



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

Audit Report

The Disposition of Uranium-233 at Oak Ridge National Laboratory



Department of Energy
Washington, DC 20585

February 18, 2010

MEMORANDUM FOR THE SECRETARY

FROM: 
Gregory H. Friedman
Inspector General

SUBJECT: INFORMATION: Audit Report on "The Disposition of Uranium-233 at Oak Ridge National Laboratory"

BACKGROUND

As a result of the Department of Energy's nuclear weapons program legacy, its Oak Ridge National Laboratory (ORNL) stores about 1.4 metric tons of uranium containing 450 kilograms of uranium-233 (U-233). The material is currently stored in a deteriorating facility at ORNL that is over 60 years old. Because of its highly radioactive and dangerous properties, the U-233 is stored in a shielded storage location and must be handled in hot cells to protect workers from exposure. Since there were no programmatic uses for the material, the Department initiated efforts to dispose of it in 2001. In 2003, however, the conferees to the Fiscal Year 2003 Omnibus Appropriations Act authorized the extraction of thorium-229, a material that is useful in medical and research isotope production, prior to disposal of the U-233.

In response, the Office of Nuclear Energy (NE) developed a three-phased approach for the thorium extraction process. In October 2003, NE awarded a contract to Isotek Systems, LLC (Isotek), to plan and design the facilities needed to extract the thorium and process the U-233 into a stable form for storage. In November 2005, however, the conferees to the Fiscal Year 2006 Energy and Water Appropriations Act directed the Department to terminate thorium extraction and to transfer responsibility for management and disposition of the U-233 to the Office of Environmental Management (EM), effectively ending any potential for obtaining medical research isotopes from this process. EM began managing the project and the Isotek contract, focusing on the processing and subsequent disposal of the U-233 at the Department's Waste Isolation Pilot Plant (WIPP). EM approved the project's \$384 million performance baseline on May 25, 2007, and authorized long-lead procurements and dismantlement activities in preparation for facility construction. Due to the risk associated with this disposition effort, we initiated this audit to determine whether the Department had adequately managed the U-233 disposition project.

RESULTS OF AUDIT

The Department's U-233 disposition project had encountered a number of design delays, may exceed original cost estimates, and will likely not meet completion milestones. In particular, our testing revealed that:

- Despite four years of effort by EM and the expenditure of about \$36 million, project planning and design had yet to be completed; and,

- The cost baseline was approved relying on inaccurate assumptions and, thus, is likely to be unreliable.

EM initially established the performance baseline and authorized long-lead procurements and dismantlement activities in preparation for facility construction based on Isotek's claim that the project's design satisfied the Department's requirement for maturity, i.e., the design was 60 percent complete. Even though the Department's project management order requires the completion of a design review prior to baseline approval, EM elected to approve the baseline, a critical project milestone, without validating the status of the design work. EM officials told us that they had considered previous design reviews that were completed prior to the change in project scope.

When EM ultimately completed the required design review in December 2007, some seven months after it approved the performance baseline, it discovered that the design was more likely in the early preliminary design stage rather than at the 60 percent design threshold. At that point, reviewers concluded that the contractor had based portions of the design on unverified assumptions in certain areas, and that once safety analyses were completed, additional review and possible design rework would be required. Further, it was not until July 2008 that the Department realized it had inaccurately assumed and reported to Congress in February 2006 that the deletion of thorium extraction would have very little effect on design. In fact, not extracting thorium had a significant effect on the amount of shielding that is now required and led to considerable design changes, including the construction of a new annex facility. EM completed another design review in September 2009 and concluded that additional work was still needed to reach the 60 percent design stage of maturity.

Problems with Federal leadership of the project, at least in part, contributed to delays in completing design and establishing a viable cost baseline. For example, after the direction to abandon thorium-229 extraction, EM had not ensured that the contract with Isotek was consistent with the new scope of work, a situation that impacted its ability to hold the contractor accountable. Further, since taking over the project in 2005, EM had assigned 5 different Federal project directors, with 4 different managers involved in the first 22 months of the project. The frequency of the change in leadership contributed to EM not providing a timely review of the contractor's preliminary design. Finally, program officials did not ensure that the contractor implemented controls necessary for timely completion of the design phase of the project. For example, even though it determined in 2006 that the contractor did not have a certified earned value management system to measure actual performance against baselines, EM did not compel the contractor to take effective corrective action. Notably, Isotek did not have a certified system in place until September 2009.

