OFFICE OF INSPECTOR GENERAL

U.S. Department of Energy

AUDIT REPORT

DOE-OIG-19-11

January 2019

IMPLEMENTATION OF INTEGRATED SAFETY MANAGEMENT AT LAWRENCE LIVERMORE NATIONAL LABORATORY

Department of Energy
Washington, DC 20585

January 2, 2019

MEMORANDUM FOR THE MANAGER, LIVERMORE FIELD OFFICE

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

SUBJECT: INFORMATION: Audit Report on "Implementation of Integrated Safety Management at Lawrence Livermore National Laboratory"

BACKGROUND

Since October 2007, Lawrence Livermore National Security, LLC has operated Lawrence Livermore National Laboratory (Livermore) for the National Nuclear Security Administration (NNSA). Livermore has a primary mission to strengthen the United States' security through development and application of science and technology to enhance the Nation's defense, reduce the global threat from terrorism and weapons of mass destruction, and respond to scientific issues of national importance. In the context of workplace safety at the Department of Energy, Livermore also must systematically integrate safety into management, work practices at all levels, and all facets of work planning and execution.

In accomplishing its mission, Livermore committed itself to perform work in a manner that protects the health and safety of employees and the public, preserves the quality of the environment, and prevents property damage by using an Integrated Safety Management (ISM) system. In our previous audit of Livermore's ISM system, *Implementation of Integrated Safety Management at Lawrence Livermore National Laboratory* (DOE/IG-0797, July 2008), we concluded that until Livermore fully implements an effective ISM system, NNSA cannot be assured that future worker-related illnesses and injuries will be prevented. The implications of preventable accidents occurring are significant, both in terms of lost productivity and personal pain and suffering. We initiated this audit to followup on progress made since our previous audit and to determine whether Livermore effectively implemented an ISM system.

RESULTS OF AUDIT

Nothing material came to our attention to indicate that Livermore had not effectively implemented an ISM system. We determined that Livermore had taken actions sufficient to address the weaknesses we identified in the prior report. Specifically, Livermore had improved its capability for tracking safety issues and deficiencies, acted to achieve performance measures

that are reviewed and revised each year, and earned its contractual fee based in part on its adherence to contractual requirements related to safety. Livermore also decided to revise its procedures concerning causal analyses to address the concerns in our prior report about identifying systemic safety issues and their causes. Additionally, to its credit, Livermore took the initiative to have an independent validation that its safety management system conforms to an internationally-applied standard for safety management systems.

While Livermore had taken sufficient actions to improve its capabilities for tracking safety issues and recording their causes, we identified an opportunity to improve the effectiveness of Livermore's ISM system. Specifically, we determined that Livermore did not always apply learnable lessons – arising from the review of serious safety issues – beyond the organizations in which they originally occurred in order to decrease the potential risk of subsequent occurrences of similar safety issues. We noted that the Department's Office of Health, Safety, and Security (now called the Office of Enterprise Assessments) made similar observations during its reviews conducted in 2009 and 2011. Although the Office of Health, Safety, and Security did not make recommendations during its reviews, its observations assisted the Livermore Site Office[1]'s own assessments of the effectiveness of Livermore's ISM system. Yet, opportunities to improve the dissemination of learnable lessons remain. These learnable lessons could be brought to light through a well-planned extent of condition review.

At Livermore, an extent of condition review determines the extent to which a given condition, issue, or cause identified in one area has affected or also exists in other activities or organizations. Livermore's risk-based process for managing safety issues and corrective actions calls for issue owners to conduct extent of condition reviews during their inquiries into why serious safety issues occur. Livermore categorizes the significance of safety issues on a 1-to-5 scale, where a level 1 issue would most likely have a negative outcome and extreme consequences, and a level 5 issue is relatively minor. During the timeframe of our audit, Livermore required an extent of condition review only for level 1 issues. As of November 2017, Livermore required an extent of condition review for level 1 and certain level 2 issues.

During the time period covered in our audit, Livermore noted that there were no level 1 issues. The most serious safety issues available for review had a significance level of 2. Based on our review of two significance level 2 issues, we found that Livermore kept learnable lessons within the organization in which the issues were initially identified, thus limiting the lessons' usefulness.

