OFFICE OF INSPECTOR GENERAL

U.S. Department of Energy

AUDIT REPORT

DOE-OIG-19-20 March 2019

RADIOACTIVE LIQUID WASTE TREATMENT FACILITY REPLACEMENT PROJECT AT LOS ALAMOS NATIONAL LABORATORY

Department of Energy
Washington, DC 20585

March 1, 2019

MEMORANDUM FOR THE ADMINISTRATOR, NATIONAL NUCLEAR SECURITY ADMINISTRATION

FROM: Michelle Anderson
Deputy Inspector General
for Audits and Inspections
Office of Inspector General

SUBJECT: INFORMATION: Audit Report on "Radioactive Liquid Waste Treatment Facility Replacement Project at Los Alamos National Laboratory"

BACKGROUND

The primary responsibility of the National Nuclear Security Administration's (NNSA) Los Alamos National Laboratory (Los Alamos) is to ensure the safety, security, and reliability of the Nation's nuclear stockpile. To meet its mission, Los Alamos stores, treats, and disposes of low-level waste (LLW) and transuranic liquid waste (TLW) at the Radioactive Liquid Waste Treatment Facility (RLWTF). The facility has been in operation since 1963, and the facility's systems have degraded and failed on multiple occasions, leaving Los Alamos with no method of processing radioactive liquid waste while repairs were made. In 2004, NNSA and Los Alamos began planning the RLWTF Replacement Project to replace the existing facility.

From June 1, 2006, to October 31, 2018, Los Alamos National Security, LLC (LANS) operated Los Alamos as an Agent for NNSA.[1] In September 2013, NNSA committed to constructing one facility for processing LLW and a second for processing TLW. The construction for LLW was scheduled to be completed in May 2018 at a cost of $82 million. In our prior report, *The Radioactive Liquid Waste Treatment Facility Replacement Project at Los Alamos National Laboratory* (OAS-L-13-15, Sept. 2013), we found that NNSA and Los Alamos had not effectively managed the project, which was behind schedule with an estimated cost increase from $86 million to as much as $214 million. Because of the importance of the project, we conducted this audit to determine whether NNSA and LANS effectively managed the RLWTF Replacement Project.

[1] On November 1, 2018, a new management and operations contractor assumed management of Los Alamos National Laboratory on behalf of NNSA.

RESULTS OF AUDIT

Although NNSA provided adequate oversight of the RLWTF Replacement Project, LANS still experienced significant problems managing the LLW and TLW projects. The NNSA provided oversight through the NNSA Acquisition and Project Management Federal Project Director regularly monitoring project progress, including construction site activities, and by independently evaluating LANS' performance in the areas of quality assurance, risk management, construction, and earned value management. In a series of letters to LANS, the Federal Project Director and NNSA Acquisition and Project Management Contracting Officer outlined expectations for the projects' costs and schedules, and made observations on project work quality and subcontractor management. In addition, the Federal Project Director and Contracting Officer repeatedly informed LANS of weaknesses in its project execution and directed LANS to provide project recovery plans to address cost overruns and schedule delays. Finally, to drive contractor performance improvements, NNSA included LANS' inadequate performance on the projects under its management in the Contractor Performance Assessment Reporting System, a Federal Government-wide information system for collecting and documenting contractor performance information. Due to concerns with LANS' performance, in December 2015, NNSA decided to re-compete the management and operations contract for Los Alamos.

Despite NNSA's adequate oversight in the areas of improving project execution, and correcting cost and schedule overruns for the LLW and TLW projects, LANS continued to experience significant problems in the:

- Design process, construction quality, and subcontractor management of the LLW project; and

- Design phase of the TLW project.

