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

Audit Report

Sludge Removal Operations at the Hanford Site's K Basins

DOE/IG-0698

September 2005

Department of Energy
Washington, DC 20585
September 9, 2005

MEMORANDUM FOR THE SECRETARY

FROM: Gregory H. Friedman
Inspector General

SUBJECT: INFORMATION: Audit Report on "Sludge Removal Operations at the Hanford Site's K Basins"

BACKGROUND

The Spent Nuclear Fuels (SNF) Project at the Department of Energy's Hanford Site was initiated to cleanup and deactivate the K Basins, two indoor pools that stored approximately 2,100 metric tons of spent nuclear fuel. These basins are located near the Columbia River and pose a serious threat of contamination to the environment. The largest phase of the project, which was completed in October 2004, required removing the spent nuclear fuel from the pools and storing it in canisters in a dry storage facility until final disposal.

With the completion of fuel removal, the SNF Project has moved to a second phase which requires removing 50 cubic meters of contaminated sludge from the basins prior to the basins being deactivated and removed. This sludge resulted from dust blown into the basins, concrete from the basins' walls and floors, and contaminated material from corroding fuel assemblies. The original project plans called for retrieving the sludge and storing it for later treatment. However, the project scope was expanded in 2004 and now includes treating the sludge to put it into a form suitable for disposal.

The *Hanford Federal Facility Agreement and Consent Order,* a Tri-Party Agreement between the Department, the U.S. Environmental Protection Agency, and the State of Washington's Department of Ecology (Ecology), set the milestones governing cleanup of the Hanford Site, including the SNF Project. The Department assigned responsibility for managing the SNF Project to Fluor Hanford, Inc. (Fluor), a Hanford Site prime contractor. We initiated this audit to determine if the sludge removal phase of the SNF Project will be completed within schedule and estimated cost parameters.

RESULTS OF AUDIT

The audit disclosed that the sludge removal operations have slipped in schedule and have experienced significant cost overruns. For example in 2005, Fluor Hanford missed a March milestone to place the K East Basin Sludge into containers. In addition, actual costs have exceeded budgeted costs by approximately $34 million since October 2002. While technical difficulties with the sludge removal have contributed to the delays, we

found that neither the Department nor Fluor focused adequate attention on the sludge removal portion of the SNF Project during the critical planning phase. Resources were concentrated primarily on fuel removal with little emphasis on key project actions, such as the development of a risk mitigation plan. Further, we found that a dedicated manager had not been assigned to the project. Finally, prior to 2004, the Department had not structured performance fees to effectively incentivize contractor activities relevant to phase two of the project. As a result of these factors, milestones set by the Tri-Party Agreement may be missed and cost overruns within the project could negatively impact the Department's ability to further accelerate cleanup work on the Hanford Site.

To its credit, the Richland Operations Office has initiated several actions to address the weaknesses noted in our report. First, in 2004, Richland revised the performance incentives for the sludge removal process to distribute fee over the various aspects of the project. Second, Richland developed a new approach to project management intended to provide more centralized control of project baselines and to ensure that adequate resources are assigned to projects. However, this effort will not be fully in place until the end of Fiscal Year 2006. While we recognize that certain improvements have been made, additional efforts focusing on project planning and risk assessment/mitigation need to be implemented. Accordingly, we made specific recommendations to assist in this effort.

MANAGEMENT REACTION

The Office of Environmental Management concurred with the report's recommendations and has initiated actions to address the issues noted in the report.

Attachment

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

REPORT ON THE SLUDGE REMOVAL OPERATIONS AT THE HANFORD SITE'S K BASINS

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Project Schedule and Cost

The sludge removal phase of the Spent Nuclear Fuels (SNF) Project has experienced schedule delays and cost increases. For example, the original Tri-Party Agreement (TPA) milestone called for sludge removal to begin by December 2002; however, Fluor was unable to begin operations until July 2004 – 18 months later than planned.

