U.S. Department of Energy
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Office of Audit Services

Audit Report

National Nuclear Security Administration's Pit Disassembly and Conversion Facility

DOE/IG-0688

May 2005

Department of Energy

Washington, DC 20585

May 3, 2005

MEMORANDUM FOR THE SECRETARY

FROM: Gregory H. Friedman
Inspector General

SUBJECT: INFORMATION: Audit Report on the "National Nuclear Security Administration's Pit Disassembly and Conversion Facility"

BACKGROUND

In September 2000, the United States and the Russian Federation signed the Plutonium Management and Disposition Agreement, which committed each country to dispose of 34 metric tons of surplus plutonium. To meet this goal, the Department of Energy's National Nuclear Security Administration (NNSA) plans to convert the plutonium into mixed oxide fuel for commercial reactors. NNSA will construct two facilities for this activity, the Pit Disassembly and Conversion Facility and the Mixed Oxide Fuel Fabrication Facility – both at the Savannah River Site.

As required by the National Defense Authorization Act (Defense Act), the Department outlined its disposal plans for surplus plutonium in February 2002. As part of that plan, NNSA reported to Congress that the Pit Disassembly and Conversion Facility (Conversion Facility) would be operational in Fiscal Year 2009 and would cost an estimated $1.7 billion. Because of the importance of this facility to achieving the Department's ultimate disposal goal, we initiated an audit to determine whether the overall project was on schedule and within budget.

RESULTS OF AUDIT

As has been widely acknowledged, the construction of the Conversion Facility has been delayed, primarily due to foreign policy issues that are beyond NNSA's immediate control. Our review confirmed that the schedule and cost parameters outlined in the Department's February 2002 Report to Congress will not be met despite the importance of the project and the high priority that it has been assigned. At the time of our review, NNSA's estimate was that the Conversion Facility would not be completed until 2013 – a four year delay – provided that the remaining foreign policy issues are resolved in the near term. In addition, NNSA's costs for the Conversion Facility will likely increase substantially beyond the life-cycle cost of $1.7 billion reported to Congress in 2002.

While international policy issues appeared to have played a paramount role in the current state of the Conversion Facility, we noted that NNSA had encountered technical problems in completing the design phase of the project. Design phase schedule delays occurred, in part, because Los Alamos National Laboratory and its responsible sub-contractor, who had primary responsibility for the equipment development portion of the project, have experienced difficulty in modifying the needed Conversion Facility equipment from prototype to full-scale production. Furthermore, NNSA had not identified an approach for disposing of the waste generated by the Conversion Facility and the Mixed Oxide Fuel Fabrication Facility (MOX Facility). We noted that the cost of the method ultimately selected for waste disposal is likely to be significantly higher than the nominal costs that NNSA officials indicated were included in its 2002 Report to Congress.

Further, because the MOX Facility processes are dependent on the output of the Conversion Facility, any material delay in completing the Conversion Facility could result in increased operational costs for the MOX Facility. In fact, we concluded that this could cause an increase in operational costs of just over $200 million.

To address the issues disclosed as part of the audit, this report includes recommendations designed to assist NNSA in finalizing its Conversion Facility design, identifying a waste disposal path, and linking project schedules of the Conversion and MOX Facilities.

During the course of the audit, NNSA expressed strong disagreement with our conclusions. Specifically, NNSA disagreed that the "prototype to full-scale production" matter was the cause for the slippage in the design schedule. But, NNSA did not provide convincing evidence that design delays were caused by any other specific factor. NNSA also disagreed that a delay in completing the Conversion Facility would increase MOX operating costs. However, we found that NNSA did not have a formal integrated schedule to manage/control the completion of the two projects. Such a schedule is essential to ensuring the Conversion Facility is completed timely and is able to provide feedstock, thereby, avoiding idle capacity costs at the MOX Facility. Finally, NNSA did not agree with our conclusion relating to the cost increase resulting from the ultimate choice in waste disposal approach. However, NNSA did agree that it has not decided on a waste disposal path for the wastes and that initial costs included in the 2002 estimate for waste disposal were nominal. In finalizing this report, we considered NNSA's position and revisited our conclusions where appropriate.

MANAGEMENT REACTION

Although Management agreed with our recommendations, it noted that it could not act on the majority of them until the current foreign policy impasse between the U.S. and Russia is resolved.

Management's detailed comments and our responses are described beginning on page 4 of this report.