Notably, LANS slipped 7 months behind an NNSA-approved revision to the LLW project baseline, which itself extended the LLW project's timeline, according to the NNSA Federal Project Director. We determined that these conditions occurred because LANS had not corrected systemic project management weaknesses. In particular, LANS lacked a consistent method of analyzing and addressing project management lessons learned. Further, LANS did not effectively incorporate lessons learned from prior capital asset projects into the planning and execution of subsequent capital asset projects. These problems in project execution continued despite NNSA's repeated attempts to direct change and hold LANS accountable. In addition, the *Capital Projects Assessment*, which was conducted by a team of LANS managers chartered by the Los Alamos National Laboratory Director and issued in November 2016, demonstrated that LANS had a pattern of weak capital asset project execution, with specific systemic issues in subcontractor bidding, selection, and management. In particular, recent projects, including the Nuclear Materials Safeguards and Security Upgrade Project and the Technical Area 55 Reinvestment Project Phase II, faced cost overruns and schedule delays.

As a capital asset project, the RLWTF Replacement Project was conducted in accordance with Department of Energy Order 413.3B, *Program and Project Management for the Acquisition of*

Capital Assets, which required risk management activities throughout the project, including implementation of lessons learned. Without effectively incorporating lessons learned from one capital asset project to the next and addressing systemic issues, Los Alamos could continue to experience recurring project execution challenges that could lead to cost increases and schedule slippage. The LLW's total project cost has already increased, and further cost increases are likely if the schedule continues to slip. Additional delays in the completion of the RLWTF Replacement Project could also jeopardize Los Alamos' ability to perform mission critical activities, including the processing of liquid waste associated with nuclear weapon programs.

LLW Project Execution

The construction of the LLW was hampered in part by problems with the design process, subcontractor management, and construction quality. One contributor to construction delays was the design process, which yielded designs that were not constructible without modification. The design phase of the LLW project did not include adequate reviews to ensure that design documents were consistent with one another. Design issues, including inconsistencies, contributed to construction delays, as the construction subcontractor had to delay work while waiting for the design documents to be corrected. In addition, the approved facility design from 2013 specified process equipment which was no longer available. LANS officials told us that many of the process equipment specifications had been developed years before the 2013 facility design was ultimately approved. For example, LANS officials told us that the company that made an evaporator specified in the design had been bought out, and the only company that produced a comparable unit was based in Europe. In December 2014, LANS accepted its construction subcontractor's request to use alternate, comparable equipment. However, the replacement equipment was physically larger than the equipment originally specified. LANS did not complete the changes to the facility layout required to accommodate the new, larger equipment until late 2016.

LANS' decision to award the construction subcontract for the LLW facility to the lowest-cost, technically acceptable subcontractor allowed LANS to select a minimally-qualified but technically acceptable subcontractor that proved unable to successfully complete project tasks. Committing to select a subcontractor based solely on the lowest acceptable bid prevents a selector from making cost and technical tradeoffs when making the selection. LANS officials told us that advertising based on this selection criteria potentially caused some subcontractors to decline to bid, and ultimately LANS received only 2 bid proposals for construction of the LLW out of 11 potential bidders. Further, one company was involved in both bids received. LANS accepted the proposal in which the company common to both proposals acted as the general contractor and subcontracted the concrete work. While the selected contractor met the minimum requirements LANS had established for the work, and was therefore technically qualified, NNSA and LANS officials told us that the general contractor overseeing the concrete work had limited experience supervising subcontractors. This contributed to problems in the general contractor's management of the concrete subcontractor's work. Specifically, the concrete subcontractor did not adequately prepare for the effects of weather. In addition, the subcontractor repeatedly failed to prepare technically acceptable concrete based on nonconformance reports prepared by the general contractor. The finished concrete frequently failed to meet quality requirements, and had cracks, patches, and improper grading that required rework. LANS recognized lessons learned

from the shortcomings of selecting the lowest-cost technically acceptable bidder and was planning to use an acquisition strategy that permits more flexibility in selecting more qualified subcontractors with the best overall value for future projects.