In April 2003, Fluor initiated the final step towards beginning sludge removal operations. This step, called the Operational Readiness Review (ORR), required an assessment to verify that an adequate state of readiness had been achieved to begin startup of sludge removal operations. Due to numerous deficiencies, the ORR was halted shortly after it started. Deficiencies included instances where installed equipment did not meet construction specifications, testing documentation was either inadequate or nonexistent, and changes were made to equipment designs without an adequate review for potential safety impacts.

Although the ORR deficiencies were resolved and operations began in July 2004, additional delays have occurred. Specifically:

- Visibility in the basin water was greatly reduced by grout poured into portions of the basins and by fine particles suspended in the water from sludge removal operations. This reduced visibility prevented efficient operation and extended all in-basin cleanup activities.

- The filters used in the sludge removal process have been blocked frequently by fibrous material and required regular cleaning to clear them.

- Operators found a large amount of debris underneath the sludge that had not been anticipated such as scaffold planks, welding blankets, a fire hose, and fuel spacers that required extensive efforts to remove.

Each of these problems, among others, impacted the sludge removal operations by either causing delays or increasing the amount of work required. Fluor officials estimated that these combined factors would delay completion of sludge containerization within the K East Basin by five months from March 1 to July 31, 2005.

Since October 2002, the actual costs incurred for sludge removal have exceeded planned expenditures by 35 percent, and cost overruns continue to increase. Richland's current cost estimate for completing sludge operations is $145.9 million with work to be completed by October 2007. However, from October 2002 through the end of June 2005, the actual cost of sludge removal operations exceeded the budgeted estimate by approximately $34 million. For the first nine months of Fiscal Year (FY) 2005, actual costs were almost $25 million – or 68 percent – higher than anticipated.

Management and Oversight

Although problems such as reduced visibility, clogged filters, and unexpected debris contributed to the schedule delays and cost overruns, officials did not focus adequate attention on project management. In addition, previous performance measures were not implemented that would have effectively incentivized Fluor to complete sludge removal.

Project Management

Neither Richland nor Fluor management provided adequate attention to the planning phase for sludge removal activities, or to ensuring that key staff were assigned to the project prior to initiation of operations. Project resources instead were concentrated primarily on fuel removal and preparation for sludge removal did not receive adequate resources. For example, critical project management activities such as the development of a risk management plan were not completed by Richland and Fluor until after sludge removal activities began. Additionally, Fluor Hanford did not assign a dedicated project manager to sludge removal until after operations began and Fluor had failed to successfully complete the ORR in April 2003.

As noted above, the sludge removal risk management plan was not developed or approved prior to the commencement of operations. While a risk management plan for sludge removal is now in place, it was not approved until August 2004 – one month after actual removal activities resumed. Moreover, the Project Execution Plan for the SNF Project as a whole, which includes the risk management plan, only covers activities through FY 2006, the end of Fluor's contract, rather than through project completion in FY 2009.

By delaying the identification and mitigation of potential project risks, the Department significantly decreased its ability to deal with

these risks in a timely and cost efficient manner. Additionally, while the risk management plan did include a listing of the risks, it did not contain in-depth risk identification or clear risk mitigation strategies, which would have provided the basis for either avoiding or minimizing the potential risks. For example, the plan to treat the sludge in a part of K East Basin, known as the North Load-Out Pit, states that careful planning and execution would be necessary to meet the schedule, but does not detail the problems that could be encountered during removal. Another example of inadequate planning was that the plan for placing the sludge in containers only considered the container design, not how the sludge will actually be put into the containers.

Fluor had also not assigned a dedicated project manager to the sludge portion of the project until after the ORR was halted, a factor that Fluor's own analysis indicated contributed to the ORR's failure. Had a sludge project manager been in place, an earlier and more thorough planning for the project may have occurred, thereby mitigating the adverse events (i.e. water visibility and clogged filters) encountered.

In addition to our audit, the Defense Nuclear Facilities Safety Board (Board) has noted similar problems within the sludge removal project. In a February 2005 letter to the Department's Office of Environmental Management (EM), the Board listed several issues identified during its recent review of the sludge removal project. The Board stated that a number of difficulties being experienced by the project were the result of not applying the core functions of Integrated Safety Management, including: defining the scope of work and identifying and controlling hazards. The Board also noted that planning for the project life cycle was incomplete and that there was a lack of integration between sludge removal subprojects. In response, EM management concurred with the Board's concerns and has stated its intent to take action.