In addition to performance and monitoring problems, we also learned that the project now faces additional challenges related to the radioactive constituents believed to be contained in the U-233. Program officials indicated that reconsideration of the design was necessitated by a January 2009 discovery that despite previous assumptions regarding the U-233 inventory, the material did not contain a sufficient amount of plutonium to qualify it for disposition in WIPP. In

March 2009, EM changed the waste process and the disposition path deciding instead to send the material to the Nevada Test Site. EM is continuing efforts to develop a waste form that will meet the Nevada Test Site Waste Acceptance Criteria. In addition to cost considerations, further disposition delays could potentially increase environmental and safety risks associated with the U-233.

EM management has recently acted to provide consistent management oversight to the project and has worked with the contractor to correct long-standing problems such as the absence of a certified earned value management system. To address the issues described in our report, we made several recommendations intended to increase the likelihood that the project is completed in a timely and successful manner.

MANAGEMENT REACTION

EM concurred with the report's recommendations but noted that actions necessary to correct issues with project leadership and management had been completed. However, management agreed that it would closely monitor contractor performance until recent concerns that have surfaced with the project's design and cost controls can be adequately addressed. Specifically, recent U-233 project status reports indicate that there are still major concerns with the contractor's final design progress, its ability to meet cost or schedule milestones for final design, the confidence that can be placed in the contractor's earned value management system, and concerns in the areas of design configuration control, subcontractor oversight, and procurement. Management's proposed actions, designed to help ensure the contractor's design and project baseline can be successfully completed and approved, are generally responsive to our recommendations.

Attachment

cc: Deputy Secretary
Under Secretary of Energy
Chief of Staff
Assistant Secretary for Environmental Management, EM-1
Manager, Oak Ridge Office
Audit Liaison, Environmental Management, EM-33
Audit Liaison, Oak Ridge Office, SC-OR

REPORT ON THE DISPOSITION OF URANIUM-233 AT OAK RIDGE NATIONAL LABORATORY

TABLE OF CONTENTS

Management of the Uranium-233 Project

Details of Finding	1
Recommendations and Comments	4

Appendices

1. Objective, Scope, and Methodology	6
2. Prior Audit Report	8
3. Management Comments	9

MANAGEMENT OF THE URANIUM-233 PROJECT

Project Design and Implementation

Despite the expenditure of about \$36 million and four years of effort by the Office of Environmental Management (EM), project planning and design had yet to be completed for the Department of Energy's (Department) uranium-233 (U-233) disposition project. In particular, the project had encountered a number of design delays, may exceed original cost estimates, and will likely not meet completion milestones. Additional design issues may develop because original assumptions regarding waste constituents have proven to be incorrect.

Facility Design and Baseline Development

Although EM approved the U-233 disposition project performance baseline and authorized the start of long-lead procurements and dismantlement activities in May 2007, design of the disposition facilities has not progressed as planned. Major factors impacting performance were that the project's cost baseline was approved based on inaccurate assumptions, and as such was not being used by EM to manage the project at the time of our review.

EM approved the performance baseline and granted Isotek Systems, LLC (Isotek), approval to start long-lead procurements and dismantlement activities in May 2007 despite the fact that the project lacked a mature design. Even though the Department's project management order requires the completion of a design review prior to baseline approval, EM elected to approve the baseline, a critical project milestone, based on the results from prior design reviews and did not validate the status of the design work. These reviews were performed by the Office of Nuclear Energy (NE) prior to changes in project scope that were mandated by Congress in November 2005. When EM ultimately completed the required design review in December 2007, some seven months after it approved the performance baseline, it discovered that the design was more likely in the early preliminary design stage rather than at the 60 percent design stage. Reviewers concluded that the contractor based portions of the design on unverified assumptions in the civil/structural, mechanical and piping, and the electrical and instrumentation and control areas. The review report noted that once safety analyses were complete, these areas would require review and potential design rework.

While design work had matured to some extent by July 2008, EM determined that the design of components for the final processing and packaging of the waste form component of the project was still only about 30 percent complete. Specifically, the Department realized it had inaccurately assumed and reported to Congress in

February 2006 that the deletion of thorium extraction would have very little effect on design. In fact, not extracting thorium had a significant effect on the amount of shielding that is now required. This resulted in significant design changes and the decision to move drying and packaging operations to a new annex facility. These operations were moved from the original location in Building 3019A because the building structurally could not support the shielding requirements. In September 2009, after an additional year of effort, EM gained sufficient confidence in the design to begin another review. However, EM completed that review and concluded that additional work was still needed to reach the 60 percent design stage of maturity. The Department indicated that it would not complete another life cycle cost estimate until it conducts a 90 percent design review, an event expected to begin in 2010.

