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

Audit Report

Depleted Uranium Hexafluoride Conversion

DOE/IG-0642

March 2004



Department of Energy

Washington, DC 20585

March 18, 2004

MEMORANDUM FOR THE SECRETARY

FROM:

Greg Friedman
Gregory H. Friedman
Inspector General

SUBJECT:

INFORMATION: Audit Report on "Depleted Uranium Hexafluoride Conversion"

BACKGROUND

For over 30 years, the Department of Energy (Department) operated gaseous diffusion plants in Oak Ridge, Tennessee; Portsmouth, Ohio; and Paducah, Kentucky, to meet its enriched uranium needs. As a byproduct of the enrichment process, about 704,000 metric tons of depleted uranium hexafluoride were generated and stored in approximately 58,000 cylinders at the enrichment plants. While the cylinders are currently stored with little risk to workers, the public, and the environment, they are gradually deteriorating. Prolonged storage has the potential to increase the Department's safety and health risks from handling operations, natural disasters, or malicious acts.

In 1998, legislation was enacted requiring the construction of facilities at Portsmouth and Paducah to convert the Department's depleted uranium hexafluoride to a more stable form for reuse or disposal. Based on the project execution plan, the Department expects to complete the conversion of all depleted uranium hexafluoride over the next 25 years at a cost of \$2.6 billion, excluding decontamination and decommissioning of the conversion facilities. The objective of the audit was to determine whether the Department has implemented an efficient plan for conversion of its depleted uranium hexafluoride inventory.

RESULTS OF AUDIT

Based on our analysis of procurement and contractor cost documents, we concluded that the Department's plan for converting depleted uranium hexafluoride inventories could be improved by adding an additional conversion line to the Portsmouth facility. Currently, plans call for three conversion lines, which will be capable of processing 13,500 metric tons of depleted uranium hexafluoride per year. By adding another conversion line, Portsmouth could process 4,500 metric tons of additional material annually and complete the project nearly 5 years earlier than planned. The facility size was not optimized because the Department's acquisition strategy emphasized initial capital costs rather than minimizing life-cycle costs. By increasing the production capacity at Portsmouth, the Department could shorten the duration of the Portsmouth conversion project by about 5 years and save about \$55 million.



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We recommended that the Department conduct a cost-benefit analysis to determine the optimum size and operation of the Portsmouth facility. We believe our recommendation is consistent with the accelerated, risk-based approach outlined in the Office of Environmental Management's (EM) 2002 *Top-to-Bottom Review of the EM Program*.

The Office of Inspector General has previously reported on similar issues. In our report on *Waste Incineration at the Savannah River Site* (DOE/IG-0453, October 1999), we found that the Department's design for the Consolidated Incinerator Facility included supplementary capacity and that the Department could save an estimated \$595 million by increasing throughput and utilizing the additional capacity.

MANAGEMENT REACTION

EM agreed with the basic thrust of our report, which identified cost savings by processing more material each year. However, EM expressed the view that the Department can improve its operations, increase throughput, and save costs without adding an additional line and that overall risk reduction and resource allocation should be considered as part of any optimization effort. In support of this position, management cited its experience on other EM projects, where higher throughput rates have been achieved by improving the efficiency of existing equipment. Also, EM management stated its intent to further incentivize the contractor to achieve accelerated results without additional cost. We agree with EM's position that operational process improvements can often be made without capital additions. However, in our judgment, proposals for improved operating approaches, while potentially beneficial, do not obviate the need for a comprehensive cost-benefit analysis of the depleted uranium hexafluoride conversion project. Management's concerns and our analysis of their comments are addressed on page 3 of the report.

Attachment

cc: Deputy Secretary
Under Secretary for Energy, Science and Environment
Assistant Secretary for Environmental Management

DEPLETED URANIUM HEXAFLUORIDE CONVERSION

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PORTSMOUTH FACILITY DESIGN

Background

In January 2002, the Department of Energy (Department) solicited proposals to design, build, and operate two facilities for the conversion of 704,000 tons of depleted uranium hexafluoride (DUF6) into a more stable form for disposal. The proposed contract term only awarded the first 5 years of operations to the successful bidder, even though bidders were expected to design facilities that would take up to 25 years to convert the entire inventory. In response, Uranium Disposition Services, LLC (UDS) proposed building facilities at the Paducah and Portsmouth Gaseous Diffusion Plants. The Paducah facility was designed to process the estimated 450,000 metric tons of DUF6 at Paducah within 25 years, while the Portsmouth facility would process the remaining estimated 254,000 metric tons located at Portsmouth and Oak Ridge within 19 years. Since the inventory at Paducah was almost twice that of Portsmouth and Oak Ridge combined, UDS proposed building a smaller facility at Portsmouth that would still be capable of converting its inventories within the required timeframe. UDS was awarded the \$500 million contract on August 29, 2002.

