



**U.S. Department of Energy**  
**Office of Inspector General**  
**Office of Audits and Inspections**

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# AUDIT REPORT

Lithium Operations at the Y-12 National  
Security Complex

OAI-L-16-05

December 2015

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**Department of Energy**  
Washington, DC 20585

December 15, 2015

MEMORANDUM FOR THE ASSISTANT DEPUTY ADMINISTRATOR OF STOCKPILE  
MANAGEMENT

FROM:

  
April G. Stephenson  
Assistant Inspector General  
for Inspections  
Office of Inspector General

SUBJECT:

INFORMATION: Audit Report on “Lithium Operations at the Y-12  
National Security Complex”

BACKGROUND

The Y-12 National Security Complex (Y-12), located in Oak Ridge, Tennessee, provides critical support for the National Nuclear Security Administration’s (NNSA) mission to ensure the safety, security, reliability, and performance of the Nation’s nuclear weapons. Y-12 provides lithium for NNSA’s Defense Programs, such as weapons life extension programs, and is the only site in the Nuclear Security Enterprise that can produce lithium materials. The lithium capability is housed primarily in building 9204-2, where lithium materials are extracted from dismantled weapon systems components and used to create new weapons components. Due to its age, building 9204-2 has significant maintenance concerns. In particular, a large portion of the traditional lithium process produces corrosive conditions, adversely affecting the facility’s structural components and equipment and causing safety and production capability concerns. In 2012, Y-12 took steps to improve maintenance efficiency and reduce costs by discontinuing a portion of the historic process of lithium purification. One of the improvements was to implement Direct Material Manufacturing (DMM). We concluded that Y-12 will not have sufficient quantities of lithium to meet stockpile requirements beyond fiscal year (FY) 2017.

Given these concerns, we performed an audit to determine whether Y-12 effectively managed the capability to produce lithium materials.

RESULTS OF AUDIT

We concluded that Y-12 had not effectively managed the lithium production process and is at risk of not producing necessary quantities of lithium materials if no additional actions are taken.

Specifically, we found the following:

- Although successfully implemented and able to meet current production requirements, DMM had not produced the expected quantity of lithium due to a lack of source material that meets DMM requirements.
- In 2010, prior to implementing DMM, Y-12 planned to qualify 11 weapons systems for DMM; however, officials told us they subsequently learned that each system must be qualified individually, a process not expected to be completed until 2017.
- Y-12 did not adequately maintain the lithium material operations facility, leading to an accumulation of about \$20 million in deferred maintenance.

DMM was not able to fully meet production expectations because source material was not available in the anticipated quantities. However, during the course of the audit, management took action to qualify additional DMM material to ensure available supply beyond FY 2017. Also, Y-12 did not intend DMM to be a permanent solution, and DMM's ability to meet production goals may not have been adequately considered when deciding to pursue the process. In addition to planning issues, we also observed that the facility issues existed, in part, because lithium operations were managed and funded by several programs at Y-12. Therefore, responsibility for ensuring the current facility could meet mission needs was fragmented. During the audit, Y-12 issued a plan that management stated would ensure safe and reliable production of lithium materials.

## **Lithium Production**

As of the date of this report, Y-12 implementing DMM for eligible weapons systems had not resulted in producing the expected amounts of lithium materials due to DMM source material limitations. The DMM process differs substantially from the traditional lithium production process. In DMM, some weapons components do not meet quality requirements and cannot be used, unlike in the traditional process in which all weapons components can be used. Initially, Y-12 estimated that this would cause a nominal loss of material. However, in practice, Y-12 officials stated that approximately 15 percent of the source material was disqualified.

Additionally, lithium dust created during the production of components cannot be reused in DMM as it was in the traditional process. According to Y-12 officials, when DMM's effective implementation allowed the shutdown of the original process, it resulted in the inability to recycle machine dust. This is significant because during the shaping process a component may be reduced by more than 50 percent to machine dust, and this dust is not currently recyclable. According to NNSA officials, Y-12 is evaluating the ability to potentially recycle some machine dust using DMM.

Furthermore, not all of the weapons systems expected to be candidates for the DMM process have been qualified. Y-12 expects 10 weapons systems to be qualified for use in DMM by the national laboratories that have weapon design responsibilities. As of June 2015, Y-12 had requested and received qualification for three weapons systems. Y-12 officials estimated that the qualification of the overall DMM process and the first three weapons systems cost approximately \$2.9 million, and officials expected qualification activities to cost an additional \$1 million per

year until all potential systems were qualified. Because the traditional process is no longer functional, if the other weapons systems are not qualified for DMM, lithium material cannot be extracted from them and used to make new weapons components.

