

DOE/IG-0489

AUDIT
REPORT

Americium/Curium Vitrification Project
At The
Savannah River Site



NOVEMBER 2000

U.S. DEPARTMENT OF ENERGY
OFFICE OF INSPECTOR GENERAL
OFFICE OF AUDIT SERVICES

November 28, 2000

MEMORANDUM FOR THE SECRETARY

FROM: Gregory H. Friedman (Signed)
Inspector General

SUBJECT: INFORMATION: Audit Report on "Americium/Curium Vitrification Project at the Savannah River Site"

BACKGROUND

In 1994, the Defense Nuclear Facilities Safety Board (DNFSB) recommended that the Department of Energy (Department) take action to stabilize the highly radioactive Americium/Curium solution (Am/Cm) stored at the Savannah River Site's F-Canyon Facility. The purpose of this recommendation was to reduce safety and health risks to Department employees and the public. In 1995, the Department made a commitment to the DNFSB to stabilize approximately 14,440 liters of Am/Cm in inventory at the Savannah River Site by September 1998.

A demonstration project for stabilizing the Am/Cm through vitrification was established at the Savannah River Site, but development of the vitrification technology proved more formidable than originally estimated. When the Department realized it would be unable to meet the September 1998 date, it proposed, and the DNFSB accepted, a new commitment date of September 2002.

The objective of this audit was to determine whether the Department will meet its commitment to stabilize the Am/Cm by September 2002.

RESULTS OF AUDIT

The Department will not meet its 2002 commitment date for stabilization of the Am/Cm solution. In fact, in June 2000, during the course of our audit, the Department submitted a revised commitment date of December 2005 to the DNFSB. However, we concluded that this date is overly optimistic and that stabilization is not likely to be completed until well after 2005. The audit disclosed that the Department committed itself to stabilization dates before knowing whether the dates were achievable. Furthermore, the Department did not establish separate funds for the stabilization project. Delays in the stabilization of Am/Cm will prolong the safety risks associated with the solution, escalate the cost of vitrification, and hinder the decommissioning of the F-Canyon Facility.

MANAGEMENT REACTION

Management did not agree with our conclusion. In response to a draft of this report, management stated that the December 2005 commitment date is achievable and that there is no firm indication of a delay as a result of qualifying the Am/Cm for disposal. Nevertheless, management agreed, as qualification issues arise, to assess the impact on the commitment date and to take appropriate action. Management also agreed to avoid submitting completion dates on future projects until a project plan has been thoroughly developed. However, management did not agree to establish the Am/Cm project as a line item project to ensure that it will receive dedicated funding, stating that doing so would reduce financial flexibility and would represent a deviation from the Department's budgeting and accounting procedures.

We disagree with management's contention that the December 2005 commitment date is achievable and that there is no firm indication of a delay. We noted that a study performed by the Westinghouse Savannah River Company (Westinghouse) indicated that it would take between 48 and 60 months to qualify the Am/Cm for the Federal repository. However, before starting "qualification runs" on the vitrification equipment, an assessment must be done to determine how the Am/Cm will perform under repository conditions. Westinghouse estimates that it would take 24 months to perform this assessment. Consequently, even if the Department directed Westinghouse to begin this assessment immediately, it would not be completed until November 2002, which is 12 months beyond the current schedule. Under the circumstances, based on the Department's own documentation, we do not believe that the December 2005 date is a reasonable target.

We do agree that converting the Am/Cm project to a line item project would reduce funding flexibility. However, doing so would provide a dedicated funding stream, which would promote completion of the project in the least possible time. We believe that the project management benefits associated with designating the Am/Cm project as a line item substantially exceed the cost of any real or perceived loss of funding flexibility.

Attachment

cc: Deputy Secretary
Under Secretary for Energy, Science, and Environment

AMERICIUM/CURIUM VITRIFICATION PROJECT AT THE SAVANNAH RIVER SITE

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OVERVIEW

INTRODUCTION AND OBJECTIVE

With the end of the Cold War, the Department's mission shifted from the production of nuclear weapons to the management and storage of nuclear materials. This left the Department with about 14,400 liters of highly radioactive Americium/Curium solution (Am/Cm) stored within a single tank in the Savannah River Site's F-Canyon Facility. In 1994, the Defense Nuclear Facilities Safety Board (DNFSB) recommended that the Am/Cm be converted to a form suitable for safe interim storage. Stabilization of the Am/Cm was considered especially urgent to avoid increased safety and health risks to workers and the public. In 1995, the Department made a commitment to the DNFSB to stabilize the Am/Cm by September 1998.