The construction problems delayed the LLW project's schedule and increased its cost. Neither LANS nor the general construction contractor were able to effectively manage the concrete subcontractor to prevent significant construction delays, and by November 2015, NNSA reported the project was more than 7 months behind. In December 2015, after the concrete subcontractor was terminated, LANS reported that it had implemented a series of corrective actions intended to improve jobsite safety and improve the accuracy of the reported status of the project's cost, schedule, and risk management. As the project continued to exceed budget and fall behind schedule, in March 2017, NNSA approved LANS' request to increase the budget by $7.1 million, bringing the LLW total project cost to $89.8 million, and also approved LANS's request to revise the project's schedule to extend the project completion date from May 2018 to November 2018. However, as of March 2018, LANS' progress on the LLW project had slipped 7 months behind the revised project schedule, according to NNSA's Federal Project Director.

Planning for TLW Execution

LANS had already faced delays and other issues in the design phase for the TLW project. For example, LANS was 2 months late awarding its design contract and had to perform an additional design review to address low-quality aspects of its contractor's design work. In March 2017, NNSA sent a letter to LANS criticizing its history of poor performance on capital asset projects. In this letter, the Federal Project Director stated that the TLW project was likely to be unsuccessful given that LANS had not changed its management practices. This letter set the expectation that LANS apply lessons learned from previous projects to its processes to ensure that the TLW project and future capital asset projects have a reasonable opportunity for success. LANS ultimately submitted the planning package for the TLW project, including a cost and schedule proposal, to NNSA in June 2017, 2 months behind schedule. The cost and schedule proposal submitted by LANS exceeded the cost and schedule range NNSA had approved in September 2013 by approximately $22 million. After receiving the proposal, NNSA directed LANS to suspend project activities on the TLW by September 30, 2017.

In response to NNSA feedback, LANS took some steps to prevent performance issues that occurred in LLW project execution from recurring during the TLW project. Specifically, the TLW project team reviewed completed and on-going capital asset projects at LANS and identified 14 lessons learned as essential to timely and cost efficient TLW project execution. These lessons learned identified improvements in design, non-manual staffing, acquisition, submittals, risk management, project controls, and estimating. However, LANS did not formally track implementation of these key lessons learned as corrective actions. According to the Federal Project Director, NNSA was not expecting LANS to provide a corrective action plan in response to the March 2017 letter.

While LANS took actions to address some lessons learned, they did not fully address all lessons learned. In particular, we determined that LANS had not addressed two documented lessons learned as described. To address a lesson that design issues caused delays, LANS officials told

us that they conducted additional, more formal reviews for the TLW to ensure that designs matched across engineering disciplines. However, the interdisciplinary review that the TLW Project Manager provided to us only included comments from reviewers who had participated in the 60 and 80 percent design reviews. Multiple reviewers stated that their methodology consisted of simply reviewing their previous design reviews to identify interdisciplinary comments rather than conducting additional reviews to ensure that the designs across engineering disciplines complemented one another appropriately. To address a second lesson, LANS committed to implementing a tiered risk management approach, and stated that a risk plan had been quantified and incorporated into the risk register and project cost estimate as of June 2017. However, we found that this tiered risk plan had not been incorporated into the July 2017 risk register for the facility prior to the project's suspension.

Of the remaining 12 lessons learned we reviewed, 5 involved actions that relate to the TLW's construction subcontract or equipment acquisition, and cannot be implemented or evaluated for adequacy until NNSA authorizes the start of construction. The actions stemming from the remaining seven lessons learned were either completed or were in the process of completion prior to the project's suspension. Specifically, TLW management had begun one on-going action: conducting full qualitative risk assessments on a monthly basis to ensure that each month's best case, most likely, and worst case cost estimates took project risk into account. The five completed actions, which were related to the design or cost estimate, were intended to improve the TLW project execution when the project begins construction. Once TLW construction begins, it will be important that these lessons learned are fully implemented.

Recurring Challenges

Despite NNSA's and LANS' repeated attempts to improve RLWTF Replacement Project execution, challenges persisted. Systemic weaknesses in LANS' implementation of lessons learned continued to impact LANS' project management execution, including its management of the RLWTF Replacement Project. In particular, LANS' poor construction subcontractor performance was part of a long line of known systemic issues in subcontractor bidding, selection, and management. At LANS, the approach to subcontract management was frequently unsuccessful, and subcontractor management and supervision frequently under-performed, leading to irrecoverable impacts to cost and schedule.

