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**DEFENSE NUCLEAR FACILITIES
SAFETY BOARD**

Washington, DC 20004-2901



October 11, 2017

The Honorable James Richard Perry
Secretary of Energy
U. S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Perry:

The Defense Nuclear Facilities Safety Board's (Board) January 7, 2016, letter to then Secretary of Energy Ernest J. Moniz identified concerns with implementation of a comprehensive training and drill program for emergency response at Los Alamos National Laboratory's (LANL) defense nuclear facilities. Subsequently, our staff performed a review of LANL's emergency preparedness and response program in April 2016, in addition to observing the site annual exercise at Technical Area 55 in August 2016 and a number of other facility exercises. Our staff identified weaknesses in National Nuclear Security Administration (NNSA) federal oversight, LANL's demonstrated emergency response in drills and exercises, LANL's site emergency exercise program, and LANL's facility-level emergency programs.

As noted in our letter of July 13, 2017, the Board considered and decided against issuing a final recommendation regarding weaknesses in emergency preparedness and response at LANL. We understand that NNSA and LANL have begun to address many of these weaknesses. The enclosed report summarizing the information developed by our staff is provided to aid the Department of Energy and NNSA in addressing LANL's weaknesses and in the broader implementation of Board Recommendation 2014-1, *Emergency Preparedness and Response*.

Sincerely,

A handwritten signature in black ink, appearing to read "Sean Sullivan", with a long horizontal flourish extending to the right.

Sean Sullivan
Chairman

Enclosure

c: The Honorable Frank G. Klotz
Mr. Joe Olencz

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

July 28, 2017

MEMORANDUM FOR: S. A. Stokes, Technical Director

COPIES: Board Members

FROM: A. Hutain and J. Deplitch

SUBJECT: Emergency Preparedness and Response at Los Alamos National Laboratory

Background. The Defense Nuclear Facilities Safety Board (Board) has been raising concerns regarding emergency preparedness and response at Los Alamos National Laboratory (LANL) since holding a public meeting and hearing in Santa Fe, New Mexico, in November 2011. Members of the Board's staff conducted a review in 2011 to support this public meeting and then conducted a follow-up review in 2012.

During 2014 and 2015, the Board's resident inspectors at LANL observed multiple drills and exercises, documenting their observations in weekly reports. Based on these observations, as well as continuing Board concerns with emergency management as expressed in its January 7, 2016, letter to the Secretary of Energy, the Board directed its staff to conduct a review of the LANL emergency preparedness and response program. This included an onsite review during the week of April 11, 2016, as well as observations of drills and exercises. The staff team found numerous weaknesses in specific areas of demonstrated emergency response and with the drill and exercise programs, including many of the same weaknesses previously raised in the Board's letter.¹

Observations. The following observations reflect the staff team's assessment of LANL's emergency preparedness and response program as of February 2017. The staff team's observations are organized into four main categories: federal oversight, demonstrated emergency response during drills and exercises, the emergency exercise program, and the facility-level emergency programs.

Federal Oversight—Based on the staff team's April 2016 review, federal oversight of emergency preparedness and response programs at LANL has not been effective. The National Nuclear Security Administration (NNSA) Los Alamos Field Office (NA-LA) has not completed

¹ Staff members participating in this review included C. Beaty, J. Deplitch, M. Dunlevy, M. Helfrich, A. Hutain, P. Migliorini, J. Plaue, and R. Verhaagen.

all the required assessments of the emergency preparedness and response program and facility exercise assessments.

Independent Assessments: NA-LA is not performing independent assessments of the LANL emergency management program. Federal assessments, performed independently of the contractor, could identify issues that a contractor program might not self-identify. The staff team's review of oversight assessments [1] in April 2016 identified that NA-LA has performed reviews of the LANL emergency management program by participating in the Security and Emergency Operations Division (SEO) self-assessments and reviewing the reports. NA-LA did not provide the staff team with evidence of independent field office assessments.

Facility Exercise Evaluations: The staff team did not find evidence that NNSA is conducting independent evaluations of the facility emergency management exercises every three years.² As of April 2016, the field office could not provide documentation that NNSA conducted these evaluations. According to the Emergency Readiness Assurance Plan [2], LANL has 18 hazardous material facilities; therefore, there should have been 18 independent evaluations during a three year period, rather than just one evaluation for the entire LANL site. As a result, NA-LA cannot be assured of the emergency preparedness and response capabilities of its facilities.

Demonstrated Emergency Response during Drills and Exercises—Based on its observations, the Board's staff team concludes that LANL has not demonstrated adequate response capabilities through its performance during drills and exercises. During its observations of drills and exercises, the staff team identified a failure to establish an effective incident command. This is evidenced by LANL's failures to implement command and control of the response at the event scene and to make decisions that prioritize the health and safety of the emergency responders and the laboratory workforce.

