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Office of Audits and Inspections

Audit Report

Mitigation of Natural Disasters at Los Alamos National Laboratory

OAS-M-13-04

June 2013

Department of Energy
Washington, DC 20585

June 24, 2013

MEMORANDUM FOR THE DEPUTY ASSOCIATE ADMINISTRATOR FOR
INFRASTRUCTURE AND OPERATIONS, NATIONAL
NUCLEAR SECURITY ADMINISTRATION
MANAGER, LOS ALAMOS FIELD OFFICE

FROM: George W. Collard
Assistant Inspector General
for Audits
Office of Inspector General

SUBJECT: INFORMATION: Audit Report on "Mitigation of Natural Disasters at Los Alamos National Laboratory"

BACKGROUND

The Department of Energy's (Department) Los Alamos National Laboratory (Los Alamos) is part of the National Nuclear Security Administration's (NNSA) nuclear weapons complex. Los Alamos' primary responsibility is to ensure the safety, security and reliability of the Nation's nuclear stockpile. Los Alamos employees and subcontractors work in close proximity to or in contact with special nuclear materials, explosives and hazardous chemicals. Two sites where such activities occur are the Area G Waste Storage and Disposal Facility (Area G) and the Plutonium Facility (PF-4). Area G has been used for radiological waste disposal and storage since 1957. Area G operations include receiving, processing, storing, shipping, and/or disposing of waste, including low-level and transuranic waste. This activity is critical to meet a consent order with the State of New Mexico to close Area G by December, 2015. PF-4 is a 1970s era structure that supports pit manufacturing, surveillance and special plutonium recovery.

Los Alamos is at some risk of seismic events and susceptible to forest fires, including those started by lightning. Since 2000, there have been two major forest fires that threatened Los Alamos. Because of these concerns, we initiated this audit to determine whether NNSA had evaluated, modified or upgraded existing nuclear facilities at Los Alamos to mitigate the effects of seismic and fire natural disasters.

RESULTS OF AUDIT

Although Los Alamos had made progress in upgrading existing nuclear facilities, concerns remained regarding the mitigation of risks related to natural disasters. Specifically:

- Seismic issues affecting PF-4 remain to be addressed. For example, fire suppression system and glove box stand improvements to mitigate the adverse consequences of a seismic event are not scheduled to be completed until 2014 and 2015, respectively.

- Fire protection and prevention vulnerabilities in Area G continue to exist. In particular, Los Alamos had not resolved all known fire suppression and lightening protection system deficiencies.

- Several known risks exist with compensatory measures implemented in Area G that may lessen their efficacy in mitigating natural disasters.

To its credit, Los Alamos has completed key compensatory measures, including physical upgrades, to reduce seismic risk for PF-4, and as of April 2013, additional upgrades were in process. With regard to Area G, Los Alamos recently implemented actions to mitigate the risk of fire from natural disasters. In addition, since 2011, the Department and NNSA have committed to the complete removal of all the non-cemented, above-ground transuranic waste from Area G by June 30, 2014.

NNSA officials responsible for overseeing Los Alamos pointed out that decisions to budget and schedule mitigation measures are based on factors including the probability of an event occurring, such as a seismic event, and whether a structure is considered to be a permanent or limited life facility. In their view, there is a rare probability of a seismic event occurring in Los Alamos of sufficient magnitude to cause a significant plutonium release from PF-4. Additionally, with an expected operational life of less than 5 years, Los Alamos considers Area G to be a limited-life facility.

While a number of compensatory and corrective actions have been completed, in our view, further actions are needed to mitigate existing vulnerabilities. As such, we made recommendations to ensure that continued management attention is focused on addressing the identified vulnerabilities.

Plutonium Facility

Los Alamos has completed several physical upgrades to reduce seismic risk for PF-4. For example, Los Alamos installed a new safety-class nuclear material storage system using fire rated safes and containers, assessed and repaired the facility's main fire wall, strengthened the roof, braced ventilation room columns and fan pads, and repaired the mezzanines located above the Laboratory floor. These upgrades were completed as required by Department standards based on revised site specific seismic hazards. These actions also addressed concerns initially raised by the Defense Nuclear Facilities Safety Board (DNFSB) in October 2009, which identified multiple, substantial deficiencies regarding potential exposures in the case of an earthquake-induced fire.

