U.S. Department of Energy
Office of Inspector General
Office of Audit Services

Audit Report

The Department of Energy's Spent Nuclear Fuel Canisters and Transportation Casks

DOE/IG-0608

June 2003

Department of Energy
Washington, DC 20585

June 20, 2003

MEMORANDUM FOR THE SECRETARY

FROM: Gregory H. Friedman
Inspector General

SUBJECT: INFORMATION: Audit Report on "The Department of Energy's Spent Nuclear Fuel Canisters and Transportation Casks"

BACKGROUND

The Department of Energy manages about 2,500 metric tons of spent nuclear fuel generated from research and development, plutonium production, and the Naval Nuclear Propulsion Program (Naval Reactors). Under current national policy, the Department is to permanently dispose of its spent fuel in an underground repository, but an appropriate repository is not expected to be available until at least 2010. Until then, the Department plans to consolidate its spent fuel at interim storage sites deemed to have the most appropriate skills, facilities, and technologies: the Hanford Site in Washington; the Idaho National Engineering and Environmental Laboratory; and, the Savannah River Site in South Carolina.

The Department's National Spent Nuclear Fuel Program (National Program) directs the research and development of technologies for all Department-owned spent fuel. Working with the Department's laboratories, the National Program is currently addressing four spent fuel issue areas: efficient packaging and transportation; safe storage; accurate characterization; and, compliance with safety and regulatory requirements. One of the primary goals is to eliminate redundant activities by coordinating common needs among the laboratories. The objective of this audit was to determine whether the National Program has succeeded in achieving this goal.

RESULTS OF AUDIT

The audit disclosed redundancies, specifically with regard to the development of canisters and transportation casks, at Department sites. We noted that Hanford, Naval Reactors, and the National Program simultaneously developed three different spent nuclear fuel canisters for interim storage and related tasks. In addition, the Office of Civilian Radioactive Waste Management and the Naval Reactors program were independently acquiring different casks in anticipation of transporting the Department's spent nuclear fuel to the national repository.

We found that the National Program did not have programmatic authority over canister and cask development for all Department-owned spent fuel. Further, the Department did not have a comprehensive integration plan for cask development. These factors undermined the National Program's goal of reducing programmatic redundancy.

While there were site-specific reasons for some of this activity, we concluded that substantial cost reductions could be achieved through greater coordination and consolidation of these activities. Had the Department eliminated redundant canister development activities when the program began, a significant portion of the $13.8 million spent on design might have been avoided. The opportunity still exists for the Department to avoid potentially redundant development activities for transportation casks by consolidating two development programs with an estimated combined cost of $9 million to $24 million.

We recommended that the Assistant Secretary for Environmental Management and the Director, Office of Civilian Radioactive Waste Management ensure that the National Program has sufficient authority to fully integrate the Department's spent fuel technology development activities, and that an analysis be conducted to determine whether standard canisters should be used for operations at the Hanford Site. Also, we recommended that the Director coordinate with the Deputy Administrator for Naval Reactors to determine whether a single cask development effort would benefit the Department.

MANAGEMENT REACTION

Management generally concurred with the finding and two of the three recommendations. However, the Director, Office of Civilian Radioactive Waste Management did not concur with the recommendation to coordinate cask development efforts with Naval Reactors, stating that there are significant differences between the two spent fuel types, and the additional cost of using a cask suitable for Naval Reactors would exceed the potential benefit from shared development activities.

We recognize that there are significant differences between the two spent nuclear fuel types. However, in our judgment, management was not able to demonstrate that it had performed sufficient technical analyses to support a final determination that additional costs would exceed potential benefits.