Incident Command: The staff team observed that members of the incident command did not demonstrate an understanding of their defined roles and responsibilities,³ did not effectively coordinate responses to the event scene, did not share a common understanding of the event and response (i.e., they did not develop a common operating picture), did not establish objectives and prioritize elements of response, and did not communicate effectively with the emergency operations center (EOC). The staff team also found several examples of the failure of the facility-level and site-level incident commander to implement a unified command structure.

² Department of Energy (DOE) Order 151.1C directs DOE oversight of hazardous material facilities and requires that: "[e]ach DOE/NNSA facility subject to this chapter must exercise its emergency response capability annually and include at least facility-level evaluation and critique. Evaluations of annual facility exercises by Departmental entities (e.g., Cognizant Field Element, Program Secretarial Officer or Headquarters Office of Security and Safety Performance Assurance) must be performed periodically so that each facility has an external Departmental evaluation at least every three years" [27].

³ The role of an incident commander can be turned over from facility-level operations personnel to first responders, and in the case of LANL, then to site-level emergency personnel.

- In the August 2014 full-scale, full-participation exercise^{4,5} (also referred to as the annual site-wide exercise) at the Chemistry and Metallurgy Research (CMR) facility, LANL failed to establish a unified incident command. According to the finding associated with this objective, the facility incident commander did not integrate with the Los Alamos Fire Department (LAFD) and the response incident command [3]. The facility incident commander was neither able to transfer command nor participate in a unified command since LANL had not established direct communication with LAFD.
- During the September 2015 CMR facility exercise, the staff team observed that the incident command did not enable direct communications with the primary support elements. The facility incident commander, who was acting as the incident commander, did not communicate with the radiological control technician (RCT) lead, resulting in missed timely RCT support.
- In the after action report (AAR) for the June 2016 Area G exercise [4], personnel at the Technical Area 54 (TA-54) operations center did not clearly understand that there had been a drum explosion (simulated as part of the exercise). Incident command did not share relevant information with the shift operations manager.
- During the August 2016 annual site-wide exercise, the staff team observed that the unified incident command consisted of six commanders (LANL emergency manager, LANL protective force, LAFD, Los Alamos County Police Department (LAPD), hazardous materials response team, and the Federal Bureau of Investigation), yet no one individual assumed command and control of the response. The commanders did not demonstrate a common understanding of the event scene and response actions. In addition, they did not hold formal briefs, establish objectives, or create an action plan. As a result, emergency responders did not enter the facility until an hour and a half after the security threat was eliminated.
- During the September 2016 Weapons Engineering Tritium Facility (WETF) annual exercise involving a potential active shooter, the staff team noted that the exercise did not include the LAPD, who would have responded and participated in a unified incident command in an actual active shooter event. LAPD officers do not receive the familiarity and the hazard awareness training that is provided to members of the LAFD. Exercise participants expressed concerns that the police procedures and response actions may not appropriately account for the unique hazards at certain LANL facilities. The exercise failed to demonstrate the integration of a key responder in a unified incident command structure.
- The DOE Office of Emergency Management Assessments (EA-33) produced a report following the 2015 fourth quarter EOC functional exercise that also identified

⁴ A full-scale exercise is a multi-discipline, site-wide exercise involving functional (e.g., incident command, emergency operation centers) and “boots on the ground” response (e.g., fire and rescue response, radiological contamination control, field monitoring).

⁵ A full-participation exercise is a multi-agency, multi-jurisdictional, full-scale exercise.

numerous similar weaknesses with the incident command. Specifically, EA-33 observed the failure to effectively incorporate the LANL protective force into the unified command structure and to develop a common operating picture [5].

The staff team also observed numerous failures of the incident command team to make and prioritize decisions that affect response time and protect the health and safety of emergency responders and laboratory workers.

- During the March 2016 exercise at Technical Area 55 (TA-55), responders travelled through the hazardous material release plume, as described in Finding 1 of the AAR [6]. The LAFD battalion chief staged the incident command in the isolation zone.⁶ Similarly, LANL Emergency Management and the hazardous material team proceeded downwind of the event. In an actual event, incident command's actions could have exposed emergency responders to the event hazards.
- During the April 2016 EOC functional exercise,⁷ the staff team observed a failure to ensure the safety of sheltered-in-place individuals. Part of the scenario involved two workers who were ordered to shelter-in-place in a room adjacent to a sulfuric acid spill. The staff team assessed that the incident commanders made poor decisions with respect to the safety of workers being sheltered-in-place adjacent to a hazard. The concentration in the room where the workers were sheltered was 1 ppm as stated by the incident commander, which is a concentration approximately equal to the AEGL-2 value⁸ when exposure time is greater than 60 minutes. At the AEGL-2 value and above, there is an increased probability that someone will have severe or irreversible health effects. In addition, according to the 2012 U.S. Department of Transportation Emergency Response Guidebook [7], for a small spill, incident command should have evacuated workers in the area out to 100 meters from the event location instead of sheltering in an adjacent room. Despite this hazard, the workers were not evacuated for more than an hour. Incident command did not discuss other options for providing safe routes or prioritize rescuing these two individuals. There was no discussion of the symptoms and effects that would likely result from exposure to this hazard.

