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memorandum

DATE: May 25, 1994

REPLY TO
ATTN OF: IG-1

SUBJECT: INFORMATION: Report on "Audit of the Uranium Solidification Facility at the Savannah River Site"

TO: The Secretary

BACKGROUND:

In the late 1980s, the Department of Energy (Department) decided to construct a Uranium Solidification Facility at the Savannah River Site to process liquid uranyl nitrate into powder. At that time, the Department had three nuclear reactors capable of producing radioisotopes for its nuclear weapons program. The Department anticipated a continuing need to process the liquid uranyl nitrate that was generated by processing spent fuel from reactor operations. However, because of decreasing requirements for weapons material, the Department placed the last of these reactors in cold standby in March 1993.

When initially conceived, the facility's estimated cost was about \$60 million. As of November 1993, the facility's estimated total project cost had risen to \$218 million, of which \$147 million had already been spent.

DISCUSSION:

We initiated this audit to assess the need for the Uranium Solidification Facility in light of the new Departmental direction. The audit disclosed that the Department was continuing to construct the Facility even though the need to process liquid uranyl nitrate had significantly diminished, and other alternatives had not been adequately considered.

Our office issued a "Management Alert" in January 1994 recommending the Manager, Savannah River Operations Office, explore transportation and processing alternatives to safely and cost effectively eliminate the current inventory of liquid uranyl nitrate, while holding project costs at a minimum during the reevaluation. The Manager, Savannah River Operations Office, immediately implemented the recommendation and is currently evaluating alternatives to identify the safest and most cost-effective method of treatment of uranyl nitrate without recovery of the enriched uranium.

MASTER

Since management had already implemented our earlier recommendations no recommendation was made in the attached report. However, the report does contain a suggestion to management to establish procedures requiring frequent reassessment of programs and projects, particularly when significant program changes occur.

John C. Layton
Inspector General

Attachment

cc: Deputy Secretary
Under Secretary

U.S. DEPARTMENT OF ENERGY
OFFICE OF INSPECTOR GENERAL

AUDIT OF THE URANIUM SOLIDIFICATION FACILITY
AT THE SAVANNAH RIVER SITE

Report Number: DOE/IG-0349
Date of Issue: May 25, 1994

Eastern Regional Audit Office
Oak Ridge, TN 37831

AUDIT OF THE URANIUM SOLIDIFICATION FACILITY
AT THE SAVANNAH RIVER SITE

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PART I
OVERVIEW

INTRODUCTION

In the late 1980s, the Department of Energy (Department) decided to construct a Uranium Solidification Facility at the Savannah River Site to process liquid uranyl nitrate into powder. At the time the facility was planned, the Department had three nuclear reactors capable of producing tritium and other radioisotopes for its nuclear weapons program. The Department anticipated a continuing need to process the liquid uranyl nitrate that was generated by processing spent fuel from reactor operations. However, because of decreasing requirements for weapons material brought about by arms reduction agreements and related events, the Department placed the last of these reactors in cold standby in March 1993.

We initiated this audit to assess the need for the Savannah River Site Uranium Solidification Facility in light of the new Departmental direction. Specifically, the audit objective was to determine whether there was a more cost effective method for processing the remaining quantities of liquid uranyl nitrate stored at the Savannah River Site.

SUMMARY OF FINDING

The audit disclosed that the Department continued to construct the Uranium Solidification Facility even though its need to process liquid uranyl nitrate had significantly diminished. Moreover, the audit identified more economical alternatives for processing existing quantities of liquid uranyl nitrate at the Savannah River Site. Construction of the facility continued because the Department's procedures did not ensure that projects of this type were periodically reassessed when significant program changes occurred. Cancellation of the project could save the Department as much as \$71 million.

On January 5, 1994, as part of this audit, we issued a "Management Alert" on the Uranium Solidification Facility. We suggested Department management reevaluate the project because it was no longer needed to support site operations. We recommended that the Manager, Savannah River Operations Office, explore transportation and processing alternatives to safely and cost effectively eliminate the current inventory of liquid uranyl nitrate, while holding project costs at a minimum during the reevaluation.

The Manager, Savannah River Operations Office, concurred with the finding and recommendation in the Alert, and provided details on corrective actions planned and already initiated. In our opinion, the Department's timely and responsive actions enabled it to maximize available opportunities for improved operations, and put limited resources to the best possible use.