Radiological Contamination Incident

In October 2014, a level 2 radiological contamination incident occurred when radioactive material stored in one room in Building 151 was detected in a different room where no such material should be present. The causal analysis concluded, in part, that the integrated work sheets were not written with enough detail to tie specific hazards to individual work activities, thereby diminishing workers' ability to ascertain the hazards associated with any one particular work activity. Also, the radioactive materials were allowed to accumulate without fully considering their concentration, storage, and other risk factors. Although not required, an extent

[1] Presently known as the Livermore Field Office.

of condition review was performed. Livermore limited the extent of condition evaluators' scope to the potential for contamination events within Building 151, rather than following Livermore's procedure to broaden the scope and consider whether the safe handling of materials should be evaluated across other organizations at Livermore. Additionally, the evaluators conducting the extent of condition review did not involve the cognizant assurance manager in the review, thereby precluding Livermore's other assurance managers from helping inform the scope of the review and from promptly disseminating any lessons resulting from the initial inquiry efforts during the review.

Subsequently, in another organization, over a year after Livermore closed the contamination incident, Livermore identified a related issue of improper handling of hazardous material in its Nanomaterials Program that was caused by a failure to accurately describe hazards associated with the handling of nanomaterials in the related integrated work sheet documentation. In order to increase awareness, Livermore should share extent of condition reviews across its organizations.

Hand Injury Incident

In May 2014, a level 2 injury occurred when a worker's hand was pinched by a 26,000 pound piece of equipment – a chiller – while it was being lifted. The causal analysis concluded in part that:

1. Not all hazards and associated controls were briefed to the workers prior to work;

2. Work was not paused or stopped when unanticipated conditions were encountered;

3. The workers did not believe that they should stop or pause work when it was appropriate to do so out of safety concerns;

4. Only one of the workers had training in rigging activities prior to the start of the work; and

5. Confusion in the roles and responsibilities between Livermore personnel and subcontractor personnel led to expectation gaps regarding on-site personnel presence that allowed workers to perform tasks without adequate planning, work release, and establishment of adequate controls.

Although not required, an extent of condition review was performed, but contrary to Livermore's procedure, the evaluator limited the extent of condition review's scope to determining whether any other chillers were to be moved through the end of fiscal year 2014 rather than broadening the extent of condition and the original safety issue inquiry to consider whether workers (a) understood relevant hazards before starting work, (b) could adjust their working conditions to mitigate safety risks, and (c) felt comfortable to halt work as safety concerns arose. Similar to what occurred in the extent of condition review on the radiological incident, the evaluator conducting the extent of condition review on the hand injury did not involve Livermore's other

assurance managers in the review, thereby precluding them from helping inform the scope of the review and from promptly disseminating any lessons resulting from the initial inquiry efforts during the review.

Following the May 2014 hand injury incident, another incident occurred in 2015 whereby a subcontractor damaged a 480-volt street light conduit during excavation activities. Like the prior occurrence, an analysis found that:

1. The relevant hazards and controls were not briefed to the worker prior to work;

2. Work was not paused or stopped when unanticipated conditions were discovered; and

3. The Livermore Construction Manager was not physically present but should have been present at the job site, if needed, to address workers' concerns.

Additionally, the scope of the causal analysis for the excavation-related safety issue stayed within the organization from which it originated. The causes contributing to the conduit incident may have been recognized and acted upon earlier, if Livermore broadened the scope of the extent of condition review to address foreseeable worker concerns in other work areas.

Extent of Condition Reviews not Capturing Inter-Related Safety Concerns

The issues we identified can be attributed to extent of condition reviews not always being broad enough in scope as required in Livermore's PRO-0076 *Evaluating for Extent of Condition* procedure to capture safety conditions existing outside of organizations or facilities in which a safety issue is initially found. If extent of condition reviews were conducted broadly enough during serious incidents, they likely would have noted the learnable lessons that could have helped minimize the harm from other related safety issues occurring afterward.