In 1995, after analyzing several alternatives, the Department issued a record of decision selecting vitrification as the preferred method to stabilize the Am/Cm. Vitrification is a process in which the Am/Cm is combined with specially formulated glass frit, heated, and poured into stainless-steel canisters, where it then solidifies into glass logs. A demonstration project for vitrifying the Am/Cm was established at the Savannah River Site, but development of a suitable melter proved more formidable than originally estimated. When the Department realized that it would be unable to meet its commitment date, it proposed, and the DNFSB accepted, a new commitment date of September 2002.

The objective of this audit was to determine whether the Department will meet its commitment to stabilize the Am/Cm by September 2002.

CONCLUSIONS AND OBSERVATIONS

The Department will not meet its commitment to stabilize the Am/Cm by September 2002. The Department submitted a revised commitment date of December 2005 to the DNFSB in June 2000. However, stabilization is not likely to be completed until after 2005. The Department committed itself to stabilization dates before knowing the dates were achievable. Furthermore, the Department did not establish separate funds for the vitrification project. Delaying the stabilization of Am/Cm will prolong the safety risks associated with the solution, escalate the cost of the vitrification project, and hinder the decommissioning of the F-Canyon Facility.

Two prior audit reports identified similar problems in the planning and funding of Savannah River Site projects. *GAO/RCED-99-69, Nuclear Waste: Process to Remove Radioactive Waste From Savannah River Tanks Fails to Work (April 1999)*, identified problems with "fast track" project management and the budgetary treatment of the In-Tank

Precipitation Project. Design and construction were done concurrently and project managers began construction before the design was completed. Also, GAO found that the Department paid for the project with operating funds instead of capital construction funds, which caused the project to receive less oversight and visibility. In addition, an Office of Inspector General report, *ER-B-95-04, Report on the Audit of the Replacement High Level Waste Evaporator at the Savannah River Site (June 26, 1995)*, found that the Replacement Evaporator Project incurred delays and cost increases that could have been avoided if the Department had adequately planned, contracted, and funded the project.

This audit identified significant issues that management should consider when preparing its yearend assurance memorandum on internal controls.

(Signed)

Office of Inspector General

**Am/Cm Will Not be
Stabilized by
September 2002**

The Department will not meet its current commitment to stabilize the Am/Cm by September 2002. During the audit, the Department approved a new baseline with a project completion date of September 2004 and a total project cost of \$129 million. The new baseline reflects a 2-year delay and a \$69 million increase in cost. The revised completion date includes the final design and construction of the vitrification system, but not the vitrification itself, which will take approximately one year. The Department submitted a new implementation plan to the DNFSB with a December 2005 commitment date. However, there are indications that the December 2005 date will also not be achievable.

A change in the project scope to address disposal requirements will push stabilization beyond the proposed December 2005 commitment date. The scope of the vitrification project focused on recovery of Am/Cm for future use and did not address disposal requirements. In July 2000, the Under Secretary of Energy signed a disposition decision memorandum directing the Department to continue with the vitrification project and ensure that the vitrified material is acceptable for disposal in the Federal repository. This decision was supported by a Departmental study that concluded the Am/Cm is not needed and its retention is not economically justified.

Additionally, a study performed by the Savannah River Site's contractor, Westinghouse Savannah River Company (Westinghouse) indicates that the process necessary to certify the material for disposal in the repository will take between 48 months and 60 months. Although some of the certification activities can be performed concurrently with already scheduled project activities, certain certification activities need to be finalized prior to particular project milestones. For example, the Department must assess how the vitrified material will perform under repository conditions before starting "qualification runs" of the vitrification equipment. This assessment must include corrosion testing, radiation damage evaluation, thermodynamic data generation, and dissolution model development. Westinghouse estimates that the assessment will take approximately 24 months to complete.

Project completion will be delayed at least 12 months beyond December 2005 in order to certify the material for disposal in the Federal repository. As of November 2000, the Department had not directed Westinghouse to begin certification activities. Even if the 24-month assessment began immediately, it would not be completed until November 2002, which is 12 months beyond the current schedule

to begin the qualification runs. This will delay the completion of the vitrification by 12 months. Other steps in the qualification process, such as the addition of required monitoring and data collection equipment, could further delay the process by up to three years.

Am/Cm Must be Stabilized

The DNFSB has authority, under 42 United States Code, Section 2286, to issue binding recommendations to the Department for events or practices that may adversely affect public health and safety. In May 1994, the DNFSB issued Recommendation 94-1 requiring the Department to formulate a plan and begin stabilizing fissile materials and other radioactive substances once used for weapons manufacture. It was considered especially urgent to convert the Am/Cm to a form more suitable for safe interim storage to avoid further deterioration of safety and increased risks to workers and the public. The DNFSB concluded that imminent hazards could arise within two to three years unless certain problems were corrected.