Attachment

cc: Deputy Secretary
Administrator, National Nuclear Security Administration
Chief of Staff
Associate Administrator for Management and Administration

REPORT ON THE NATIONAL NUCLEAR SECURITY ADMINISTRATION'S PIT DISASSEMBLY AND CONVERSION FACILITY

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Project Design and Schedule

Background

In order to dispose of surplus plutonium, the National Nuclear Security Administration (NNSA) planned to construct two facilities at the Savannah River Site. The first facility, the Pit Disassembly and Conversion Facility (Conversion Facility), is designed to convert surplus nuclear weapon pits and plutonium metal into an oxide. The second facility, the Mixed Oxide Fuel Fabrication Facility (MOX Facility) will convert the plutonium oxide produced by the Conversion Facility into fuel for use in commercial nuclear power plants. The Conversion Facility will utilize the Advanced Recovery and Integrated Recovery System (ARIES) developed by the Los Alamos National Laboratory (LANL) in collaboration with Lawrence Livermore and Sandia National Laboratories to produce plutonium oxide. The ARIES system separates plutonium from nuclear weapons components called pits and produces plutonium oxide. The ARIES system consists of eight modules housed in a sequential series of gloveboxes for bisecting the pits, removing the plutonium from the pits and converting the plutonium into plutonium oxide.

Cost and Schedule Slippage

Based on our review of project data, we determined that NNSA will not meet the schedule and cost established for the Conversion Facility as outlined in its February 2002 Report to Congress (Report). In the National Defense Authorization Act of FY 2002, Congress directed the Department to provide, not later than February 1, 2002, a plan outlining a schedule and cost for disposing of surplus defense plutonium. NNSA issued the Report, which indicated that the Conversion Facility would be completed by FY 2009 at a life-cycle cost of $1.7 billion. Since that time, the schedule to finish construction of the Conversion Facility has slipped and may not be completed until 2013. In addition, total project costs will increase substantially from the original 2002 cost estimate once the full cost of waste disposal is recognized.

Schedule Slippage

Although the Conversion Facility Project is still in the design phase, the schedule for construction completion of the Conversion Facility has slipped by as many as four years. In May 2003, NNSA approved the Design Contractor's Preliminary Design Report for the building, which set the project's detailed design date at October 2003 and revised the overall project completion date to FY 2010. Subsequently, the project's detailed design slipped about two years – to September 2005. Then, the Request for Proposal (RFP) for award of a contract for a full-time construction manager,

originally scheduled to be issued in October 2003, was delayed until April 2005. The Contracting Officer projected that once the RFP for a construction manager was issued, it would take from 12 to 18 months to award the contract. Therefore, the contract award could be delayed to as late as October 2006. In September 2004, the Assistant Deputy Administrator for Fissile Materials Disposition provided us with documentation showing that the startup of the Conversion Facility had slipped to 2013.

NNSA officials stated that the schedule delays were attributable to the disagreement between the U.S. and Russia about liability for work performed by U.S. contractor personnel working in Russia and a change in funding priorities. NNSA officials indicated that Congressional and Administration direction has been that the U.S. and Russian plutonium disposition programs must proceed in parallel and the disagreements between the two countries have impacted NNSA's ability to proceed with construction.

While foreign policy issues have delayed the start of construction, we found that NNSA has experienced technical problems completing equipment design for the Conversion Facility. Specifically, NNSA has had difficulty in taking prototype equipment and modifying it for full-scale production use in the Conversion Facility. NNSA believed that LANL's ARIES demonstration model was prototypical of the equipment needed to produce 3.5 metric tons of plutonium oxide per year and would easily convert from the laboratory to the industrialization phase. However, this turned out not to be the case. For example, the prototype lathe used to dissect the pits required modification. The lathe was wider than the original, which required a wider glovebox, making the interior of the lathe inaccessible to the operators if problems occurred. Additionally, while the ARIES system made use of robotics to reduce worker dosage, LANL has encountered difficulties in incorporating the use of robotics into its final equipment designs. Also, the technical design of the crucible breaking station had to be modified. Finally, the direct metal oxidation furnace, used to heat pits to extremely high temperatures, had to be redesigned in order to meet design requirements for surface temperature. The Conversion Facility's equipment design is still not complete and, in March 2004, NNSA transferred the responsibility for equipment design from LANL's subcontractor to the building design contractor.

Waste Disposition Costs

We determined that, once waste disposal is factored in, NNSA's costs for the Conversion Facility Project will increase substantially over the $1.7 billion estimate. While NNSA officials told us that they included nominal amounts for waste disposal in their 2002 cost estimate to Congress, they did not identify a specific plan for disposal of the surplus plutonium generated by the Conversion and MOX Facilities.