On February 25, 1994, the Manager, Savannah River Operations Office, directed the contractor to suspend construction of the facility. The Manager advised the Office of Inspector General that the contractor had prepared a detailed plan for the suspension of the construction project, and most of the contractor employees involved with the facility had already been reassigned. In addition, the Manager reported that the contractor had been directed to "pursue vigorously" the evaluation of alternatives, to identify the safest and most cost-effective method of treatment of uranyl nitrate without regard to the recovery of enriched uranium. The evaluation is to be completed in June 1994. The actions taken by Department management in response to our Management Alert are discussed in more detail on page 7 of this report.

To further improve the efficiency and effectiveness of Departmental operations, we suggest that the Manager, Savannah River Operations Office establish procedures requiring frequent reassessment of programs and projects, particularly when significant program changes occur.

The Savannah River Operations Office reviewed the draft report and concluded that an exit conference was not necessary. The exit conference was waived on May 3, 1994.

Office of Inspector General

PART II
DETAILS OF FINDING

BACKGROUND

For almost 30 years, the Department recovered and recycled the enriched uranium left in its spent production reactor fuel elements at the Savannah River Site. Recycling was accomplished by: (1) shipping liquid uranyl nitrate ^{1/} to the Department's Y-12 Plant in Oak Ridge, Tennessee; (2) processing the liquid uranyl nitrate into a uranium alloy; and (3) shipping the uranium alloy back to the Savannah River Site for fabrication into reactor fuel tubes for use in the reactors. For Fiscal Years 1983 through 1987, the site averaged 70 shipments (approximately 296,000 gallons) of liquid uranyl nitrate per year to Oak Ridge. While this approach was successfully employed, it required over-the-road shipments between Savannah River and Oak Ridge.

In the late 1980's, the Department decided to construct a facility at the Savannah River Site to process liquid uranyl nitrate generated by reactor operations and to process the 55,000 gallons of liquid uranyl nitrate already in storage. The facility was intended to convert the liquid uranyl nitrate into uranium oxide powder, which could be shipped more safely to the Department's Y-12 Plant in Tennessee. The uranium oxide powder would then receive further processing to recover highly enriched uranium for use in reactor operations.

When initially conceived, the facility's estimated cost was about \$60 million. As of November 1993, the facility's estimated total project cost had risen to \$218 million, of which \$147 million had already been spent.

NEED FOR THE URANIUM SOLIDIFICATION FACILITY

The facility was originally justified based on a continuing need to process liquid uranyl nitrate to recover and recycle uranium for use in reactor operations. However, current

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^{1/} A liquid which contains a compound composed of uranium-235 and various nitrates. The liquid is produced when certain operations at the Savannah River Site chemically process spent fuel reactor rods to recover neptunium-237 and uranium-235, which provides a fuel source for nuclear reactors.

circumstances, including the decrease in nuclear weapons production, differ from those originally envisioned. The Department had not reevaluated its need for the facility, even though the need to convert liquid uranyl nitrate into powder had significantly diminished as a result of the changing conditions.

Original Justification

The Department's original justification for constructing the facility was to meet long-term processing and transportation safety needs. In 1988, the Department expected its three nuclear materials production reactors at the Savannah River Site to resume operations at 90 percent capacity. These three reactors would create a long-term need to recover and recycle highly enriched uranium for use in reactor operations.

Constructing the facility was also intended to address the Department's revised transportation safety requirements for materials, including liquid uranyl nitrate. Revised Departmental guidance lowered allowable enrichment levels for safely transporting liquid uranyl nitrate. For example, the guidance made it necessary to dilute liquid shipments from 60 to 20 percent enrichment, which increased the number of shipments. Powder shipments, on the other hand, could be made without diluting the commodity, reducing the overall number of shipments by two-thirds, and further reducing the safety risk. After considering the revised guidance, the Department decided to construct the Uranium Solidification Facility to convert the liquid uranyl nitrate into a powder at the Savannah River Site. The Department could then ship the lower-risk powder to the Oak Ridge Y-12 Plant for processing.