When issue owners assign evaluators to conduct a safety inquiry, Livermore's procedure for extent of condition reviews requires the evaluators to determine the breadth of activities, locations, or organizations in which the circumstances and causes of the safety issue may apply or be foreseeable. To aid in their determination and shape their inquiry, the evaluators should coordinate with assurance managers and/or safety subject matter experts for perspective. This coordination also allows the assurance managers to share safety information applicable to multiple organizations and facilitate, through the Assurance Managers Committee, the dissemination of any learnable lessons from the inquiry. In both the radiological contamination incident and the hand injury incident, the evaluators did not share enough information about the incident's circumstances and causes with the assurance managers to allow assurance managers to promptly share lessons learned with other organizations. The assurance managers in turn could not promptly share perspectives gained from safety subject matter experts and other organizations' experiences to help inform the direction and scope of evaluators' safety inquiries.

Opportunities to Improve the ISM System

In the context of our present observations and conclusions, we believe that Livermore has an opportunity to decrease the risk of similar safety issues by broadly applying lessons learned. Specifically, the adverse effects of similar safety-related issues we reviewed may have been identified and addressed sooner had extent of condition reviews been more broadly designed and executed. Additionally, the Committee could more proactively affect the rigor of extent of condition reviews if it was specifically empowered and responsible for doing so.

RECOMMENDATIONS

To ensure that Livermore continues to improve its integrated safety management system, we recommend that the Manager, Livermore Field Office, direct Livermore to:

1. Reinforce policies and procedures so extent of condition reviews for serious safety incidents encompass all applicable activities, locations, or facilities; and

2. Ensure lessons learned from the circumstances and causes of safety issues are included, as appropriate, at the Assurance Managers Committee meetings.

MANAGEMENT RESPONSE

Management concurred with the recommendations and indicated that corrective actions are underway. Management committed to pursuing opportunities to enhance the application of lessons learned across the laboratory and stated that NNSA is committed to ensuring the safety and health of its employees at all of its sites. Management's formal comments are included in Attachment 3.

AUDITOR COMMENTS

Management's comments and proposed actions are responsive to our findings and recommendations.

Attachments

cc: Deputy Secretary
Chief of Staff

OBJECTIVE, SCOPE, AND METHODOLOGY

OBJECTIVE

We conducted this audit to followup on progress made since our previous audit and to determine whether Lawrence Livermore National Laboratory (Livermore) effectively implemented an integrated safety management system.

SCOPE

The audit was performed from August 2016 to January 2019 at Livermore, located in Livermore, California. The audit scope included a review of safety issues recorded in Livermore's Issues Tracking System during fiscal years 2014 through 2016. We did not test Livermore's compliance with contract terms, applicable laws, regulations, policies, and procedures, as Livermore's third party safety management auditor conducted its own audit to verify compliance. However, we did evaluate the third party auditor's opinion and the relevant standards under which the auditor conducted its work at Livermore. We conducted this audit under Office of Inspector General (OIG) project number A16LL055.

METHODOLOGY

To accomplish our audit objective, we:

- Reviewed Federal laws and regulations, Department of Energy regulations and guidance, and contract provisions related to safety.

- Reviewed Livermore's internal policies, procedures, and practices.

- Reviewed Livermore's process for managing safety-related issues and the Department's oversight activities.

- Judgmentally selected 379 safety issues from a universe of 2,394 recorded in Livermore's Issues Tracking System during fiscal years 2014 through 2016 based on categorizations of risk and key words documented in the issues themselves. An iterative, non-statistical sample design was chosen with the intent to identify issues with both high safety risk indicators and common causal factors. Because the selection was based on a judgmental sample, results and overall conclusions cannot be projected to the entire population or universe of safety-related issues within the scope of our audit.

- Reviewed the relevant documents associated with the 379 issues in order to identify issues likely to have causal factors or root causes in common and to assess whether Livermore could have applied lessons learned from reviews of earlier-occurring issues to prevent or mitigate the effects of later-occurring issues.

- Focused on linkages between each of two significance level 2 issues and the causal factors underlying 31 issues having significance levels of 3 or 4 – whereby the level 3

issues and level 4 issues occurred at least 30 days after one or the other of the two significance level 2 incidents and had causal factors similar to the causes leading to the two significance level 2 incidents. Of these 31 issues, there were 16 issues where the effort to determine how broadly the safety issue existed stayed within the organization in which the issues were initially identified.

- Reviewed prior reports issued by the OIG and the Office of Enterprise Assessments.

- Interviewed key Department officials and Livermore personnel to obtain an understanding of the processes for managing and administering Livermore's integrated safety management system.

We conducted this performance audit in accordance with generally accepted Government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objective. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objective. The audit included tests of 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 for the safety management activities we reviewed.