To its credit, LANS recognized these issues as corporate-level lessons learned for capital asset projects. Further, LANS reported that it implemented many lessons learned during the design phase for the TLW. Specifically, Department Order 413.3B stated that lessons learned and best practices should be captured throughout the continuum of a project. Department Order 413.3B also stated that lessons learned were valuable because they would benefit future endeavors and ideally prevent any negative happenings from taking place in the future. While LANS reported to have implemented lessons learned for the TLW design package, LANS' own review identified inadequacies in the incorporation of lessons learned, as well as additional issues with estimating and risk identification, and concluded that the package was not ready for submission to NNSA. The NNSA Federal Project Director has told us that LANS' lessons learned implementation plans appeared effective but that LANS had not demonstrated an ability to successfully execute its improvement plans in the past.

Impacts

LANS' inability to effectively incorporate lessons learned from one project to the next led to recurring project execution challenges, including schedule slippage and cost increases. These problems can adversely impact NNSA programs that rely on the success of Los Alamos projects. The unexpected increase of $7.1 million and 200 calendar days required for the LLW project was funded in part through reprogramming (reducing) funds from other NNSA mission critical activities. Without addressing known issues for the TLW project, execution of the TLW project will likely also exceed its cost and schedule parameters. Conversely, if the management and operations contractor incorporated the lessons learned actions to improve TLW project execution into institutional project management practices, it should improve execution of future projects.

Further delays in completing the RLWTF Replacement Project on time increases the use and potential failure of the existing facility equipment. The RLWTF must maintain a capability to collect, store, treat, and discharge radioactive liquid waste until such time that the overall Los Alamos stockpile stewardship mission is terminated. Currently, the RLWTF represents a potential single-point failure for all Los Alamos programs that generate radioactive liquid waste.

RECOMMENDATIONS

To address the issues we identified, we recommend that the Administrator, National Nuclear Security Administration direct the Associate Administrator, Acquisition and Project Management to:

1. Ensure that lessons learned are adequately implemented during TLW performance; and

2. Ensure identification and incorporation of cross-cutting project management lessons learned into institutional practices.

MANAGEMENT RESPONSE

Management concurred with the report's recommendations. Specifically, management stated that during the transition to a new site contractor, the incumbent contractor had identified opportunities for improvement of project execution, which the new contractor began to implement where appropriate.

Management's comments, in their entirety, are included in Attachment 3.

AUDITOR COMMENTS

We consider management's comments and corrective actions to be responsive to our recommendations. In addition, we consider management's actions adequate to meet the intent of our recommendations and commend them for taking action without waiting for a formal report.

Attachments

cc: Deputy Secretary
Chief of Staff

OBJECTIVE, SCOPE, AND METHODOLOGY

OBJECTIVE

We conducted this audit to determine whether the National Nuclear Security Administration (NNSA) and Los Alamos National Security, LLC effectively managed the Radioactive Liquid Waste Treatment Facility (RLWTF) Replacement Project.

SCOPE

The audit was performed from October 2016 to March 2019 at Los Alamos National Laboratory in Los Alamos, New Mexico and included RLWTF activities since September 2013. We conducted this audit under Office of Inspector General project number A17LA002.

METHODOLOGY

To accomplish our audit objective, we:

- Reviewed applicable laws and regulations, and Department of Energy policies related to project management;
- Reviewed and analyzed documents concerning the cost overruns and schedule delays in the RLWTF Replacement Project;
- Analyzed the *Capital Projects Assessment* for lessons learned that were applicable to the RLWTF Replacement Project;
- Reviewed the Performance Evaluation Plans and the Contractor Performance Assessment Reporting System for Los Alamos National Security, LLC;
- Examined Departmental and Parent Organization reviews of Los Alamos' Earned Value Management System;
- Examined the Parent Organization Functional Management Review for the RLWTF; and
- Interviewed Los Alamos National Security, LLC; Los Alamos Field Office; and NNSA officials responsible for the RLWTF.