## **Facility Condition**

Y-12 did not adequately maintain the lithium operations facility. Both the traditional lithium process and the new DMM process were conducted in building 9204-2, a facility that is more than 70 years old. As with a number of other production facilities at Y-12, building 9204-2 is aged and in disrepair, with extensive deferred maintenance. According to Y-12, deferred maintenance is maintenance not performed when it should have been. According to the *Facility Condition Assessment Survey Report for Building 9204-2*, as of June 2015, the facility had 223 deferred maintenance items with a total estimated cost of more than \$19.4 million, the majority of which were overdue for repair by an average of 6 years. The items included damage to insulation that may have asbestos, roof deficiencies, and concrete detachment.

According to documentation, Y-12 prioritized maintenance projects, giving precedence to the areas of fire protection; heating, ventilation, and air conditioning systems; and electrical repairs. Y-12 further prioritized maintenance projects site-wide based on management's evaluation of safety and mission impact. Y-12 management officials stated that due to limited resources and the site-wide prioritization, projects such as repairing concrete detachment in building 9204-2 were deferred.

We noted that delaying necessary maintenance can affect Y-12's ability to achieve production goals and to conduct safe operations of the facility. For example, in March 2014, concrete weighing more than 200 pounds detached from the ceiling of building 9204-2 and fell in an area that housed operations. Pieces weighing up to 5 pounds landed in an area adjacent to where operators had been working just minutes before. The falling concrete damaged a portable welding exhaust unit and broke a drain pipe. A Y-12 official told us that pipe had been connected to a fire suppression line, and if water had leaked and been exposed to lithium, it could have resulted in a fire. Y-12 identified the concrete deterioration in February 2005 and determined that repair was needed within 2 years; however, 9 years later, the task continued to be classified as deferred maintenance. In our opinion, this incident might have been prevented if Y-12 had not deferred this maintenance task.

As an immediate response to the fallen concrete, Y-12 management restricted access to several areas and rerouted activities to ensure personnel safety, actions that temporarily impeded operations. Ultimately, Y-12 planned to implement a repair project addressing several ceiling areas of concern, which is estimated to cost a total of \$6 million and is expected to be completed by the end of FY 2016. Y-12 also planned to erect a temporary protective structure to allow for safe continued operations until permanent repairs were made.

## **Lithium Management**

DMM's production capabilities did not fully meet expectations because source material was not available in the anticipated quantities. As mentioned previously, Y-12 underestimated the amount of lithium that would be lost because source material did not meet DMM's quality

requirements. This loss of material has contributed to DMM's inability to meet Y-12's future production needs. In addition, a Y-12 official told us that Y-12 did not consider the ability of DMM to achieve long-term lithium production goals before making the decision to implement the process because Y-12 did not intend DMM to be a permanent solution for meeting lithium requirements. Rather, the official stated that Y-12 planned to develop new processes that would be housed in a new lithium production capability. As such, we noted that in 2007, Y-12's proposal for DMM made no mention of any production limitations that DMM may have had as compared to the traditional process.

Maintenance-related problems of the current lithium facility occurred, in part, because lithium operations were managed and funded by several programs at Y-12, including Material Recycle and Recovery, Production Support, and Directed Stockpile Work. Thus, each program area oversaw the portion of the process funded by its organization. While some Y-12 officials stated that those involved with the program can easily determine their funding responsibilities, another Y-12 official, as well as a life extension program official, told us that determining the party responsible for resolution was confusing when structural problems occurred in the process areas. Program areas also often disagreed on which program should fund a particular maintenance task. One life extension program official told us that, while he recognized the potential lithium supply shortage, he felt that the life extension program funding should not be assigned to lithium operations because issues with lithium operations were related to infrastructure at Y-12. Y-12 management also told us that maintenance of the lithium facility was not a higher priority due to constrained program budgets. Consequently, the prioritization of maintenance was based on mission deliverables.

### **Mitigating Actions**

During the audit, a Y-12 official acknowledged the need to provide more attention to this matter. In January 2015, Y-12 issued the *Lithium Materials Production Transition Implementation Plan* (Plan). The Plan notes that funding will be required from multiple sources, including Directed Stockpile Work, Readiness in Technical Base and Facilities, and line-item capital construction. Thus, we concluded that the participating organizations will need to coordinate with each other for the Plan to be successful. Both NNSA Headquarters and Y-12 management have taken steps to improve coordination, including designating a Federal point of contact and a local Director of Lithium Transformation. NNSA was also considering consolidating lithium operations under one budgeting and reporting code.