The Department's original implementation plan committed to stabilizing the Am/Cm by September 1998. When the Department realized that it would be unable to meet this date, it revised the implementation plan and proposed to complete stabilization of the Am/Cm by September 2002. The DNFSB accepted the Department's new commitment, but noted that it would continue to monitor the Department's progress. In January 2000, the DNFSB issued Recommendation 2000-1, which reiterated the urgency of completing the Am/Cm stabilization.

Commitments Were Made Without Sufficient Planning

The Department will not meet its commitments regarding Am/Cm stabilization because it made commitments before knowing if they were achievable, and did not establish a continuous level of funding necessary to complete the project on time.

The Department committed to stabilizing the Am/Cm by 1998 and 2002 before it knew if the commitments were achievable. For example, the Department's initial implementation plan, which committed to stabilizing the Am/Cm by September 1998, was contingent upon the Savannah River Site being able to develop a vitrification process even though the Department had not yet selected a preferred stabilization method. Once vitrification was selected, the project schedule baseline was developed to fit the commitment date. In an attempt to achieve this schedule, research and development was performed concurrent with design and construction. To save more time, the technical staff was restricted to the modification of an

off-the-shelf bushing melter. When this concept was found to be unsuitable, approximately \$8.3 million worth of design and construction activities were abandoned. An independent review team found that delays from excessive redesign and rework could have been avoided if design and construction had been preceded by a thorough research and development phase.

In 1998, the Department revised its implementation plan while the Am/Cm project was being reassessed. The commitment date was extended to September 2002 to allow time to refocus research and development activities on a new cylindrical induction melter prototype. Then, the Department proposed to revise the commitment date again based on the latest project baseline. However, the scope of the project still does not take into account the time necessary to qualify the vitrified material for disposal in the Federal repository.

Also, the Department did not establish separate funds for the Am/Cm Vitrification Project. Instead, the Department established a demonstration project, using site operating funds. This funding method extended the project schedule by at least 14 months. In August 1999, Westinghouse proposed a project baseline spending of \$27.8 million in Fiscal Year (FY) 2000 and \$23.2 million in FY 2001 with a project completion date of June 2003. Management used this baseline to prepare the project data sheet that was sent to Congress for the FY 2001 budget request. However, management never approved this baseline and required Westinghouse to develop another baseline assuming funding restraints through the remainder of the project. The new baseline proposed spending \$18.6 million in FY 2000 and \$16.2 million in FY 2001 with a project completion date of September 2004. Management approved this baseline in February 2000. Subsequently, management requested that Westinghouse prepare another baseline without funding restraints, but it has not been approved and has not been the basis of funding requests.

Had the Department established the stabilization of Am/Cm as a line item project, it could have received dedicated funding and would not have had to compete for operating funds. Once research and development on the melter was completed, the concept of stabilizing Am/Cm via vitrification was successfully demonstrated in a pilot facility, and a construction subcontract was awarded. Thus, the project could be budgeted as a line item.

Delays Prolong Safety Risks, Escalate Project Costs, and Hinder the Decommissioning of F-Canyon

Delaying the stabilization of the Am/Cm will prolong the safety risks associated with the solution, escalate the cost of vitrification, and hinder the decommissioning of the F-Canyon Facility. Although the Department has taken steps to reduce the risk of the Am/Cm in its current storage configuration, its continued storage poses inherent environmental, safety and health concerns. Liquid solutions such as the Am/Cm pose the greatest hazards due to the higher possibility of dispersal. For example, the loss of tank integrity, as might be caused by corrosion or seismic action, would create an almost insurmountable problem by spreading radioactive contamination. Safety risks continue to escalate until stabilization is complete.

Also, as the project completion date is delayed, the overall cost of the project continues to escalate. For example, \$12 million of the \$69 million increase in the project cost was due to Westinghouse delaying completion of the project until September 2004 because of imposed funding restraints. Additionally, for each additional year that the project continues, there is a minimum unavoidable annual cost of \$1.7 million. This is primarily attributable to the fully loaded cost of dedicated management personnel assigned to the project.

Finally, delays in stabilizing the Am/Cm adversely affect the decommissioning of the F-Canyon Facility. The canyon cannot be decommissioned without removing the Am/Cm, which is the single largest source of radioactivity in the facility. The vitrification of the Am/Cm solution is a component of the critical path for completing all operations in F-Canyon and allowing the facility to achieve minimal surveillance and maintenance costs.