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 conclusions based on our audit objective. The audit included tests of internal controls and compliance with the laws and regulations to the extent necessary to satisfy the audit objective.

Additionally, we assessed the Department's implementation of the *GPRA Modernization Act of 2010* as it relates to our audit objective and found that the Department had established performance measures to execute key milestones in support of Los Alamos capital asset projects.

Because our review was limited, it would not have necessarily disclosed all internal control deficiencies that may have existed at the time of our audit. We relied on computer-processed data on a limited basis to achieve our audit objective. We compared data generated from reporting systems with other available documents, histories, and analyses to determine a sufficiently reliable project history for the purposes of this audit. We disclosed other data shortcomings in our report.

An exit conference was waived on February 13, 2019.

RELATED REPORTS

Office of Inspector General

- Audit Report on *Department of Energy Contractors' Implementation of Earned Value Management* (OAI-L-17-03, November 2016). The Department of Energy uses Earned Value Management (EVM) as a project management tool to measure the value of completed work against the planned work schedule and estimated cost. Given the reliance the Department places on EVM to manage its projects and provide an early warning of negative trends, this audit was conducted to determine whether the Department's management and operating contractors effectively implemented EVM systems. To its credit, the Office of Project Management and Oversight and Assessments has identified deficiencies with the contractors implementing EVM. During our audit, we observed that reviews of some contractors' EVM systems were delayed; however, we noted that the Office of Project Management and Oversight and Assessments was taking corrective actions. Without certifying compliance with the Electronic Industries Alliance publication 748 and conducting surveillance reviews to ensure that contractors properly implement their certified EVM systems, the Department cannot ensure that the EVM data it receives from the contractors are reliable. Granting concessions from EVM reporting to troubled projects further impedes Department decision makers.

- Special Report on *NNSA's Management of the $245 Million Nuclear Materials Safeguards and Security Upgrades Project Phase II* (DOE/IG-0901, January 2014). To address aging security infrastructure, the National Nuclear Security Administration (NNSA) upgraded the security at Los Alamos National Laboratory's (Los Alamos) Technical Area-55 through the Nuclear Materials Safeguards and Security Upgrades Project - Phase II. Our review revealed that the Project suffered from a number of project management weaknesses. These weaknesses included failures to ensure that work scope was fully and accurately planned or that construction subcontractors were required to promptly correct inferior work. These issues ultimately resulted in cost increases of as much as $41 million and delayed completion of the project by nearly a year. In addition, management information systems failed to provide accurate and complete information about the funds available to complete the remaining work scope. These project management issues created a series of problems that collectively resulted in significant unanticipated cost and schedule impacts. The NNSA had taken a number of positive actions to hold Los Alamos accountable for lack of performance; however, project management concerns remain despite these actions.

- Audit Report on *The Radioactive Liquid Waste Treatment Facility Replacement Project at Los Alamos National Laboratory* (OAS-L-13-15, September 2013). The NNSA and Los Alamos have been planning a replacement project for the Radioactive Liquid Waste Treatment Facility (RLWTF) since 2004. Over the years, they have made multiple changes in the design of the facility, first planning to construct two facilities in 2005, then changing plans to construct only one facility in 2006, and finally returning to the two facilities approach in 2011. As of 2013, the two facility design had a total estimated project cost of as much as $214 million and completion dates of 2017 and 2020. While

NNSA has recently taken action to address RLWTF Replacement Project issues, we observed that NNSA and Los Alamos had not effectively managed the project over most of its lifecycle. Despite more than 7 years of effort and the expenditure of $56 million, design work for the transuranic facility had not been completed and the project's completion date was 11 years behind schedule. Furthermore, the total estimated cost for the replacement project increased from $86 million to as much as $214 million, a 149 percent increase. Additionally, independent peer and internal control reviews have noted that NNSA and Los Alamos had not developed reliable life cycle cost estimates, used a Risk Management Plan, nor applied Value Engineering principles to optimize the design of the facility. The NNSA and Los Alamos have made improvements in the project management of the RLWTF Replacement Project; however, we made suggestions for further improvement.