The Plan includes two main strategies: (1) pursuit of a new lithium production capability; and (2) implementation of interim activities to address the gap between current operations and operations after 2025, when the new lithium production capability is expected to be available. NNSA approved a mission need statement in June 2015 that, according to the Plan, is the initial step to pursue a new lithium production capability. Y-12 will identify a preferred solution to meet mission need by FY 2017. Y-12 anticipates that the new capability would be a line-item construction project with a total estimated project cost between \$301 million and \$646 million and a target beneficial occupancy date by FY 2025. Y-12 also expects the new lithium production capability to be smaller, safer, less expensive, and more agile than the current

facility's capability. Key assumptions supporting the new lithium production capability include: (1) FY 2016 funding to begin preliminary design efforts, and (2) subsequent funding of the line-item project to support construction activities through completion.

The Plan also includes interim activities to address the anticipated lithium production gap between current operations and operations after 2025. Those activities include obtaining approval of additional weapons systems for use in DMM, processing existing inventories of lithium chloride, developing advanced lithium technologies, and implementing infrastructure bridging actions. According to lithium production documentation, the approval process is currently underway for four additional weapons systems. According to the Plan, the approval process, which is estimated to cost \$3 million, is expected to be completed by the end of FY 2017 and should extend lithium supply through the early 2020s. Should any of these activities not be completed as planned, Y-12 identified several mitigation strategies, including the acceleration of the new lithium production capability and procurement of lithium materials from a source outside NNSA.

In addition, according to the Plan, Y-12 intends to evaluate options for converting partially processed inventories of lithium. Two options are being considered: (1) restarting part of the traditional lithium production process, and (2) outsourcing the conversion process to an external vendor. According to the Plan, restarting part of the traditional lithium production process will require Y-12 to address deferred maintenance and refurbish key equipment before conversion activities can begin. Performing the restart activities and converting the partially processed lithium inventory is expected to cost \$66 million with an estimated completion date of 2020. If it decides to outsource the conversion process, Y-12 identified three vendors as capable of performing this work. Therefore, Y-12 issued a request for an expression of interest from these vendors in FY 2014 and planned to perform a make-or-buy decision in FY 2015 when it received the vendors' responses. Y-12 estimates that the outsourcing option will cost between \$17 million and \$40 million and expects it to be completed in 2019. However, Y-12 will still have to perform additional activities to the lithium material that was outsourced to create a final useable form, an additional expense that is expected to cost \$18 million and would not be completed until 2020.

Furthermore, the Plan states that Y-12 is developing advanced lithium production technologies. The technologies being explored fall into three categories: advanced purification techniques, direct recycle of machine dust, and expansion of outsourcing to include full lithium production operations. According to the Plan, these advanced lithium production technologies are expected to be integrated into the new lithium production capability or in place by 2025. The total estimated cost to develop these advanced technologies is between \$14.3 million and \$26.3 million.

The Plan recognizes that infrastructure bridging and process upgrade activities are necessary in building 9204-2 to maintain operations until the new lithium production capability is available. Therefore, Y-12 plans to improve several systems, including heating, ventilation, and air conditioning; electrical; and fire suppression. Y-12 also plans to address maintenance and structural integrity issues. Y-12 expects to perform these activities from FY 2015 to FY 2021 at a cost of \$74.2 million.

Finally, management informed us that the 2016 Planning and Production Directive has been issued and that this document provides current information regarding weapons dismantlement schedules for use in DMM. Management stated that this will help ensure future lithium requirements are met.

### IMPACT AND PATH FORWARD

As detailed in this report, without timely action, Y-12 will not produce sufficient quantities of lithium to meet NNSA requirements beyond FY 2017. Accordingly, we recommend that the Assistant Deputy Administrator of Stockpile Management for NNSA ensure that:

1. Y-12 fully executes its Plan while incorporating lessons learned from the implementation of DMM; and
2. NNSA continues to improve coordination of lithium operations management among participating programs.

### MANAGEMENT RESPONSE

Management concurred with the report's findings and recommendations, and provided corrective actions to address the issues identified in the report. Y-12 management will coordinate with NNSA Headquarters to continue to pursue the strategies in the *Lithium Materials Production Transition Implementation Plan*, while implementing lessons learned from DMM. NNSA has taken steps to improve coordination. NNSA is also pursuing consolidation of funding sources into a lithium funding line to simplify program management. Management's formal comments are included in attachment 2.

### AUDITOR COMMENTS

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

#### Attachments

cc: Deputy Secretary  
Administrator, NNSA  
Chief of Staff

## OBJECTIVE, SCOPE, AND METHODOLOGY

### OBJECTIVE

To determine whether the lithium capability at the Y-12 National Security Complex was managed effectively.