Performance Measures

Finally, Richland did not initially develop strong performance measures with associated incentives to effectively complete sludge removal. Rather, the performance incentives within the contract were "front-loaded" with the majority of fee being earned when the initial quantities of sludge was removed from the basin, but with little incentive offered to complete sludge removal. Richland

officials stated that the incentives were intentionally structured in this manner to ensure the initiation of difficult one-of-a-kind projects. However, during FY 2004 Richland revised the performance incentives for the sludge removal project. Under the new performance incentives Fluor's ability to earn fee was distributed throughout the various phases of the sludge project. Although no formal recommendations will be made concerning this issue, the effectiveness of the revised incentives should continue to be monitored.

Impact on Future Milestones and Other Projects

If project management and oversight are not improved, it is likely that the milestones to complete sludge removal will slip further. It should be noted that since March 2001, the TPA milestones for the sludge project have been changed on at least three occasions due to scope changes. Furthermore, if additional problems are encountered, the ability to accelerate cleanup work at the Hanford Site will be impacted. For example, in order to provide additional funding for increased sludge operations costs, Fluor may need to eliminate lower priority cleanup work currently scheduled to be done in FY 2005.

RECOMMENDATIONS

We recommend that the Assistant Secretary for Environmental Management direct the Richland Operations Office to:

1. Develop a complete risk assessment/mitigation plan that addresses all aspects of risk regarding the SNF Project, along with developing effective mitigation strategies for identified risks to support ongoing project operations.

2. Ensure that long term project planning is completed in sufficient detail to prevent further delays to the project.

3. Based on the prior two recommendations, reevaluate the current cost and schedule baseline to ensure that all project requirements and potential risks are addressed.

MANAGEMENT COMMENTS

The Office of Environmental Management (EM) concurred with the recommendations and initiated corrective actions to address each of the recommendations. These actions included updating and completing documented risk assessments for the balance of contract work scope by the end of January 2006; applying a

disciplined, systematic approach to long-term planning to be completed by the end of April 2006; and, reevaluating and updating the project baseline to reflect impacts associated with K East sludge containerization to be completed by the end of May 2006.

AUDITOR COMMENTS

We consider management's comments and actions to be responsive to our recommendations.

Management's comments are included in their entirety in Appendix 3.

Appendix 1

OBJECTIVE

To determine if the sludge removal process phase of the Spent Nuclear Fuels (SNF) Project will be completed within the revised schedule and estimated cost parameters.

SCOPE

We conducted the audit from July 2004 to June 2005, at the Hanford Site in Richland, Washington. The scope of the audit covered Richland's Spent Nuclear Fuel Project.

METHODOLOGY

To accomplish the audit objective, we:

- Obtained and reviewed project documents for the SNF Project;
- Researched Federal and Departmental regulations;
- Reviewed findings from prior audit reports regarding SNF activities;
- Reviewed the Fluor Hanford, Inc. contract with the Richland Operations Office;
- Assessed internal controls and performance measures established under the *Government Performance and Results Act of 1993*; and,
- Interviewed key personnel in the Richland Operations Office and Fluor Hanford, Inc.

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 audit objective. We assessed compliance with the Government Performance and Results Act of 1993 related to Richland's Spent Nuclear Fuel Project. As stated in the report, the audit found that although performance incentives had been established they were not effective to ensure project completion. 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 we did not consider such data critical to achieving our audit objective.

Management officials waived the exit conference.

RELATED AUDIT REPORTS

Office of Inspector General Reports:

- *Completion of K Basins Milestones* (DOE/IG-0552, April 2002). This report found that the Department of Energy was in jeopardy of missing milestones in the Tri-Party Agreement associated with the removal of fuel from the K-Basins. Achievement of the TPA's milestones was jeopardized because the Department's plan for cleanup of the K Basins was not adequate to ensure that the deadlines would be met. Specifically, the Department agreed to the milestones before completing construction of required facilities, without a full understanding of new technologies that would be employed, and without a realistic processing schedule. Essentially, the Department's planning assumptions were overly optimistic.