After considering several options for disposition of waste, NNSA informed Congress, through budget data sheets for FYs 2004 and 2005, of its intent to dispose of the waste generated by the Conversion and MOX Facilities by constructing a Waste Solidification Building (WSB) that would be added to the Conversion Facility Project. However, an estimated cost for this disposal option was not reported. NNSA stated that they had not made a final decision on how they would dispose of waste generated by the process and that a decision on proceeding with the WSB or some other alternative is not expected to be forthcoming until 2005.

Project Impacts

Problems with completing the Conversion Facility in a timely manner could result in increased operational costs for the associated MOX Facility. Specifically, each year that the Conversion Facility is delayed could potentially impact MOX Facility operations by $102 million, the estimated annual operating cost of the MOX Facility. Based on NNSA's current assumptions, the MOX Facility has only enough feedstock to run until 2011. After that date, the MOX Facility will be dependent upon the Conversion Facility to supply its feedstock. If the Conversion Facility is not operational, processing at the MOX Facility would cease. As stated previously, the Conversion Facility may not be operational until 2013; therefore, the two-year delay to the Conversion Facility Project could result in a $204 million increase in operational costs for the MOX Facility.

Not providing for a means to dispose of waste produced by the Conversion and MOX Facilities resulted in a substantial underestimate of the projects' overall cost. Specifically, regardless of the method of waste disposition ultimately selected by NNSA, it is clear that the cost of the project will increase beyond the $1.7 billion reported to Congress in 2002. For example, NNSA approved the Design Contractor's May 2003 Preliminary Design Report which contained a life-cycle cost estimate (LCCE) of $158 million for the WSB. As of February 2004, the LCCE of the WSB had increased to $617 million.

RECOMMENDATIONS

We recommend that the Administrator, National Nuclear Security Administration:

1. Finalize the design of the equipment needed to successfully operate the Conversion Facility;

2. Determine a waste disposal path for Conversion Facility and MOX Facility waste;

3. Develop a complete cost baseline for the Conversion Facility Project that includes waste disposal;

4. Ensure that the Conversion Facility Project and MOX Facility schedules are linked to avoid idle capacity at the MOX Facility; and

5. Inform Congress of changes to the cost of the Conversion Facility Project, including the cost for waste disposal.

MANAGEMENT AND AUDITOR COMMENTS

Management agreed with our recommendations, but indicated that, with the exception of recommendation 1, they would not be able to implement them until the foreign policy impasse is resolved with the Russians. With regard to recommendation 1, NNSA cited that they are in the process of finalizing the design of the equipment. Management disagreed with several of the conclusions outlined in the report. Their specific comments, followed by our responses, are detailed below.

Management Comment: Management disagreed that the award of the construction management contract for the Conversion Facility was past due. Specifically, the contract award is linked to the start of construction of the MOX Facility and, therefore, given the Conversion Facility delays, sufficient time is remaining to award the construction management contract. Management also did not agree that the two-year design schedule delay was caused by technical problems in modifying the ARIES model.

Auditor Comment: NNSA has been unable to demonstrate how the award of the contract, the execution of the construction manager's responsibilities, and final construction is linked to the operation of the MOX Facility within the two-year timeframe. Management had not developed an integrated schedule of the critical events necessary to design and construct the two facilities. For example, management chose to include waste disposal as part of the Conversion Facility Project. However, it has not scheduled the actions necessary to dispose of waste generated when the MOX

Facility begins operation. Without integrated schedules, management cannot be assured that design and construction activities associated with the two facilities are proceeding in synchronization to achieve the two-year linkage in the beginning dates for operating the two facilities. Although management disagreed that problems in taking prototype equipment and modifying it for full-scale production use caused the design delay, it did not provide any convincing evidence of other specific factors contributing to the delay.

Management Comment: Management also disagreed that the delay in constructing the Conversion Facility could cause an increase in the operating cost of the MOX Facility. Management stated that the Conversion Facility is scheduled to begin operation no later than two years after the MOX Facility begins operation. During the interim period, the MOX Facility will process readily available feedstock. Management asserted that, although the beginning dates for operation of the two plutonium processing facilities have changed, the time linkage remains fixed which would avoid any increases in the MOX operating costs.

Auditor Comment: While management asserted that it is maintaining a two-year linkage in the schedule for the construction of the two plutonium disposition facilities that will avoid increased operating costs for the MOX Facility, it was unable to demonstrate how it planned to manage the design and construction of the two facilities within the two-year window.