Portsmouth Facility Capacity

We found that the Department's plan for converting DUF6 inventories at Portsmouth emphasized initial capital costs rather than minimizing life-cycle costs. The Department's current plan to operate a smaller facility at Portsmouth for 19 years is less cost effective than building a facility with the same capacity as Paducah and completing the conversion within approximately 14 years. Based on its current contract with the Department, UDS is designing the Portsmouth facility with three conversion lines. These lines will be capable of processing 13,500 metric tons of depleted uranium hexafluoride per year. At this rate, UDS could treat 198,000 metric tons of material stored at Portsmouth and 56,000 metric tons stored at Oak Ridge in approximately 19 years. By adding another conversion line, Portsmouth could process 4,500 metric tons of additional material annually. The additional conversion line would increase capital costs by about \$5.6 million; however, it would also reduce life-cycle operating costs by \$60.2 million, allowing the project to be completed nearly 5 years earlier than planned.

We presented our conclusions to UDS and the Department's Office of Engineering and Construction Management (OECM) during the audit. UDS reviewed the potential savings calculations and agreed they were reasonable. OECM, based on our presentation, directed its contractor -- a non-profit consulting organization dedicated to improving public-sector management -- to review our calculations. The consulting

organization came to similar conclusions and issued a formal report¹ to OECM that stated actual savings could be as high as \$70 million.

In contrast to our findings at Portsmouth, it should be noted that it would not be feasible to add additional conversion lines to the Paducah Facility. Specifically, the Paducah conversion facility site is bordered by two permanent structures, a cylinder yard and protected wetlands. Therefore, to increase the capacity at Paducah, a new site selection and evaluation analysis would have to be completed. These activities could substantially delay the project causing the Department to miss the congressionally-mandated milestones.

Request for Proposals

When the Department issued the request for proposals on the conversion project, it did not emphasize minimizing life-cycle costs. The design basis in the request for proposal stated, "The conversion facilities shall be capable of processing...cylinders...at a rate such that the total DUF6 inventory at all three sites could reasonably be converted and dispositioned in no longer than 25 years after conversion operations start, subject to constraints of projected funding levels." In addition, cost estimates for the contract term were deemed a higher priority than life cycle costs. As a result, the bidders had little incentive to propose larger facilities to increase throughput, because larger facilities would increase proposed contract costs. In fact, UDS management stated that they chose one of the smallest facility designs possible to complete the conversion process within the 25-year requirement, thereby reducing the design, construction, and operational costs during the contract term.

Cost and Schedule Reductions

The Department has an opportunity to save at least \$55 million by adding an additional conversion line at the Portsmouth facility. The savings are the result of accelerated schedules and the increased throughput. Based on our calculations, while the additional line will cost about \$5.6 million to build, the Portsmouth inventory will be converted about 5 years sooner, saving about \$60.2 million in estimated operating costs. The Department agreed that modifying the design of the Portsmouth facility would result in a positive return on investment. However, Department officials stated that other factors, including schedule impacts and design basis safety issues, required consideration. We agree that these factors are important and should be considered by the Department as part of a cost-benefit analysis.

¹ DUF6 Project Reconfiguration Limited Review LMI Analysis for OECM, DE424SI November 2003.

Reducing the conversion cycle by nearly 5 years would also be consistent with the Office of Environmental Management's (EM) planned cleanup schedule for the Portsmouth facility. The Department's current approach for converting DUF6 at Portsmouth will not be able to meet EM's closure baseline with only three conversion lines. However, if the facility is designed with four conversion lines, the accelerated schedule will give the Department additional time to complete decontamination and decommissioning of the facilities.

RECOMMENDATIONS

We recommend that the Manager, Portsmouth Paducah Project Office:

1. Conduct a cost-benefit analysis to determine the optimum size and operation of the Portsmouth depleted uranium hexafluoride conversion facility; and,
2. Based on the results of the review, implement the most cost effective approach.

MANAGEMENT REACTION

The Assistant Secretary for Environmental Management agreed with the basic thrust of the report, which identified cost savings by processing more material each year. In its response to the recommendations, EM stated that it has been able to achieve higher throughput rates without constructing additional process lines. These improvements were achieved by making process changes to increase the efficiency of the existing equipment. Given this experience, EM believes that the DUF6 project can improve its operations, increase throughput, and save costs without the additional line. EM also stated that this approach will minimize the facility footprint, thereby reducing decommissioning and demolition costs, as well as reducing the volume of waste generated during decontamination and decommissioning operations. In addition, management asserted that the Office of Inspector General (OIG) recommendations were based on an analysis conducted by the Logistics Management Institute (LMI) for OECM.

Subsequent discussions were held with EM to clarify the Department's position on these issues. Management stated that the decision process to size and operate the conversion facility includes many factors beyond cost. Consideration is also given to overall risk reduction and the project's priorities within the context of the entire EM program, issues which may not be considered in a cost-benefit

analysis. Furthermore, EM is evaluating alternative ways to increase contractor innovation and accelerate project completion through improved contract incentives.