Government Accountability Office Reports

- *Nuclear Waste: Management Problems at the Department of Energy's Hanford Spent Nuclear Fuel Storage Project* (GAO/T-RCED-98-119, May 1998). The GAO reported that the project was over 4 years behind schedule and that its estimated cost had doubled to about $1.4 billion. The GAO identified several reasons for the problems, including an overly optimistic schedule that lacked adequate time to address contingencies, poor performance by the project contractor in managing the schedule and resolving critical issues, and inadequate management and oversight by DOE and its contractor in charge of managing the entire Hanford Site.

- *Nuclear Waste: DOE's Hanford Spent Nuclear Fuel Storage Project-Cost, Schedule, and Management Issues* (GAO/RCED-99-267, September 1999). The report found that completion of the project is scheduled for July 2007 at a cost of $1.7 billion-about 6 years and $1 billion beyond the original estimates. Additionally, the report specified that the estimated date for completing safety documentation has slipped, operational readiness issues have become major challenges, and most of the extra time built into the schedule for addressing contingencies has already been used up. The GAO report found that concerns continue to exist about the project's management and oversight. Also, focused management attention is needed to successfully bring the project to completion.

Department of Energy
Washington, DC 20585
August 17, 2005

MEMORANDUM FOR GEORGE W. COLLARD
ASSISTANT INSPECTOR GENERAL FOR
AUDIT OPERATIONS
OFFICE OF INSPECTOR GENERAL

FROM: CHARLES E. ANDERSON
PRINCIPAL DEPUTY ASSISTANT SECRETARY FOR
ENVIRONMENTAL MANAGEMENT

SUBJECT: The Office of Inspector General's Draft Audit Report Entitled "Sludge Removal Operations at the Hanford Site's K Basins"

This is in response to the draft audit report entitled "Sludge Removal Operations at the Hanford Site's K Basins" which we received on July 20, 2005. Thank you for the opportunity to comment on the revised subject draft report. The Office of Environmental Management (EM) concurs with the recommendations provided in your draft audit report, and has initiated actions to address the issues of concern. Specific comments regarding the draft report recommendations are presented below:

1. Develop a complete risk assessment/mitigation plan that addresses all aspects of risk regarding the Spent Nuclear Fuel Project, along with developing effective mitigation strategies for identified risks to support ongoing project operations.

   The Richland Operations Office (RL), in conjunction with the contractor, plans to update and complete documented risk assessments for the balance of contract work scope. To better understand the remaining risks, identify schedule consequences, and develop appropriate strategies to prevent or mitigate the risks, RL will complete this risk identification and mitigation process by the end of January 2006. Regarding the work scope beyond the current contract period fiscal year 2006, RL will continue to refine and monitor the project risks and develop the strategies to prevent or mitigate those risks through project completion.

2. Ensure that long-term project planning is completed in sufficient detail to prevent delays to the project.

   The Department of Energy (DOE) will apply a disciplined, systematic approach to long-term planning which can define all work requirements, flexibly handle first-of-a-kind unique challenges/risks, and realistically establish cost and schedule targets. These long-term planning efforts will be done in parallel with the risk management activities identified in recommendation one by the end of April 2006 to reflect the risk prevention

and mitigation strategies as well as the remaining work requirements for timely input to the baseline update task identified in recommendation three.

3. Based on the two prior recommendations, reevaluate the current cost and schedule baseline to ensure that all project requirements and potential risks are addressed.

   DOE is currently reevaluating and updating the project baseline to reflect impacts associated with K East sludge containerization. Once the impacts are fully analyzed and quantified, a revised baseline will be established. The revised baseline will reflect the results of the risk assessment (recommendation one) and long-term planning efforts (recommendation two) described above. This will be complete by the end of May 2006.

If you have any further questions, please call me at (202) 586-7709 or Barbara D. Male, Deputy Assistant Secretary, Office of Performance Intelligence and Improvement, at (202) 586-1665.

Attachment

cc:
Keith A. Klein, Richland Operations Office

IG Report No. DOE/IG-0698

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