Recent events, including the decrease in nuclear weapons production, have changed the Department's direction from production of nuclear materials to environmental restoration and waste management. As a result, the accumulation of additional liquid uranyl nitrates from reactor operations would no longer occur, eliminating the need for recovery and recycling of highly enriched uranium, and eliminating the long-term need for the facility.

Since there was no longer a long-term requirement to process additional liquid uranyl nitrate, the site's needs became limited to processing the existing 55,000 gallons already in storage, with the possibility of an additional 300,000 gallons if the reactor basins are cleaned up.

Uranium Solidification Facility Not Reevaluated

When we initiated our audit, the Department had not reevaluated the long-term need or the cost effectiveness of completing the facility. This occurred because neither the Program Execution Guidance development process nor the project validation process were designed to identify an invalid project in circumstances such as were present with Uranium Solidification Facility.

Annual Program Execution Guidance provides the Savannah River Operations Office with consolidated input from the Department Headquarters organizations sponsoring site work. It establishes programmatic assumptions, milestones, financial controls, and reporting requirements to be used in developing, implementing, and monitoring site operations. While the development of Program Execution Guidance would normally have been adequate to identify invalid projects, it did not do so in this case because of unforeseen cost increases and schedule slippages that were not identified when the Fiscal Year 1994 Guidance was developed. As a result, Department Headquarters, in its June 1993 Program Execution Guidance to Savannah River, explicitly stated the need to complete and operate the Uranium Solidification Facility.

The specific reason the Department had not reevaluated the continued construction of the facility was that available data showed that the facility was approximately 90 percent complete, and minimal resources would be necessary to complete the project. In the fourth quarter of Fiscal Year 1993, however, problems with an integrated project had a significant impact on the project's schedule, necessitating an extension of the project's completion date by 9 months, and the potential for additional costs of about \$35 million.

In addition to Program Execution Guidance, the project validation process should also disclose an invalid project under normal circumstances. The project validation process is done two years prior to the start of the affected Fiscal Year. For example, in Fiscal Year 1993 the Department would be in the process of preparing the Fiscal Year 1995 budget, and validating projects that would require funding in Fiscal Year 1995. Because the Uranium Solidification Facility was expected to be completed in Fiscal Year 1994, the Fiscal Year 1993 project validation process did not provide for a review of this project.

Because the Department had not reevaluated the facility and analyzed alternatives, construction continued on a project with limited useful life and an estimated total project cost of \$218 million. At the time of our review, the estimated cost to complete the facility was \$71 million.

COST EFFECTIVE ALTERNATIVES

The audit identified several alternatives that could cost significantly less than the \$71 million needed to complete the facility. On January 5, 1994, as part of this audit, we issued a "Management Alert" on the Uranium Solidification Facility, recognizing the need for the Department to reevaluate the project in view of the fact that it was no longer needed to support site operations. We recommended that the Manager, Savannah River Operations Office, immediately reevaluate the project by exploring transportation and processing alternatives to safely and cost effectively eliminate the current inventory of liquid uranyl nitrate, while holding project costs at a minimum during the reevaluation.

The Savannah River Operations Office and the Office of Inspector General, working jointly, identified three alternatives for processing current inventories of liquid uranyl nitrate, which were conveyed by the Manager, Savannah River Operations Office, to Department Headquarters. The first two alternatives were discussed in the Management Alert, and the third alternative was identified by the Department after reviewing the Alert. Each of these alternatives could be more cost effective than completing the facility.

First, it may be more cost effective for the Department to ship the uranyl nitrate in liquid form. To meet Departmental regulations, the current inventory of 55,000 undiluted gallons would need to be diluted. If the liquid were diluted to less than 20 percent enrichment, as required by Departmental Orders, approximately 40 shipments would be needed. Based on the current estimated cost of \$3,000 per tanker shipment, the entire inventory could be shipped in diluted form for approximately \$120,000. Facility modifications and upgrades may be required for this alternative, and determining the cost and specific modifications or upgrades necessary will require further evaluation.

We also identified a commercial vendor capable of processing the uranyl nitrate. This vendor was licensed to ship liquid uranyl nitrate at an enrichment of less than 20 percent, and has an operating facility that can process the solution into

powder form. The vendor indicated that it can process liquid uranyl nitrate in either the lowly enriched or fully enriched state.