Additionally, Los Alamos has scheduled upgrades to the fire suppression system and glove box stands to be completed in 2014 and 2015, respectively. However, NNSA has identified new seismic structural vulnerabilities in response to the DNFSB's concerns and initiated action on an Unreviewed Safety Question (USQ) in September 2012. The USQ process is intended to alert the Department of events, conditions or actions (both natural and man-made) that affect the safety analysis of a facility or operation, and to ensure appropriate management action. It involves keeping a safety analysis current by reviewing potential USQs, reporting them to the Department, and obtaining approval from the Department prior to taking any action that involves

a USQ. As a result of the USQ, Los Alamos has prepared an addendum to the safety analysis governing operations of the facility. Los Alamos submitted the addendum in January 2013, it was approved by NNSA in March 2013 and transmitted to Los Alamos in April 2013.

In addition, according to a July 2012 letter from the DNFSB, PF-4 lacks the structural resilience and redundancy required by modern building codes and makes it susceptible to structural failure if subjected to the strong seismic ground motions. In January 2013, the DNFSB informed the Department that while the structural upgrades that are necessary to fix the vulnerabilities at PF-4 are currently projected to take several years to complete, the potential for very high offsite dose consequences remains. Los Alamos Field Office officials noted that while the dose consequence of a seismic event at PF-4 is high, the probability of a large earthquake that would cause a significant plutonium release is low. The officials also stated that although the seismic issues still need to be addressed, NNSA's decision process is based on risk in accordance with established Department policy. In a March 2013 letter to the DNFSB, the Secretary of Energy responded to the seismic risks identified in DNFSB's January 2013 letter. The Secretary stated that the Department is continuing to take further actions to reduce the amount of plutonium at PF-4 and to improve the facility's seismic capabilities. For example, NNSA plans to implement a new safety-class container for heat source plutonium. The Secretary concluded that PF-4 can continue to operate safely while longer-term structural modifications are completed. As of April 2013, the engineering work on the modifications was in progress, but completion timeframes for the modifications had not been established.

Area G Lightning and Fire Protection

Although Los Alamos had made fire prevention and protection improvements to Area G, vulnerabilities continue to exist. As of August 2012, Area G had 11 waste storage dome structures that housed over 5,600 containers with transuranic waste. According to a 2010 Los Alamos fire hazard analysis for Area G, wildland fires result in a high hazard rating for the dome structures. Since March 2011, Los Alamos has repaired the Lightning Protection Systems for three waste storage dome structures, added remotely monitored automatic fire suppression systems for one of the structures, restored a previously inoperable remotely monitored automatic fire suppression system for another dome structure, and expanded vegetation control to reduce the incidence of combustibles in areas beyond the Area G fence.

Los Alamos, however, has not resolved all known fire suppression system and Lightning Protection System deficiencies. Although Los Alamos has established compensatory mitigation measures to address known deficiencies in Area G, we noted a number of concerns regarding the efficacy of such mitigation measures. While the Lightning Protection Systems and fire suppression systems at Area G are not recognized as viable engineered controls, which provide the most robust approach to address a nuclear safety hazard, they are considered safety support systems in the nuclear safety analysis for Area G. The Lightning Protection Systems are identified in the safety analysis as part of the facility's defense-in-depth.[1]

[1] Defense-in-depth builds in layers of defense against the release of hazardous materials so that no one layer by itself is completely relied upon.

Given Los Alamos' stated reliance on these systems, continuing problems with coverage and system upkeep is troubling. For example, a 2008 Fire Hazard Analysis for Area G identified 11 of the domes that lacked remotely monitored automatic fire suppression systems. In addition, we noted that wind sway and snow loading have caused numerous pipe breaks and freeze damage to fire sprinkler piping within the Dome 229 and 230 structures, resulting in long-standing and repeated fire suppression system impairments. Furthermore, a Los Alamos official stated in March 2012, that the fire suppression systems for two Area G structures (Dome 33 and Building 412) were unreliable and inoperable due to piping integrity issues and a failed air compressor. Although Los Alamos corrected the Dome 33 issues, it provided only a temporary solution for Building 412 that involved connecting compressed nitrogen cylinders to a high-pressure hose. When we discussed this issue with Los Alamos officials, they stated that they had requested a temporary modification extension to allow continued operation without a permanent, operational fire suppression system and that the configuration for the temporary modification was compliant with fire protection requirements. In its response to our draft report, NNSA stated that Los Alamos has scheduled to provide a permanent solution by replacing the air compressor in June 2013.