AUDITOR COMMENTS

While management agreed that increasing throughput is desirable, its comments do not address the report's recommendations. EM's position is that process improvements can be made without capital additions, thereby minimizing decontamination and decommissioning costs at the end of the project. However, this decision was arrived at without any quantitative analysis of alternatives. Hence, while we appreciate EM's efforts to improve processing efficiencies throughout the Department, we believe these efficiencies could be augmented by cost savings from increasing the capacity. A cost-benefit analysis is the primary quantitative means whereby the Department will be able to assess many key factors, including an increase in facility size, incentivizing the contractor to optimize the facility beyond the 84 percent efficiency already planned, and the additional decontamination and decommissioning costs.

Finally, in its response, EM stated that the principal basis for these recommendations is an analysis conducted by the LMI for OECM. As noted in LMI's report, the reported savings were based on our analysis. The LMI study was initiated by OECM in response to our audit findings.

Appendix 1

OBJECTIVE

To determine whether the Department has implemented an efficient plan for conversion of its depleted uranium hexafluoride inventory.

SCOPE

The audit was performed at the Oak Ridge Operations Office, Oak Ridge, Tennessee, from October 1 to November 7, 2003. The audit was limited to an evaluation of the Department's Depleted Uranium Hexafluoride Conversion Project activities at Portsmouth, Ohio, and Paducah, Kentucky, from 1999 through 2003.

METHODOLOGY

To accomplish the audit objective, we:

- Reviewed the current design for the Portsmouth and Paducah conversion facilities;
- Reviewed costs associated with the depleted uranium hexafluoride conversion facilities project;
- Evaluated the Department's procurement strategy for the depleted uranium hexafluoride conversion facilities and supporting documentation;
- Held discussions with Departmental and contractor personnel; and,
- Participated in the Office of Engineering and Construction Management's review of our cost savings calculation.

The audit was conducted 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 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. We did not conduct a reliability assessment of computer-processed data because only a limited amount of computer-processed data was used during the audit.

We held an exit conference with the Manager of the Portsmouth Paducah Project Office on February 19, 2004.

Appendix 2

PRIOR AUDIT REPORT

- *Waste Incineration at the Savannah River Site* (DOE/IG-0453, October 1999). The Consolidated Incinerator Facility (CIF) at the Savannah River Site was not operating at its permitted capacity. The CIF was operated at about 8 percent of capacity in Fiscal Years 1997 and 1998. This occurred because the Department designed the CIF to incinerate more waste than the Savannah River Site had available for treatment.

DOE # 1325-8
10-831
EFG 107-901

United States Government

Department of Energy

Memorandum

DATE: February 4, 2004

REPLY

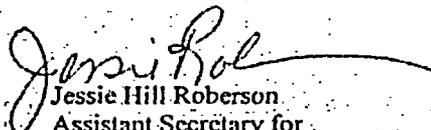
ATTN OF: EM-22 (R. Bradley, 301-903-7646)

SUBJECT: Draft Audit Report on "Depleted Uranium Hexafluoride Conversion"

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

This is in response to your memorandum to William Murphie, Manager, Portsmouth/Paducah Project Office, dated December 18, 2003, which forwarded the Draft Audit Report (A04OR013). Per your request, the attached comments reflect the current position of this office as to the conclusions and recommendations provided by the Office of Inspector General. We apologize for the delay in this response. Your letter was sent to our new Lexington Office during its transition to the new building.

If you have any further questions, please call me at (202) 586-7709 or Mr. Eugene Schmitt, Deputy Assistant Secretary for Environmental Cleanup and Acceleration, at (202) 586-0755.


Jessie Hill Roberson
Assistant Secretary for
Environmental Management

Attachment

Appendix 3 (continued)

Office of Environmental Management Comments on
Office of Inspector General Draft Audit Report on
Depleted Uranium Hexafluoride Conversion

The draft audit report provided by the Office of Inspector General (OIG) memorandum, dated December 18, 2003, recommends that the Office of Environmental Management (EM) conduct a cost benefit analysis to determine the optimum size of the Portsmouth Depleted Uranium Hexafluoride (DUF6) conversion facility, and, based on the results of that review, implement the most cost-effective approach. The report further states that it would not be feasible to conduct a similar analysis and implement changes at the Paducah facility because to do so would cause the Department to miss the congressionally mandated construction start milestone. The report goes on to state that for an estimated capital cost of \$5.6M to add an additional process line to the Portsmouth facility, the time to process the Portsmouth and Tennessee inventories of DUF6 could be shortened by five years at a cost savings of \$55M. The principal basis for these recommendations is an analysis conducted by the Logistics Management Institute for the Office of Engineering and Construction Management.

We agree with the basic thrust of the OIG report which identifies cost savings by processing more material each year. On other EM projects, we have been able to achieve higher throughput rates without the need to construct additional process lines. The improvements were achieved by making process changes to improve the efficiency of the existing equipment. Given this experience, we believe that the DUF6 project can improve its operations, increase throughput, and save costs without adding an additional line. Additionally, from a lifecycle standpoint, minimizing the facility footprint will reduce decommissioning and demolition costs as well as reduce the volume of waste generated during decontamination and decommissioning operations.

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