Attachment

cc: Deputy Secretary
Under Secretary for Energy, Science and Environment
Assistant Secretary for Environmental Management
Director, Office of Civilian Radioactive Waste Management
Deputy Administrator for Naval Reactors
Manager, Idaho Operations Office

THE DEPARTMENT OF ENERGY'S SPENT NUCLEAR FUEL CANISTERS AND TRANSPORTATION CASKS

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CANISTERS AND TRANSPORTATION CASKS

Development Activities

Despite the existence of the National Spent Nuclear Fuel Program (National Program), the Department of Energy (Department) had not eliminated redundant spent nuclear fuel (SNF) technology development activities at all of its sites. Specifically, the Hanford Site, the Naval Nuclear Propulsion Program (Naval Reactors), and the National Program simultaneously developed three separate canisters for use in storing, transporting, and disposing of SNF. Additionally, the Office of Civilian Radioactive Waste Management and Naval Reactors were independently acquiring casks for transporting the Department's SNF to the national repository.

Canisters

In 1996, as part of the National Program, the Idaho National Engineering and Environmental Laboratory (INEEL) began developing a "standard" SNF canister for storing, transporting, and disposing of 250 types of Department-owned SNF without additional repackaging. As of October 2002, $3.6 million had been expended on this effort and canister design was nearing completion. However, due in part to delays in funding the development effort, no standard canisters other than prototypes had been fabricated.

Although the National Program's intent was to design a standard canister, two other sites undertook separate canister development activities to meet their specific needs. In 1994, prior to the National Program's design effort, Hanford began developing Multi-Canister Overpacks (MCOs) to store N-reactor and single-pass reactor fuel. Hanford's canister development activities were prompted by the 1994 Tri-Party Agreement between the Department, the State of Washington, and the Environmental Protection Agency to address an imminent environmental risk to the groundwater from the Hanford K Basins. One of the Tri-Party Agreement's original milestones was to remove all spent fuel from the K Basins by December 2002, and Hanford officials believed that they were unlikely to achieve that milestone if they waited for the National Program's canister design to be completed. However, one of the limitations of the MCO is that it was not designed for use as a disposal canister. Rather, it was only designed for interim on-site storage. Although National Program officials asked Hanford to postpone MCO development work in order to pursue the possibility of using the standard canister, given the Tri-Party Agreement constraints, Hanford's decision to proceed with its own canister was, from a site-specific perspective, reasonable. However, had Hanford and the National Program been able to better coordinate their efforts, some portion of the $8.1 million spent to develop MCOs might have been avoided.

In 1996, Naval Reactors also began developing a canister. In this case, the canister was to store, transport, and dispose of SNF generated by the Naval Reactors program. Although Naval Reactors utilized design work previously completed in a joint effort among several Department offices, its overall canister development project, like Hanford's, was not fully integrated with the National Program. The lack of such integration raises the question whether Naval Reactors could have avoided some of the $2.1 million spent on its development efforts.

Both the National Program's standard canister and the Naval Reactors' dual-purpose canister were designed for disposal in the national repository. However, because the Hanford-developed MCO was designed only for interim storage, and not for disposal, the National Program is currently performing tests to determine whether the MCO ultimately can be used for disposal. If not, the fuel may have to be repackaged to meet the national repository's disposal requirements. The Department's Office of Environmental Management and Office of Civilian Radioactive Waste Management stated that they were working closely to avoid any repackaging. However, given uncertainties in the licensing process, there is a possibility that some fuel may need to be repackaged regardless of whether it is in an MCO or standard canister.

In total, the Department spent about $13.8 million on three different canister development programs. In some cases, actions taken by individual sites or programs to protect their mission and compliance status were, in our judgment, understandable. However, a more unified approach to canister development across the Department might have eliminated redundant efforts and unnecessary costs and resulted in a superior and more efficient canister.

Transportation Casks

As of 2001, the Department's Office of Civilian Radioactive Waste Management had sole responsibility for acquiring transportation casks for both commercial SNF and most of the Department's SNF. We noted, however, that a second Departmental program is currently developing a cask. Specifically, Naval Reactors has a separate program to design a transportation cask for its SNF. Existing transportation casks will not accommodate either the 15-foot standard canisters used for Environmental Management's SNF or Naval Reactors' 17.5-foot dual-purpose canisters. While similarities in these needs exist, the development efforts are being pursued separately. The Office of Civilian Radioactive Waste Management intends to issue a request for

proposal to acquire a transportation cask in 2004, while Naval Reactors expects to submit its cask design to the Nuclear Regulatory Commission for approval at about the same time. Combined, the two development efforts could cost as much as $24 million.