### SCOPE

This audit was conducted between November 2013 and December 2015, at the Y-12 National Security Complex in Oak Ridge, Tennessee, and National Nuclear Security Administration Headquarters in Washington, DC. The audit was conducted under Office of Inspector General project number A14YT004.

### METHODOLOGY

To accomplish our audit objective we:

- Reviewed applicable laws and regulations pertaining to lithium operations;
- Analyzed historical mission data and future demand for lithium operations;
- Reviewed planned lithium production operation activities, including the *Lithium Materials Production Transition Implementation Plan*;
- Evaluated mission need documents regarding the new lithium production capability;
- Analyzed maintenance data for current lithium facilities; and
- Interviewed National Nuclear Security Administration and contractor personnel to gain an understanding of lithium operations.

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. Accordingly, the audit included tests of controls and compliance with laws and regulations necessary to satisfy the audit objective. In particular, we assessed compliance with the *GPRA Modernization Act of 2010* and found that the National Nuclear Security Administration had not established performance measures for lithium operations. 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 relied on computer-processed information to achieve our audit objective. Based on a recent review of the Y-12 National Security Complex's information technology controls performed by KPMG, LLP, on behalf of the Office of Inspector General, we determined that the data was sufficiently reliable for the purpose of the review.

We held an exit conference with management on December 1, 2015.



## MANAGEMENT COMMENTS



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



November 5, 2015

MEMORANDUM FOR RICKEY R. HASS  
ACTING INSPECTOR GENERAL

FROM: FRANK G. KLOTZ *fk 11/5/2015*

SUBJECT: Comments on the Office of Inspector General Draft Report Titled  
*Lithium Operations at the Y-12 National Security Complex*  
(A14YT004)

Thank you for the opportunity to review and comment on the subject draft report. The National Nuclear Security Administration is committed to ensuring a sustained supply of lithium to meet our enduring mission needs. We appreciate the auditors' acknowledgement of the successful implementation of the Direct Material Manufacturing process (DMM), which was a critical accomplishment that allowed the safe shutdown of purification processes until a new lithium production capability comes on line. As clarified in our technical comments and discussed with your team, implementation of DMM was only one source of lithium material and was not intended to be the only source to meet long-term production goals. We would disagree with the implication that lack of effective management of DMM by Y-12 was a cause of or increased challenges in meeting those goals.

As noted in the report, the Lithium Materials Production Transition Implementation Plan outlines strategies for pursuing a new lithium production capability, while providing a safe and reliable interim process to meet our needs. We concur with the auditors' recommendations to continue our efforts to execute the transition plan and to improve coordination among participating programs. An attachment to this memorandum details the actions taken and planned to address each recommendation, as well as timelines for completion. We have also provided technical comments under separate cover to enhance the clarity and factual accuracy of the report.

If you have any questions regarding this response, please contact Mr. Dean Childs, Director, Audit Coordination and Internal Affairs, at (301) 903-1341.

Attachment



Attachment

**NATIONAL NUCLEAR SECURITY ADMINISTRATION**  
**Response to Report Recommendations**

**Lithium Operations at the Y-12 National Security Complex (A14YT004)**

The OIG recommends the Assistant Deputy Administrator for Stockpile Management ensure:

**Recommendation 1:** Y-12 fully execute its Lithium Materials Production Transition Implementation Plan (Plan) while fully incorporating lessons learned from the implementation of Direct Material Manufacturing (DMM).

**Management Response: *Concur***

Y-12 management, coordinating with NNSA Headquarters, will continue to pursue the strategies in the Plan, while implementing lessons learned from DMM. It should be noted that the Plan is a living document and will continue to mature based on further evaluation of included strategies, future funding decisions, etc. Full execution of the plan is a longer term effort (approximately 10 years) culminating in the implementation of the new Lithium Production Capability. For audit tracking purposes, NNSA will consider this recommendation closed once a reliable strategy for the interim capability has been identified. The estimated completion date for this recommendation is December 15, 2015.

**Recommendation 2:** NNSA continue to improve coordination of lithium operations management among participating programs.

**Management Response: *Concur***

As noted in the report, NNSA has taken steps to improve coordination, including designating a Federal point of contact, while the contractor has established a local Director of Lithium Transformation. We are also pursuing consolidation of funding sources into a lithium funding line to simplify program management. As this is an on-going activity that will be executed and evaluated through the Lithium Materials Production Transition Implementation Plan outlined in recommendation 1, NNSA considers this recommendation closed.

## **FEEDBACK**

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