposition planning. There are no disposal or disposition paths for many inactive items, while others have identified pathways that are presently unworkable. Examples include neptunium, plutonium-contaminated enriched uranium, highly enriched and depleted uranium, multiple-material items, and sealed actinide sources. Many non-plutonium items to be addressed under Recommendation 94-1 also have unclear packaging and disposition pathways. It appears that LANL and LLNL will have to store some materials indefinitely, until DOE makes policy decisions regarding their final disposition. In the future, it would benefit the sites to have material disposition plans developed before bringing additional material on site or creating inactive material during programmatic work. This approach would help minimize future accumulations of unneeded nuclear materials at the laboratories.

Additional Observations. The staff also made the following observations regarding shipping containers and sealed sources.

Shipping Containers—Site personnel at both LLNL and LANL stated that their ability to ship inactive material off site is hampered by the lack of certified and available shipping containers. Shipping and transportation initiatives within DOE are normally undertaken on a material-specific and program-driven basis. In many cases, each departmental program that ships nuclear material develops its own packaging, and certification of specific shipping containers is pursued on a project-by-project basis. LANL personnel are working to procure shipping containers and gain approvals to allow off-site shipment of plutonium and enriched uranium. DOE's priorities regarding interstate transportation of nuclear materials are heavily focused on issues associated with closure of the Rocky Flats Environmental Technology Site. LANL personnel stated that they are having difficulty obtaining 9975 containers because Rocky Flats needs most of these containers for shipment of its plutonium. Eventual certification of the SAFKEG shipping container should help alleviate problems caused by the shortage of 9975 containers. It must be noted that the plutonium-contaminated uranium items at LANL do not fit in either plutonium shipping container or in the DT-22 container currently used to transport highly enriched uranium to the Y-12 National Security Complex. Increased intradepartmental integration is needed for the design and certification of containers that can be used to ship materials to receiver sites for disposition or reuse.

Sealed Sources—LANL and LLNL continue to store a large number of sealed actinide neutron sources that are not needed by the laboratories. Many of these sealed sources were fabricated before current standards for encapsulation had been promulgated. A small but unnecessary worker dose, along with added potential for contamination release, is created by continued storage of these sealed sources. Radiological risk could be reduced if these sources were removed; however, neither LLNL nor LANL has identified a disposition method. The sealed sources—most of which have not been used for years—contain primarily plutonium-238, plutonium-239, and americium-241, in addition to other actinides.

Conclusion. Both laboratories continue to store significant amounts of inactive nuclear materials that are not part of a rigorous stabilization and disposition program. The staff observed that numerous materials require stabilization and repackaging for safe interim and long-term storage, and many require that decisions be made regarding paths forward for ultimate disposition.