The Office of Civilian Radioactive Waste Management stated that it is pursuing efforts to reconfigure and license commercially developed transportation casks. If this effort is successful, design costs could be reduced by as much as $15 million. However, Environmental Management previously determined that development of a new cask was necessary because no commercially viable cask could readily accommodate the standard canister.

Program Authority and Integration Plan

Canister and cask development activities were not well coordinated because the National Program did not have programmatic authority for all Department-owned SNF, and the Department lacked a comprehensive integration plan. In 1997, officials with the National Program recognized the opportunity to improve operating efficiencies by eliminating redundant efforts being performed at Department sites. However, the National Program had no authority to require the various sites to consolidate their efforts. As a consequence, Hanford and Naval Reactors selected and implemented their own technologies. Further, development of the standard canister progressed according to a funding level determined at a site, rather than as a national-level priority. Also, although Naval Reactors' fuel is considered part of the SNF owned by the Department, and some of the fuel is currently stored in the same facility as Environmental Management fuel, the National Program has no authority over the development of canisters and casks for Naval Reactor fuel.

The Department issued the *Department-Owned Spent Nuclear Fuel Technology Integration Plan* in May 1996 to define technology needs and to begin integrating development efforts. However, it did not use the plan to coordinate and integrate SNF canister and cask development. For example, the plan identified the need for a standard canister, but it did not analyze opportunities for consolidating the multiple programs that were developing canisters at the time. Further, the plan did not address transportation cask development.

We noted that opportunities to avoid some costs on canisters and casks may still exist. For example, according to the National Program, the unit cost of the standard canister is less than the unit cost of the MCO. Therefore, if Hanford is able to use the standard canister for the remainder of its K Basin SNF, it may be able to reduce overall costs.

Cost Impact

However, we found that no formal cost analysis had been prepared. As part of our audit, we identified about $13.8 million in design costs for spent fuel canisters, some portion of which might have been reduced or eliminated had the Department consolidated redundant SNF activities. Additionally, the Department may still be able to save some of the $9 million to $24 million it expects to spend developing transportation casks.

It may also be feasible for the Department to realize savings by using standard canisters, rather than MCOs, for the remainder of the Hanford Site's SNF. The cost to fabricate an MCO is approximately $80,200, compared to an estimate of about $20,000 per unit for the standard canister. Departmental personnel informed us that these savings might be partially offset by additional costs to migrate to the standard canister. Such costs would include modifying the lifting and handling equipment, fuel drying systems, etc. We were unable to estimate the amount of these potential additional costs. We also noted, however, that using more large standard canisters and fewer MCOs could result in additional savings once the national repository is opened. The Department plans to place MCOs with high-level waste canisters in a waste package for disposal in the national repository. The large standard canister can accommodate the same amount of SNF as the MCO, but has a smaller diameter overall, thereby allowing an additional canister of high-level waste to be placed in each waste package. Thus, the large standard canister would allow for more efficient use of repository space, require fewer shipments, and allow reduced handling.

RECOMMENDATIONS

We recommend that the Assistant Secretary for Environmental Management:

1. Coordinate with the Director, Office of Civilian Radioactive Waste Management to ensure that the National Spent Nuclear Fuel Program has sufficient authority to fully integrate the Department's SNF technology development activities; and,

2. Conduct an analysis to determine whether using standard canisters, rather than MCOs, for the remainder of the SNF at Hanford is feasible and cost-effective.

We recommend that the Director, Office of Civilian Radioactive Waste Management:

3. Work with the Deputy Administrator for Naval Reactors to determine whether a single cask development effort could serve the Department's needs for transporting Department-owned SNF.