In response to our Management Alert, the Savannah River Operations Office identified a third alternative to completing the facility. This alternative involves diluting the liquid uranyl nitrate to 1 or 2 percent enrichment by blending with the site's depleted uranium, and then processing the solution locally. Processing would take approximately 3 to 6 months, and the lower enriched oxide could be stored in existing onsite storage facilities. One benefit of using this method is that it would eliminate offsite shipments of the liquid uranyl nitrate solution.

ACTIONS TAKEN BY MANAGEMENT

The Savannah River Operations Office concurred with the recommendation in the Management Alert, and immediately initiated the following actions:

1. Directed the contractor to establish an accurate baseline of project schedule and costs.
2. Directed the contractor to pursue alternatives for dispositioning of the uranyl nitrate liquid and provide a matrix of these options and relevant concerns developed by the end of January 1994.
3. Requested Headquarters guidance on the acceptability of lessening enrichment of the liquid uranyl nitrate. Additionally, requested a review of commitments and programmatic impacts which might limit some of the options being explored.
4. Limited capital funding available to the operating contractor such that project activities could continue only through early February 1994.

On February 7, 1994, the Savannah River Operations Office Manager notified Headquarters of the alternatives to completing the Uranium Solidification Facility, and suggested that the project be temporarily suspended pending evaluation of these alternatives. The Assistant Secretary for Defense Programs concurred with the recommendation to suspend the project, and stated that the Department has no need for the highly enriched uranium; therefore, dilution is acceptable. The Assistant Secretary also stated that the evaluation should focus on recommending the safest and most cost-effective alternative

without regard to recovery. Accordingly, on February 25, 1994, the Savannah River Operations Office Manager directed the responsible site contractor to establish a plan to suspend the project within 10 days.

On March 25, 1994, the Manager, Savannah River Operations Office, provided the Office of Inspector General with a status update on actions taken in resolving the issues related to the Uranium Solidification Facility. The Manager reported that most of the contractor employees involved with the facility had already been reassigned to other projects. In addition, the Manager reported that the contractor had been directed to "pursue vigorously" the evaluation of alternatives, to identify the safest and most cost-effective method of treatment of uranyl nitrate without regard to the recovery of enriched uranium. The evaluation is to be completed in June 1994. Finally, the Manager stated that "preliminary indications are that significant savings will be achieved by pursuing these options."

To its credit, once the Office of Inspector General Management Alert was issued, the Department aggressively took advantage of an opportunity to improve operations, and put limited resources to the best possible use. Cancellation of the project could potentially save as much as \$71 million in taxpayer-provided funds.

To further improve the efficiency and effectiveness of Departmental operations, we suggest that the Manager, Savannah River Operations Office establish procedures requiring frequent reassessment of programs and projects, particularly when significant program changes occur.

SCOPE AND METHODOLOGY

The audit was conducted from October 1993 through February 1994 at the Savannah River Site in Aiken, South Carolina. To accomplish the audit objective, we performed a comprehensive review of the background, justification, and construction activities related to the Uranium Solidification Facility.

The audit was performed in accordance with generally accepted Government auditing standards for performance audits, and it included tests of internal controls and compliance with laws and regulations to the extent necessary to satisfy the objective of the audit. 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. Additionally, we placed no reliance on computer-generated data during this audit and, thus, did not test the reliability of any computer generated data.

The audit focused on the need for the Uranium Solidification Facility in light of the recent change in Departmental direction and alternatives to completing the Uranium Solidification Facility. It included: (1) a review of the historical files related to the project; (2) an analysis of the justification used to support the project; and (3) a comparison between completing the project and using alternatives to process the site's existing inventory of liquid uranyl nitrate.

Our review included the following methodologies:

- o Obtain and review applicable Departmental Regulations and site procedures.
- o Identify a licensed commercial vendor capable of processing and transporting the current inventory of liquid uranyl nitrate.
- o Review safety analysis and feasibility studies on the shipment of liquid uranyl nitrate.
- o Interview key Savannah River Operations Office Program and Project Management personnel involved with the Uranium Solidification Facility.

- o Interview Savannah River Operations Office Separations Division personnel and Albuquerque Operations Office Transportation Safeguards Division personnel regarding the transportation of liquid uranyl nitrate.
- o Review the project files for the Uranium Solidification Facility to obtain the history, original justification, and original cost for the project.

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