Department Order 420.1B, *Facility Safety*,[2] requires automatic fire extinguishing systems throughout all facilities and areas with significant life safety hazards or fire loss potential in excess of limits defined by the Department. Consequently, Los Alamos submitted an exemption request to NNSA in January 2011, which includes compensatory measures for the 10 domes not equipped with the automatic fire extinguisher system, to relax the fire protection requirements set forth in the Order. As of March 2013, NNSA had reviewed the exemption request and was in the process of providing feedback to Los Alamos. NNSA will require Los Alamos to re-submit a revised exemption request to NNSA for approval.

We noted several known risks associated with one of the compensatory measures cited in Los Alamos' exemption request that may lessen the effectiveness of the measures. Los Alamos believes the fire suppression deficiencies with the dome structures are mitigated by temporary compensatory measures, such as the limited combustible fabric of the waste storage domes. The exemption request stated that the dome fabric was a compensatory measure. In addition, the fire hazard analysis supporting the exemption request noted that the fabric is not expected to provide a propagation path for fire within the dome. However, Los Alamos officials told us that the dome fabric has exceeded its expected in-service life of 15-20 years and its fire retardant properties are likely diminished but unknown. We also noted that the nuclear safety analysis did not credit the dome fabric as a mitigation factor in any accident scenarios. Fire protection staff who prepared the fire hazard analysis stated they did not fully participate in the nuclear facility safety analysis and noted that features that contribute to reducing fire loss risk may not directly contribute to nuclear safety risk reduction. In response to our concerns, in January 2013, a Los Alamos Field Office official stated that the Los Alamos Field Office will be withdrawing the exemption request for revision to clarify that the dome fabric cannot be relied upon to retain heat or smoke.

Finally, a February 2011 Los Alamos inspection identified Lightning Protection System impairment issues for two of the dome structures (153 and 283), but as of March 2013, (2 years

[2] Department Order 420.1B was replaced by Department Order 420.1C in December 2012.

later) the issues were still pending resolution. According to a June 2011 NNSA Los Alamos Field Office assessment, there was no assurance that the Lightning Protection System could perform the designed safety function. Los Alamos installed temporary modifications to keep the Lightning Protection System operable, and Los Alamos officials pointed out that the temporary modifications were appropriate. However, Los Alamos officials acknowledged in November 2012, that they did not have plans for permanent solutions. In January 2013, Los Alamos submitted an engineering service request for design support to make the temporary modifications permanent.

Continuing concerns about protection improvements prompted the DNFSB to report in September 2012, that the delay in taking corrective action contributes to a degraded safety posture at Area G. Even though we agree Area G is considered a limited-life facility, we believe it is still important to address risks which affect the facility's safety support systems.

Related Safety Controls

Los Alamos' processes and procedures have not always been fully effective in ensuring that hazards, including natural disasters, are fully analyzed and effectively mitigated. Federal Regulation 10 CFR 830, *Nuclear Safety Management*, requires that the safety analysis for a nuclear facility identify both natural and man-made hazards associated with the facility, evaluate conditions including consideration of natural and man-made external events, and derive the hazard controls necessary to ensure adequate protection of workers, the public, and the environment. To address these requirements, Los Alamos instituted a New Information (NI) process to identify potential inadequacies with the safety analysis for a nuclear facility. However, assessments performed by the Department's Office of Health, Safety and Security, Los Alamos and the Los Alamos Field Office have identified concerns regarding Los Alamos not using the NI process correctly.

Symptomatic of such concern, we found that a 2011 System Health Report review performed by Los Alamos identified deteriorated gaskets on waste containers stored at Area G, but according to a Los Alamos official, the issue was never entered into the NI process. While the Area G safety analysis does not recognize the gaskets as an engineered safety control, it does consider the waste containers to be a major contributor to defense-in-depth by providing containment of hazardous or radiological materials. When we discussed this with a Los Alamos official, he stated that for unknown reasons, the deteriorated gaskets had not been entered into the NI process. As of February 2013, Los Alamos was revising the NI process to clarify how it should be used.

Also, as previously noted, the USQ process is a mechanism (required by 10 CFR 830) intended to alert the Department of events, conditions, or actions, both natural and man-made, which affect the safety analysis of a facility or operation and ensure appropriate management action. A 2008 Los Alamos Field Office surveillance review of institutional procedures at selected Los Alamos nuclear facilities found that USQ determinations were not being completed and reported as required. As a result, a revised USQ procedure was implemented in September 2009. However, an April 2012 Los Alamos Field Office assessment covering several nuclear facilities identified systemic weaknesses in the previously performed USQ determinations that could invalidate the results, an issue that could impact the resolution of safety issues. For example the assessment concluded that the information contained in the USQ determination supporting an

exception to waste disposal requirements did not contain sufficient information for granting the exception. Consequently, as of February 2013, the USQ process was under revision to clarify the information needed for the process.