MANAGEMENT REACTION

The Assistant Secretary for Environmental Management and the Director, Office of Civilian Radioactive Waste Management generally concurred with the finding and recommendations 1 and 2. Management stated that the finding was consistent with Environmental Management's *Top-to-Bottom Review* and that corrective measures have been initiated to ensure better integration of SNF technology development activities. However, the Director, Office of Civilian Radioactive Waste Management did not concur with recommendation 3, stating that there are significant differences between SNF types, and the additional cost of using a cask suitable for Naval Reactors would exceed the potential benefit from shared development.

The Deputy Administrator for Naval Reactors also responded to the draft report, and generally concurred with the finding and recommendations. However, the Deputy Administrator did not agree with the OIG's conclusion that a portion of the $13.8 million in design costs might have been reduced or eliminated had the Department consolidated its spent fuel activities, stating that the design cost was not redundant. Rather, the design work was necessary to develop and optimize the overall design to meet the unique requirements of Naval Reactors SNF. Also, the unique design saved Naval Reactors $30 million in procurement costs, and could save several hundred millions of dollars more by reducing the number of waste packages at the repository.

Management's verbatim response to the finding and recommendations is included as Appendix 3.

AUDITOR COMMENTS

With regard to recommendation 3, we recognize that there are significant differences between Naval Reactors SNF and other types of SNF. However, management was unable to document that it had performed a technical analysis to support a final determination that additional costs would exceed potential benefits from a consolidated cask development program. If, after such analysis, the Department determines that technical needs are sufficiently diverse to justify development of two different casks, then the Department's integration efforts will have been successful to the maximum extent practical.

Regarding Naval Reactors' assertion that its canister design effort will save the Department millions of dollars in procurement and emplacement costs, these savings are not mutually exclusive of integrating design efforts across the Department. During the audit, Environmental Management made similar statements regarding savings from its standard canister design efforts. Still, regardless of the savings achieved individually, had development efforts been better integrated, some redundant efforts might have been avoided, thereby realizing additional savings.

Appendix 1

PRIOR AUDIT REPORTS

- *Audit of the U.S. Department of Energy's Management of Research and Development Integration* (DOE/IG-0417, March 1998). The audit concluded that the Department of Energy (Department) did not have a system in place to ensure that research and development projects were fully integrated. This occurred because the Department had not clearly established organizational responsibility or authority for integrating research across programs. As a result, the Department may not be using research and development funds effectively to meet its mission.

- *Completion of K Basins Milestones* (DOE/IG-0552, April 2002). Persistent equipment problems and process complexities had kept the Department from meeting its schedule to move spent nuclear fuel from the K Basins to interim storage. Unless these issues can be effectively overcome, the Department will not meet any of the milestones established in the Tri-Party Agreement relating to the cleanup of the K Basins.

Appendix 2

OBJECTIVE

Determine whether the National Spent Nuclear Fuel Program (National Program) has eliminated certain redundant technology development activities across the complex.

SCOPE

The audit was performed from April 16, 2002, to December 5, 2002, at the Idaho Operations Office and Bechtel BWXT Idaho, LLC in Idaho Falls, Idaho; the Richland Operations Office in Richland, Washington; and, the Naval Nuclear Propulsion Program (Naval Reactors) Office in Washington, D.C. The audit scope was limited to certain technology development activities for the storage, treatment, transportation, and disposal of Department-owned Spent Nuclear Fuel (SNF).

METHODOLOGY

To accomplish the audit objective, we:

- Researched Federal and Departmental regulations regarding SNF activities and technology development;
- Reviewed findings from prior audit reports regarding SNF activities and technology integration;
- Assessed internal controls and performance measures established under the Government Performance and Results Act of 1993;
- Interviewed key Department personnel regarding technology development activities and plans; and,
- Analyzed the Department's planning, performance, and budgetary data for technology development activities associated with the treatment, storage, transportation, and disposal of Department-owned SNF.

The audit was performed in accordance with generally accepted Government auditing standards for performance audits and included tests of internal controls and compliance with laws and regulations to the extent necessary to satisfy the audit objective. Specifically, we tested controls with respect to the Department's planning process for waste management activities. Because our review was limited, it would not necessarily have disclosed all internal control deficiencies that may have existed at the time of our audit. We did not rely on information processed on automated data processing equipment to accomplish our audit objective.