Project Management

Delays in completing the design and uncertainty about the eventual cost of the project were caused, at least in part, by inconsistent Federal leadership resulting in inadequate contractor oversight. Additionally, EM did not ensure that the contractor's partnership was properly structured to manage the project.

Consistent Federal Leadership

Since taking over the project in 2005, EM has not ensured that appropriate Federal leadership was applied to the project. Notably, EM assigned five different Federal project directors in the four plus years that it has managed the effort. The project was managed by 4 separate directors in the first 22 months of its life. In some cases, the project director had other responsibilities which prevented adequate oversight of the project. An August 2006 External Independent Review, for example, noted that the project did not have a permanent Federal project director. Rather, the assistant site manager was the designated Federal project director. Because of the extent of his other duties, this individual was not able to devote the requisite attention to Federal project director's tasks.

Federal project director continuity problems impacted EM's ability to complete a timely review of the contractor's preliminary design and to ensure that the contractor had controls in place necessary for timely completion of the design phase of the project. As previously noted, EM did not review the contractor's design, as required by the Department's project management order 413.3A, before approving the performance baseline. In fact, EM did not perform the design review until seven months after approving the

baseline. Additionally, EM did not ensure that the contractor implemented quality assurance and earned value management systems. EM determined in 2006, for example, that in spite of specific requirements to the contrary, the contractor did not have a certified earned value management system to measure actual performance against performance baselines. The Department's project management order specifically conditions approval of the project baseline on having such a system in place. EM also did not ensure that Isotek took effective corrective action to resolve the previously observed weakness. A particularly troubling example of this lack of action was the fact that the contractor did not have a certified earned value management system until September 2009.

Finally, EM had not ensured that the contract with Isotek was consistent with the scope of work actually being performed by the contractor, a situation that impacted its ability to hold the contractor accountable. Since taking over the project in November 2005, EM had been managing the project under the contract negotiated with Isotek by NE. This contract required thorium extraction and storage rather than the treatment and disposition of the U-233. It was not until September 2007 that EM modified the contract to properly reflect the changed scope of work that eliminated thorium extraction and focused work on processing the inventory for disposal.

Contractor Structure

Even though it assumed responsibility for managing the Isotek contract in 2005, EM did not act promptly to ensure that Isotek, a limited liability company, was organized to effectively manage the project. Specifically, Isotek was a partnership composed of three companies with no single partner having a controlling interest in the company until November 2007. We concluded that the lack of clear lines of authority in the partnership structure contributed to known quality assurance problems in the design phase of the project. Isotek had an inadequate oversight infrastructure in place to resolve a continuing deficiency in the design partner's implementation of an appropriate quality assurance program. In fact, it was not until September 2008 that the contractor's management structure was changed to better oversee the project. After the management restructure, Isotek acted in October 2008 to correct problems with the design partner, including the lack of a quality assurance program that they first detected in 2004.

Impact on Cost and Risk

In addition to performance and monitoring problems, we learned that the project now faces additional challenges related to the radioactive constituents believed to be contained in the U-233. Program officials indicated that reconsideration of the design was necessitated by a January 2009 discovery that despite previous assumptions regarding the U-233 inventory, the material did not contain a sufficient amount of plutonium to qualify it for disposition at the Department's Waste Isolation Pilot Plant. In March 2009, EM changed the waste process and the disposition path to the Nevada Test Site and is continuing efforts to develop a waste form that will meet the Nevada Test Site Waste Acceptance Criteria.

As we have demonstrated in a number of contract management reviews in the past, poor project administration and performance frequently increase total project costs. In November 2008, for example, the project's contractor proposed a revised cost baseline of \$477 million, a cost increase of approximately \$93 million. Because the project baseline was approved based on faulty assumptions related to design maturity, we were unable to specifically determine whether these increases will ultimately materialize. EM has not approved the contractor's proposal pending its decisions regarding process design changes and the outcome of future design reviews, and as such, cannot determine the total cost of the project. In addition to cost and schedule impacts, further disposition delays also potentially increase environmental and safety risks associated with U-233 identified by the Defense Nuclear Facilities Safety Board in 1997.