Management Comment: NNSA indicated that any major construction project delayed several years as a result of foreign policy concerns would incur significant cost increases and, although there was no separate cost category for waste disposal in the 2002 Report to Congress, such costs were included in the design, construction, operation, and contingency costs for the two plutonium disposition facilities. Management added that it did not believe that the $617 million Waste Solidification Building was a cost-effective solution to waste disposal and that it is unlikely to be built. Management plans to initiate discussions with the Office of Environmental Management in 2005 to explore ways to utilize existing infrastructure at the Savannah River Site to reduce waste disposal costs.

Auditor Comments: While we recognize that the schedule delays have resulted in cost increases, a major driver of the cost increases is attributable to waste disposal. Since NNSA has not, as of 2005, decided on how it will dispose of waste, it is unlikely that the 2002 Report to Congress fully considered the magnitude of the cost to

dispose of waste. Furthermore, although management asserts that the Waste Solidification Building is unlikely to be built, we noted that it is part of the application that the Department submitted to the Nuclear Regulatory Commission for a permit to begin construction of the MOX Facility. The Nuclear Regulatory Commission approved the application in March 2005.

Appendix 1

OBJECTIVE

The objective of the audit was to determine whether the Pit Disassembly and Conversion Facility was on schedule and within budget.

SCOPE

The audit was performed from April 2003 to February 2005 at the Savannah River Site in Aiken, South Carolina; Washington Group International, Inc. in Denver, Colorado; and Los Alamos National Laboratory in Los Alamos, New Mexico. The audit included a review of the Department's plans for designing and constructing the Conversion Facility from December 1997 to December 2003.

METHODOLOGY

To accomplish the audit objective, we:

- Researched Departmental directives regarding project management;
- Analyzed the Design-only Conceptual Design Report for Pit Disassembly and Conversion Facility (December 1997, Revision 0);
- Reviewed additional studies, cost estimates, and schedules for the Conversion Facility;
- Assessed compliance with the Government Performance and Results Act of 1993; and,
- Interviewed NNSA personnel, the Department's contracting officer, Washington Group International, Inc. personnel, and LANL and Jacobs Engineering personnel to evaluate the Department's goals for the Conversion Facility.

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. Accordingly, we assessed internal controls and performance measures related to the design of the Conversion Facility. We assessed the Department's compliance with the Government Performance and Results Act of 1993 and determined that performance measures had been established and were appropriate. 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 conduct a reliability assessment of computer-processed data because only a very limited amount of computer-processed data was used during the audit.

We held an exit conference with management officials on April 8, 2005.

PRIOR AUDIT REPORTS

- *Savannah River Site's Waste Solidification Building* (IG-0618, September 2003). The Department's plan for the Plutonium Disposition Program was incomplete in that NNSA plans to transfer the waste treated at the WSB to Environmental Management, but Environmental Management has no corresponding plans to receive, process, and dispose of the waste. In addition, neither NNSA nor Environmental Management has developed a cost or schedule baseline for the disposal of WSB-treated waste. A path forward does not exist because the Department has not established a policy for disposal of newly generated nuclear wastes from NNSA activities. Without an integrated and coordinated plan, the Department's accelerated cleanup goals may not be achieved and life-cycle costs for the Plutonium Disposition Program are likely to exceed initial estimates.

- *The Department of Energy's Strategy for Disposal of Plutonium* (ER-L-02-01, February 2002). The Department's original approach for the disposal of plutonium – immobilizing 8.4 metric tons of plutonium and converting 25.6 metric tons to fuel – is estimated to cost about $6.3 billion. In contrast, we estimated that converting all 34 metric tons to reactor fuel would cost about $4.6 billion and immobilizing all the material would cost about $4.3 billion. Department officials originally believed that converting all of the plutonium into fuel was not technically feasible and the Russian Federation would reject a proposal to immobilize the entire amount. However, the Department had since resolved the technical feasibility issues surrounding conversion. The audit disclosed that the Department could save at least $1.7 billion by converting all of the surplus plutonium into fuel and avoiding the cost of plutonium immobilization.

- *The Plutonium Immobilization Plant at the Savannah River Site* (IG-0522, September 2001). The proposed Plutonium Immobilization Plant potentially overlapped with the capability of the Savannah River Site's FB Line Facility, and could duplicate the capability of the Treatment and Storage Facility, which was scheduled to be operational in September 2008. The Department's Office of Fissile Materials Disposition had not considered the FB Line Facility or the Treatment and Storage Facility as alternatives for disposing of excess plutonium. We estimated that the Department could save $650 million if it used existing or planned facilities, rather than build the Plutonium Immobilization Plant.

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