We held an exit conference with management from the Office of Environmental Management, Naval Reactors, and the Office of Civilian Radioactive Waste Management on April 28, 2003.

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United States Government **Department of Energy**

memorandum

DATE: April 7, 2003

REPLY TO ATTN OF: EM-21 (Andrew Griffith, 301-903-7120)

SUBJECT: Draft Report on "The Department of Energy's Spent Nuclear Fuel Program"

TO: Frederick D. Doggett, Deputy Assistant Inspector General for Audit Services
Office of Inspector General

Thank you for the opportunity to review the Office of Inspector General draft report, "The Department of Energy's Spent Nuclear Fuel Program." This response represents the position of both the Office of Environmental Management (EM) and the Office of Civilian Radioactive Waste Management (RW).

Our offices agree that greater coordination is needed in all of the Department's SNF disposition activities. Further, we acknowledge that improved integration could have minimized redundancies and cost in some cases. This was a finding of the EM Top-to-Bottom review.

To address this finding, a Corporate Project was established by EM and is being supported by RW and other Departmental offices. This project, Integrated/Risk Driven Disposition of Spent Nuclear Fuel, was initiated in October 2002 to develop a comprehensive, integrated strategy for the disposition of DOE's SNF. The initial findings of the Corporate Project validate the need for greater integration and more formal project management tools. The Corporate Project is scheduled to complete its review and recommend a corporate strategy by the end of this fiscal year.

In regard to the specific recommendations of the draft report:

- EM concurs with recommendations 1 and 2. These are already sub-projects of the EM Top-to-Bottom Corporate Project, Integrated/Risk Driven Disposition of Spent Nuclear Fuel.

- RW non-concurs with Recommendation 3 and believes the significant differences between the Naval Reactor SNF and other fuel require different approaches.

Attachment 1 provides the consolidated comments from EM and RW, the National SNF Program, and the Richland and Idaho Operations Offices. General reactions are provided, as well as specific responses to sections of the draft report and to the draft recommendations.

Jessie Hill Roberson
Assistant Secretary for
Environmental Management

Dr. Margaret S. Y. Chu, Director
Office of Civilian Radioactive
Waste Management

Attachment

cc:
K. Klein, RL
W. Bergholz, ID

U. S. DEPARTMENT OF ENERGY
Washington, DC 20585

February 14, 2003

Mr. Fred Doggett
Deputy Assistant Inspector General for Audit Services
IG-32/FORS
U.S. Department of Energy
1000 Independence Ave. S.W.
Washington, DC 20585

Dear Mr. Doggett

This is Naval Reactors' (NR) response to the DOE IG draft report "The Department of Energy's Spent Nuclear Fuel Program," dated January 24, 2003. NR generally concurs with the recommendations of the report. In fact, NR has been working with and exchanging information with the Office of Civilian Radioactive Waste Management on canister design. Like the canister design, NR's transportation cask will be designed with significant interaction with RW. As these designs develop, information is and will be shared to ensure that any redundant work is eliminated.

While NR generally agrees with the information reported by the IG, NR would like to clarify one issue raised by the audit. With regard to the information on cost impact, the IG stated that about $13.8 million in design costs expended for spent fuel canister design might have been reduced or eliminated had the Department consolidated SNF activities.

Unfortunately this is an inaccurate conclusion. The canister design cost was not redundant. This work was necessary to develop and optimize the overall design to meet the unique requirements of naval spent nuclear fuel. This work significantly reduced the required number of canisters, storage overpacks, and associated hardware. By increasing the length of the standard canister to meet naval spent nuclear fuel requirements, NR will save over $30 million in procurement costs for this hardware since it reduces the number of canisters needed by about 100. This savings does not include the several hundred million that will come from reducing the number of emplacements at the repository.

NR appreciates the opportunity to comment on the COE-IG draft report.

/s/
T. H. Beckett
Naval Reactors

IG Report No.: DOE/IG-0608

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