Finally, the Office of Inspector General recently issued an Inspection Report on *Radiological Waste Operations in Area G at Los Alamos National Laboratory*, (INS-O-13-03, March 2013), that identified opportunities to further improve the consistency of Area G operational activities, including responses to natural disasters such as fires, with safety requirements. For example, the inspection found that the emergency access roadway in Area G was blocked on two occasions; a practice that could limit access for wide vehicles such as ambulances and fire trucks. While there is no Los Alamos or Department policy or procedure that addresses this issue, the roadway in question is considered an "emergency access route" where the Los Alamos Fire Department has the responsibility to periodically conduct "walk-downs" to identify obstacles that impede emergency access. Therefore, we believe that delayed emergency vehicle access due to roadway obstruction could lead to additional and/or more severe worker injuries.

RECOMMENDATIONS

While Los Alamos has taken significant actions to mitigate risks related to natural disasters, continued effort is needed to ensure the Department meets facility safety and nuclear safety standards in Area G and PF-4, which are critical to sustaining public trust and confidence. Therefore, Los Alamos should give full consideration to hazard controls and continue improvements that are needed to ensure the safety of the workers, the public, and the environment. To this end, we recommend that the Deputy Associate Administrator for Infrastructure and Operations:

1. Complete the review of the Area G exemption request for the lack of automatic fire suppression systems.

In addition, we recommend that the Los Alamos Field Office Manager ensure:

2. PF-4 seismic upgrades are completed in a timely manner; and

3. Los Alamos completes the previously initiated revisions for the NI and USQ processes.

Regarding Lightning Protection Systems and fire suppression system deficiencies in Area G, we recognize that the facility is a limited life facility and that Los Alamos plans to remove vulnerable transuranic waste from the site by June 30, 2014 as a risk mitigation measure. Accordingly, it is management's responsibility to ensure that upgrades to protective systems are cost-effective in mitigating risks. Therefore, we also recommend that the Los Alamos Field Office Manager:

4. Ensure that Los Alamos' planned removal of vulnerable transuranic waste is carried out as scheduled and that temporary protective measures are effective and carried out in a timely manner.

MANAGEMENT REACTION

Management concurred with the report's recommendations and indicated that corrective actions have been or would be initiated. Management's proposed and initiated corrective actions are responsive to our recommendations. We appreciate management's recognition that additional action is needed to mitigate potential risks and that corrective actions are underway. Management's comments are included in Attachment 2.

Attachment

cc: Deputy Secretary
Acting Administrator, National Nuclear Security Administration
Chief of Staff

OBJECTIVE, SCOPE AND METHODOLOGY

OBJECTIVE

To determine if the National Nuclear Security Administration (NNSA) has evaluated, modified, or upgraded existing nuclear facilities in order to mitigate the effects of natural disasters.

SCOPE

This audit was performed between January 2012 and April 2013, at the Los Alamos National Laboratory (Los Alamos) and the Los Alamos Field Office (Field Office), located in Los Alamos, New Mexico, and the NNSA Complex, located in Albuquerque, New Mexico. Our scope primarily encompassed the Los Alamos Technical Area 54, Area G Waste Storage and Disposal Facility and activities associated with waste disposition operations. We also reviewed the seismic upgrade activities for the Los Alamos Plutonium Facility located in Technical Area 55.

METHODOLOGY

To accomplish the audit objective, we:

- Determined whether evaluations, modifications, and upgrades are proceeding as planned;
- Identified the assets that have not been maintained and pose a safety concern;
- Determined real property asset management goals and performance expectations;
- Identified the facility evaluations and assessments that have found potential weaknesses; and
- Held discussions with personnel from the Los Alamos Field Office, Los Alamos, and NNSA.

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 objectives. 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 controls and compliance with laws and regulations necessary to satisfy the audit objective. 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. During the audit, we assessed the Department's compliance with the *GPRA Modernization Act of 2010* and found that the Department had established performance measures related to Area G waste disposition projects. We did not rely on computer-processed data to satisfy our audit objective. Management waived an exit conference.