RECOMMENDATIONS

We recommend that the Manager, Savannah River Operations Office:

1. Reevaluate the proposed December 2005 commitment date, taking into account the time needed to qualify the vitrified Am/Cm for disposal at the Federal repository;
2. Submit a revised project completion date to the Office of the Deputy Assistant Secretary for Project Completion, Office of Environmental Management that is based on an achievable baseline;
3. Establish the Am/Cm Vitrification Project as a line item project to ensure that it will receive dedicated funding; and

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4. Avoid submitting estimated completion dates on future projects until a project plan has been thoroughly developed.

MANAGEMENT REACTION

Management concurred in principle with Recommendations 1 and 2, nonconcurred with Recommendation 3, and concurred with Recommendation 4.

Recommendation 1. Management stated that there is no firm indication of a delay as a result of qualifying the Am/Cm for disposal. Nevertheless, as qualification issues arise, the Department will assess the potential impact to the commitment date and take appropriate action.

Recommendation 2. Management stated that the December 2005 commitment date reflects an achievable schedule. The schedule was completed using a formal baseline change proposal, incorporated technical and programmatic risk analyses, and was based on 35-percent design completion of the project.

Recommendation 3. Management stated that the current approach of funding the Am/Cm project with operating funds meets the intent of the recommendation. Management would not object to creating a line item project for Am/Cm; however, doing so would result in a loss of financial flexibility and would represent a deviation from the Department's budgeting and accounting procedures. A line item would significantly reduce the flexibility to redirect funds as developments occur. A line item "fences" specific funds each fiscal year that cannot be changed without Congressional action. Additionally, one reason the project is funded out of operating expense is that the facility is expected to operate only about one year. Pursuant to the Department's Accounting Handbook, since the facility does not meet the 2-year life required for capitalization, procedures call for the project to be expensed. This effectively drives a requirement for an operating expense funded project versus a line item project.

Recommendation 4. Management stated it has already implemented the use of project engineering and design line items. Future projects will not be baselined until the project design is 35-percent complete. The Department will continue to assess the progress of this project through completion of design and construction. Additionally, management has contracted Project Management Oversight consultants to assess and validate the progress of this and other projects.

AUDITOR COMMENTS

Although management agreed in principle with Recommendations 1 and 2, their response did not indicate what corrective actions, if any, it planned to take or when they would be completed.

Recommendation 1. We disagree with management's statement that there is no indication of a delay in vitrifying the Am/Cm. The current scope of the project does not include the requirement to qualify the vitrified Am/Cm for disposal in the Federal repository. Westinghouse project management believes that the certification process will delay vitrification by at least 12 months.

Recommendation 2. We disagree with management's statement that the December 2005 completion date is achievable. That date was developed using the current project baseline, which does not include efforts to qualify the material for disposal in the Federal repository.

Recommendation 3. We agree that converting the Am/Cm project to a line item project would reduce funding flexibility. However, doing so would provide dedicated funding to complete the project in the least possible time. Also, there are no Departmental regulations that prohibit the Am/Cm project from being established as a line item project. DOE Order 430.1A, *Life Cycle Asset Management*, defines line item projects as those separately identified project activities that are submitted for funding and specifically reviewed and approved by Congress. According to the Department's Deputy Director for the Office of Budget, the 2-year life required for capitalization has no direct impact on the type of funding a project should receive. Any project can be established as a line item, and there is no requirement to budget a project as an operating expense funded project just because it has a life expectancy of less than 2 years.

Recommendation 4. Management's comments are responsive to the recommendation.

Appendix

SCOPE

The audit was performed from December 1999 to November 2000 at the Savannah River Site in Aiken, South Carolina. The audit covered a review of the activities associated with the Am/Cm Vitrification Project, from its inception in 1995 through November 2000.

METHODOLOGY

To accomplish the audit objective, we:

- Evaluated the requirement to stabilize the Am/Cm solution;
- Identified the date for which the Department had committed to complete Am/Cm stabilization;
- Interviewed Savannah River Operations Office and Westinghouse project management personnel regarding the background of and future plans for the project;
- Reviewed project baselines and baseline change proposals for the project;
- Evaluated the most current planning targets for Am/Cm stabilization; and
- Assessed the impact of performance measures related to Am/Cm vitrification.

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. For example, we evaluated the Department's adherence to established requirements for project management as documented in the Savannah River Project Management Manual. Also, we evaluated the Department's compliance with portions of the Department of Energy Accounting Handbook related to budgeting and accounting for experimental and demonstration projects. 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. In performing this audit, we did not rely significantly on computer generated data.

In accordance with the Government Performance and Results Act of 1993, we determined that the Department has established performance measures tied to Am/Cm vitrification. Specifically, the Department has interim performance measures in place designed to accelerate the completion of the Am/Cm vitrification and stabilization activities. For FY 2000, the Department incentivized five specific tasks.

Management waived an exit conference.

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