RECOMMENDATIONS

EM management has recently acted to provide consistent project management oversight to the project and has worked with the contractor to correct long-standing problems such as the absence of a certified earned value management system. In order to help ensure the timely and successful completion of the U-233 disposition project, we recommend that the Assistant Secretary, Environmental Management, ensure that:

1. Consistent and adequate Departmental leadership is maintained;
2. The contractor's performance on the U-233 disposition project provides a sound basis for final design and baseline approval, as required by Departmental project management orders; and,

-
3. Future limited liability companies have a majority ownership partner and are structured to provide adequate leadership over the project.

**MANAGEMENT AND
AUDITOR
COMMENTS**

EM concurred with the report and its recommendations and stated that all actions necessary to close Recommendations 1 and 3 were complete. Regarding Recommendation 1, EM stated that the current Federal project director has provided consistent leadership for more than 20 months. In response to Recommendation 3, EM explained that they evaluate the management structure of limited liability companies as an element in the Request for Proposal evaluation criteria. Additionally, EM requires the limited liability companies to identify a single point of contact to address contract and project matters.

During an exit conference to discuss management's comments on a draft of this report, regarding Recommendation 2, EM asserted that the U-233 disposition project is currently being managed in accordance with Departmental project management orders; however, continuing concerns identified in the area of project management were the direct result of poor contractor performance. In December 2009, the Federal project director informed EM of major concerns with the contractor's progress on the project's final design. Specifically, the project director noted that the contractor will not meet its cost or schedule milestones for final design, an issue that, in our opinion, calls into question the confidence that can be placed in the ability of the contractor's earned value management system to keep the project on track. In January 2010, additional concerns were identified in the areas of design configuration control, subcontractor oversight, and procurement.

We clarified Recommendation 2 to more accurately emphasize the role that the contractor's performance has played in project delays and cost increases. As a result, EM agreed to keep Recommendation 2 open until the contractor's 90 percent design review and project baseline can be successfully completed and approved, respectively.

We consider management's comments generally responsive to our recommendations.

Appendix 1

- OBJECTIVE** The objective of this audit was to determine whether the Department of Energy (Department) had adequately managed the Uranium-233 (U-233) project.
- SCOPE** We conducted the audit from November 2008 to December 2009 at Department Headquarters in Washington, D.C., and the Oak Ridge Office in Oak Ridge, Tennessee. The audit scope included U-233 disposition efforts since November 2005 when the project was transferred from the Office of Nuclear Energy to the Office of Environmental Management (EM).
- METHODOLOGY** To accomplish the audit objective, we:
- Reviewed regulations, directives, contract requirements, and performance measures relating to the U-233 disposition project;
 - Determined and evaluated the current status of the U-233 disposition project;
 - Reviewed the baseline and other project management tools associated with the disposition project;
 - Evaluated internal controls associated with the U-233 project;
 - Reviewed prior audits and reviews relating to the disposition project; and,
 - Held discussions with key Department and contractor officials responsible for dispositioning the U-233.

We conducted this performance audit in accordance with generally accepted Government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objective. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objective. The audit included tests of controls and compliance with laws and regulations necessary to satisfy the audit objective. 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. The U-233 disposition project did not meet all of its specific

Appendix 1 (continued)

performance measures in 2009 associated with the *Government Performance and Results Act of 1993*. Also, we did not rely upon computer processed data to accomplish our audit objective.

An exit conference was held with EM's Deputy Assistant Secretary for Program and Site Support on February 3, 2010.

PRIOR AUDIT REPORT

- *Meeting Medical and Research Needs for Isotopes Derived from Uranium-233* (DOE/IG-0795, May 2008). The Office of Inspector General determined that the Department of Energy (Department) would not have sufficient quantities of uranium-233 (U-233) and its progeny isotopes to support U.S. medical and research needs. The Department is the only domestic producer of progeny isotopes from U-233 and current production is insufficient to meet medical and scientific research needs. At present, no viable alternative methods of production of actinium and bismuth have been demonstrated or proven. U-233 also is used to support other Department missions such as the National Nuclear Security Administration's Test Readiness Program.



Department of Energy

Washington, DC 20585

January 15, 2010

MEMORANDUM FOR GEORGE W. COLLARD
ASSISTANT INSPECTOR GENERAL
FOR PERFORMANCE AUDITS
OFFICE OF INSPECTOR GENERAL

FROM:

INÉS R. TRIAY 
ASSISTANT SECRETARY FOR
ENVIRONMENTAL MANAGEMENT

SUBJECT: Draft Audit Report on "The Disposition of Uranium-233
at Oak Ridge National Laboratory"

This memorandum responds to your December 16, 2009, memorandum requesting review and comments on subject draft audit report (IG-32 A09ET008). The Office of Environmental Management (EM) appreciates the opportunity to provide comments. EM has no comments on the report.