Department of Energy
National Nuclear Security Administration
Washington, DC 20585

May 30, 2013

MEMORANDUM FOR RICKEY R. HASS
DEPUTY INSPECTOR GENERAL
FOR AUDITS AND INSPECTIONS
OFFICE OF INSPECTOR GENERAL

FROM: CYNTHIA LERSTEN
ASSOCIATE ADMINISTRATOR
FOR MANAGEMENT AND BUDGET

SUBJECT: Comments on the Office of Inspector General Draft Report Titled *"Mitigation of Natural Disasters at Los Alamos National Laboratory"* (A12AL011/2011-03374)

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 (IG) efforts and its recognition of the significant actions we have taken to mitigate potential risks related to natural disasters.

The report provides four recommendations to help improve efforts to ensure the Department meets facility and nuclear safety standards in Area G and PF-4. NNSA agrees with the recommendations and has already begun to take actions to address the IG's findings.

The attachment to this memorandum provides NNSA's response to each recommendation, including the planned actions and timeframes for resolution, as well as technical comments to improve the clarity and factual accuracy of the report. If you have any questions regarding this response, please contact Dean Childs, Director, Audit Coordination and Internal Affairs, at (301) 903-1341.

Attachment

Attachment

NNSA RESPONSE TO INSPECTOR GENERAL DRAFT REPORT
Mitigation of Natural Disasters at Los Alamos National Laboratory

The Inspector General (IG) recommended the Associate Administrator for Infrastructure and Operations:

Recommendation 1: Complete the review of the Area G exemption request for the lack of automatic fire suppression systems.

Management Response: Concur

The Office of Infrastructure and Operations (NA-00) has completed its review of the *"Los Alamos National Laboratory Technical Area- 54 Area G – Request for Approval of Exemption Request for the Lack of Automatic Fire Extinguishing Systems in Area G Domes."* On April 4, 2013, Los Alamos Field Office (LAFO) directed Los Alamos National Security, LLC (LANS) to revise and resubmit the exemption request within four months to provide additional information including qualitative assessment of nuclear risk, cost-benefit, and integration of the fire hazards analysis and the documented safety analysis. The estimated completion date for this recommendation is September 30, 2013, upon resubmission and review of the revised request.

The IG further recommended that the Manager, Los Alamos Field Office:

Recommendation 2: Ensure that the PF-4 seismic upgrades are completed in a timely manner.

Management Response: Concur

The IG report refers to planned seismic upgrades to fire protection and glove-box stands. NNSA is also pursuing structural upgrades, as discussed in a letter from Secretary Chu to the Defense Nuclear Facilities Safety Board (DNFSB), dated March 27, 2013. In that letter, the Secretary stated: "Since PF-4 can provide its confinement safety function based on our current seismic analysis, and the identified near-term risk reductions will further reduce potential consequences, I have concluded that PF-4 can continue to operate safely while longer-term structural modifications are completed." NNSA has mechanisms in place to track completion of PF-4 seismic upgrades (currently scheduled to be in place within 2 to 3 years) and will continue to effectively monitor and manage these upgrades in accordance with contractual incentives, safety basis commitments, and the multiyear plan to execute the upgrades. Based on the actions taken and mechanisms currently in place to monitor and manage completion, NNSA considers this recommendation closed.

Recommendation 3: Ensure that Los Alamos completes the previously initiated revisions for the New Information (NI) and Unreviewed Security Requirements (USQ) processes.

Management Response: Concur

NNSA will monitor LANS progress on the revisions to the NI and USQ processes and expects these revisions to be in place before the end of fiscal year (FY) 2013. The estimated completion date for this action is September 30, 2013.

Recommendation 4: Ensure that the Los Alamos' planned removal of vulnerable Transuranic (TRU) waste is carried out as scheduled and that temporary protective measures are effective and carried out in a timely manner.

Management Response: Concur

During the last quarter of FY 2011, the New Mexico Environment Department, DOE's Office of Environmental Management, and NNSA were engaged in a series of discussions regarding re-prioritization of cleanup activities to address removal of the above-ground combustible and dispersible TRU legacy waste currently located in Area G. As a result of these discussions, a non-binding framework agreement was developed which establishes, among other things, a schedule for removal of this material from Area G and disposes of it at the Waste Isolation Pilot Plant. This agreement sets a deadline for disposal of 3,706 cubic meters of TRU waste from Area G by June 30, 2014, and complete removal of all newly generated TRU waste received at Area G during FYs 2012 and 2013 by December 31, 2014. NNSA and LANS are also developing an Area G safety basis update, expected to be issued and implemented by the end of this year. The estimated completion date for these actions is December 31, 2014.

IG Report No. OAS-M-13-04

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