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 to satisfy the audit objective. Based on recent reviews of Livermore's information technology controls performed by KPMG LLP on behalf of the OIG and our own inquiries about technology controls relevant to Livermore's Issues Tracking System, we determined that the data was sufficiently reliable for the purposes of the audit.

Management waived an exit conference on December 10, 2018.

RELATED REPORTS

Office of Inspector General

- Audit Report on the *Implementation of Integrated Safety Management at Lawrence Livermore National Laboratory* (DOE/IG-0797, July 2008). The audit concluded that Lawrence Livermore National Laboratory (Livermore) had not fully implemented an integrated safety management system to improve its safe conduct of work. Specifically, we found that Livermore had not always (1) developed and implemented controls to eliminate hazards; (2) performed work within defined controls; (3) provided feedback to managers about identified hazards or aggressively pursued continuous improvement in safety; and (4) analyzed safety issues to determine the extent of condition and root cause. The issues identified were attributed to a lack of performance measures associated with safety that encouraged improvement in Livermore's implementation of integrated safety management.

Office of Enterprise Assessments

- Report on the *Mission Support Review of the Integrated Safety Management System at the Lawrence Livermore National Laboratory*, dated November 2009. The nonpublic report concluded that Livermore generally met expectations set forth in agreed-upon criteria and review documents. However, the Office of Health, Safety, and Security – the predecessor to the Office of Enterprise Assessments at the time of the review – identified some opportunities for improvement in the areas of operations, industrial hygiene, radiation protection, and assessment and feedback.

- Report on the *Independent Oversight Review of Integrated Safety Management System Effectiveness at the Lawrence Livermore National Laboratory*, dated September 2011. The nonpublic report concluded that Livermore established an adequate Integrated Safety Management system that is consistent with Department of Energy Integrated Safety Management policy. However, the Office of Health, Safety, and Security identified some opportunities for improvement in the areas of process implementation and issues management.

MANAGEMENT COMMENTS

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

November 27, 2018

MEMORANDUM FOR APRIL G. STEPHENSON
ACTING INSPECTOR GENERAL

FROM: LISA E. GORDON-HAGERTY

SUBJECT: Comments on the Office of Inspector General Draft Report "Implementation of Integrated Safety Management at Lawrence Livermore National Laboratory" (A16LL055)

Thank you for the opportunity to review and comment on the subject draft report. The National Nuclear Security Administration (NNSA) is committed to ensuring the safety and health of its employees at all of its sites. NNSA appreciates the auditors' recognition of the significant actions Livermore has taken to enhance integrated safety management, including independent validation of conformance to international safety management system standards.

NNSA concurs with the auditors' recommendations and will continue to pursue opportunities to enhance the application of lessons learned across the laboratory. The attachment to this memorandum details the specific actions taken and planned to address the report's recommendations, as well as estimated timelines for completion. If you have any questions regarding this response, please contact Mr. Dean Childs, Director, Audits and Internal Affairs, at (301) 903-1341.

Attachment

Attachment

NATIONAL NUCLEAR SECURITY ADMINISTRATION
Response to Report Recommendations

Implementation of Integrated Safety Management at Lawrence Livermore National Laboratory (A16LL055)

The Office of Inspector General (OIG) recommended that the Manager, Livermore Field Office, direct Livermore to:

Recommendation 1: Reinforce policies and procedures so extent of condition reviews for serious safety incidents encompass all applicable activities, locations, or facilities.

Management Response: Concur. Livermore will revise the Assurance Manager Meeting Charter to include a discussion of extent of planned condition reviews for serious safety incidents at Assurance Manager Committee meetings. This will ensure that all applicable activities and locations can be included in planning for the reviews. Estimated Completion Date: March 31, 2019

Recommendation 2: Ensure lessons learned from the circumstances and causes of safety issues are included, as appropriate, at the Assurance Managers Committee meetings.

Management Response: Concur. Livermore will revise the Assurance Manager Meeting Charter to ensure that reviews of appropriate lessons learned from the circumstances and causes of safety issues are included as a standing agenda item for the Assurance Managers Committee meetings. Estimated Completion Date: March 31, 2019

FEEDBACK

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Office of Inspector General (IG-12)
Department of Energy
Washington, DC 20585

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