EM concurs with all three of the recommendations contained in the draft audit report. EM has been working closely with the Department of Energy, Office of the Inspector General (DOE-IG) on this audit; therefore, we believe that the actions taken to date are in-line with the recommendations received from the IG and the recommendations are considered to be complete.

Currently, the Uranium-233 (U-233) Material Downblending and Disposition Project at Oak Ridge National Laboratory (ORNL) is operating to the November 2008 proposed baseline as an interim baseline until design reaches 90 percent maturity. At that time, a new estimate and baseline change proposal will be developed.

RECOMMENDATIONS

Recommendation 1: Consistent and adequate Departmental leadership is maintained.

Action Plan: *The current Federal Project Director (FPD) was appointed in April 2008 and has provided consistent project leadership for over 20 months. In addition, a Deputy FPD position was added to the team in November 2008 and has been filled by the same person for the last 14 months. This has provided project continuity while also supporting succession planning in the event other changes in project management (i.e., retirement, promotion, or other career opportunity) take place.*

Estimated Completion Date: *Complete.*



Recommendation 2: Project management complies with Departmental management orders.

Action Plan: *The U-233 Material Downblending and Disposition Project is currently being managed under DOE Order 413.3. The current Federal Project Director (FPD) was certified as a Level 3 FPD through the Project Management Career Development Program (PMCDP) in September 2008; this is the appropriate level of certification for the project. The Deputy FPD and another full-time project staff member were certified as Level 1 through the PMCDP in November 2009. To maintain certification, 60 hours of continuing education must be completed every two years.*

Estimated Completion Date: *Complete.*

Recommendation 3: Future limited liability companies have a majority ownership partner and are structured to provide adequate leadership over the project.

Action Plan: *The approach that EM has taken with respect to limited-liability companies (LLC) is to evaluate the LLC management make-up as an element in the Request for Proposals (RFP) evaluation criteria. This is included as part of the management plan. EM-HQ also has a clause for the LLC to identify a single point of contact (POC) to address contract and project matters. With respect to the U-233 contractor, EM has ensured the voting rights of Isotek Systems, LLC member companies were restructured so EnergySolutions had majority voting rights. As a result, EnergySolutions became the single point of accountability for the Department on this project.*

Estimated Completion Date: *Complete.*

If you have any further questions, please contact Mr. Fred Butterfield of my staff at (202) 586-3110.

cc:

G. Boyd, ORO
J. Echenberg, ORO
T. Pooler, ORO
C. Shafik, CF-1.2
D. Williams, CF-1.2
D. Chung, EM-2
F. Marcinowski, EM-3
J. Boone, EM-4.1
M. Gilbertson, EM-50
F. Butterfield, EM-51

CUSTOMER RESPONSE FORM

The Office of Inspector General has a continuing interest in improving the usefulness of its products. We wish to make our reports as responsive as possible to our customers' requirements, and, therefore, ask that you consider sharing your thoughts with us. On the back of this form, you may suggest improvements to enhance the effectiveness of future reports. Please include answers to the following questions if they are applicable to you:

1. What additional background information about the selection, scheduling, scope, or procedures of the inspection would have been helpful to the reader in understanding this report?
2. What additional information related to findings and recommendations could have been included in the report to assist management in implementing corrective actions?
3. What format, stylistic, or organizational changes might have made this report's overall message more clear to the reader?
4. What additional actions could the Office of Inspector General have taken on the issues discussed in this report which would have been helpful?
5. Please include your name and telephone number so that we may contact you should we have any questions about your comments.

Name _____ Date _____

Telephone _____ Organization _____

When you have completed this form, you may telefax it to the Office of Inspector General at (202) 586-0948, or you may mail it to:

Office of Inspector General (IG-1)
Department of Energy
Washington, DC 20585

ATTN: Customer Relations

If you wish to discuss this report or your comments with a staff member of the Office of Inspector General, please contact Felicia Jones (202) 253-2162.

This page intentionally left blank.

The Office of Inspector General wants to make the distribution of its reports as customer friendly and cost effective as possible. Therefore, this report will be available electronically through the Internet at the following address:

U.S. Department of Energy Office of Inspector General Home Page
<http://www.ig.doe.gov>

Your comments would be appreciated and can be provided on the Customer Response Form attached to the report.