- Audit Report on *The Use of Staff Augmentation Subcontracts at the National Nuclear Security Administration's Mixed Oxide Fuel Fabrication Facility* (DOE/IG-0887, May 2013). Shaw AREVA MOX Services, LLC (MOX Services) is responsible for the design and construction of NNSA's Mixed Oxide Fuel Fabrication Facility at the Savannah River Site. MOX Services used staff augmentation subcontracts to fill professional, technical, and administrative support service positions on an as-needed basis. This audit disclosed that MOX Services had not effectively managed the temporary living expense component of its staff augmentation effort and had been reimbursed for about $3.7 million for inappropriate expenses. These excessive and unnecessary costs occurred, in part, because MOX Services had eliminated portions of a relevant policy and had not consistently implemented other established policies and procedures. This was compounded by the fact that NNSA had not effectively monitored MOX Services' management of the staff augmentation subcontracts.

Government Accountability Office

- *Nuclear Waste: DOE Needs to Improve Cost Estimates for Transuranic Waste Projects at Los Alamos* (GAO-15-182, February 2015). The NNSA's cost estimate for the Transuranic Waste Facility (TWF), which consisted of separate cost estimates for completing construction and for operations and maintenance, partially reflected each of the four characteristics of a reliable estimate (comprehensive, well-documented, accurate, and credible) as established by best practices. However, NNSA did not sufficiently document the approach used to develop the operations and maintenance estimate, which represented about 74 percent of the TWF's life-cycle costs, because the Department's project management order does not require these costs to be documented when a project is approved to request funding from Congress for construction. As a result, the Government Accountability Office could not determine whether the cost-estimating approach was appropriate. Updating the TWF's cost estimate to include all life-cycle costs and needed analyses would provide NNSA with more reliable information for better managing the TWF project as NNSA prepares for the start of operations.

MANAGEMENT COMMENTS

Department of Energy
Under Secretary for Nuclear Security
Administrator, National Nuclear Security Administration
Washington, DC 20585

November 26, 2018

MEMORANDUM FOR APRIL G. STEPHENSON
ACTING INSPECTOR GENERAL

FROM: LISA E. GORDON-HAGERTY

SUBJECT: Comments on the Office of Inspector General Draft Report "The Radioactive Liquid Waste Treatment Facility Replacement Project at Los Alamos National Laboratory" (A17LA002)

Thank you for the opportunity to review and comment on the subject draft report. The National Nuclear Security Administration (NNSA) appreciates the Office of Inspector General's recognition of the extensive oversight provided by the Office of Acquisition and Project Management (NA-APM) on the Radioactive Liquid Waste Treatment Facility (RLWTF) Replacement Project at Los Alamos National Laboratory (LANL). As noted in your report, NNSA recognized and proactively pursued resolution of performance issues with Los Alamos National Security, LLC. Notwithstanding findings on this project, since 2013, NNSA has completed 6 projects at LANL, valued at $667M, 3.5 percent under their original budgets.

NNSA recently terminated the prior Management and Operating Contractor (M&O). Effective November 1, 2018, a new M&O for LANL has assumed operations, including management of the RLWTF Replacement Project. As part of the contract transition, the incumbent M&O has identified opportunities for improvement of project execution that have been provided to the new M&O contractor. The NNSA's Acquisition and Project Management office will ensure these lessons learned are communicated and implemented. The above actions are expected to effectively address the auditors' recommendations.

NNSA subject matter experts have also provided technical comments to your audit team under separate cover. If you have any questions regarding this response, please contact Mr. Dean Childs, Director, Audits and Internal Affairs, at (301) 903-1341.

FEEDBACK

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