⁶ The exercise AAR identified a finding for a related exercise control issue. The AAR states "LAFD was escorted in a specific route for exercise play. The Battalion Chief (BC) proceeded with the responding companies in the security 'bubble' and broke off prior to entering the protected area. At this point, the BC was downwind of the event and appropriately noted that due to security requirements and simulations he would have staged upwind of the event and simulated being upwind. LANL Emergency Management and HAZMAT noted similar considerations and simulated staging upwind in an effort to continue exercise play, but proceeded downwind of the event. Emergency responders were allowed to simulate actions that were not pre-approved in the exercise plan."

⁷ An EOC functional exercise examines and/or validates the coordination, command, and control between various coordination centers (e.g., emergency operation center, incident command). It does not involve any "boots on the ground" (i.e., emergency responders responding to an incident in real time).

⁸ Acute Exposure Guidelines Level 2 (AEGL-2) is the airborne concentration (expressed as ppm or mg/m³) of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape [24].

- During the August 2016 site-wide annual exercise at TA-55 involving simulated mass casualties, the staff team observed multiple examples of a lack of focus on worker safety and a lack of coordination between responders in the unified incident command. An hour and a half after the event commenced, the majority of injured patients still had not received medical attention, despite emergency medical responders waiting in proximity to the event scene, directly outside of the security area. Command and control issues led to problems getting the responders into the area. As a result, protective force personnel (who are not trained to provide medical support) began transporting contaminated patients in security vehicles. Further, protective force personnel were standing unprotected in the release plume for the duration of the exercise.
- The AAR for the September 2016 CMR exercise identified a deficiency in which the incident command moved personnel through the release plume [8].
- In the September 2015 EOC functional exercise, the staff team observed that the emergency manager did not use all of the available communication tools. The emergency manager used telephone, radio, and direct verbal communications, but did not use, or direct the use of, electronic media, e-mail, and network servers for information exchange. As a result, the emergency manager was not fully cognizant of, and did not disseminate, essential information concerning hazard releases, plume projections, conditions of facilities and resources, and accountability of personnel.

Shelter-in-Place Protective Actions: For certain emergency situations, the LANL emergency response program depends on workers to take protective actions. During some drills and exercises, the staff team observed the inability of workers to demonstrate appropriate shelter-in-place protective actions. Gaps in adequate implementation include the failure to secure ventilation, the failure to achieve personnel accountability, and the failure to develop contingency plans when emergency responders are affected by shelter-in-place protective actions.

- During the September 2015 Technical Area 48 (TA-48) exercise, the staff team observed that some adjacent facilities did not have qualified personnel or available procedures to secure outside ventilation intakes. TA-48's simulated spill occurred close to the ventilation intake for the facility. The intake vents near the spill were not secured. It is important to note that TA-48 is adjacent to TA-55 and its occupants may be directed to shelter-in-place in response to an event at TA-55.
- During the September 2015 TA-48 exercise, the staff team observed that the incident command only received accountability reports from two of the five buildings directed to shelter-in-place. The staff team could not find evidence that personnel in the remaining three buildings were aware of the shelter-in-place order.
- During the September 2015 quarterly EOC functional exercise, the emergency response organization (ERO) had no contingencies for accomplishing the functions of ERO members affected by a shelter-in-place protective action. In response to the

simulated earthquake event, the emergency manager had directed a site-wide shelter-in-place protective action and ERO personnel were not able to get to the EOC in a timely manner. At other DOE sites, members of the Board's staff have observed that ERO personnel can participate remotely if they are sheltered-in-place.

- During the March 2016 Plutonium Facility (PF-4) exercise, as noted in the AAR [6], various personnel in PF-4 and other adjacent buildings were confused and/or did not take any actions during the shelter-in-place protective action.

Worker Notification: LANL has not consistently demonstrated an ability to notify affected workers of an event in progress.

- LANL's notification system assigns workers to a specific facility's notification list, but many personnel have work areas at a location separate from their assignment on the list. Thus, the notification system is not set up for notifying workers who are at a location other than the one designated by the notification list. For example, during the September 2015 TA-48 exercise, many participants who should have been alerted to take protective actions never received the notification from the EOC. The EOC sent a shelter-in-place direction to the distribution lists for five buildings via the page/text/email notification system. As stated in the AAR, "[o]nly 6 of 60 people who sheltered indicated that they had been notified by text, phone, or e-mail." [9]
- LANL also relies on the individual facility public address systems to notify facility workers who do not receive a page, text, or email. However, not all facilities have public address systems. Further, the staff team observed issues with the ability of individual facilities to effectively use the public address system for this purpose. For example, during the September 2015 TA-48 exercise, no one in the TA-48 facility used the paging system to announce the protective actions. The AAR for this exercise [9] noted that the "TA-48 paging system is available for use but it is [not known] how to use the system or if it reaches everyone in the TA-48 complex." As a result, personnel continued to travel through the spill area, unaware of the hazard.
- When a facility has a release, other nearby facilities are not notified to take appropriate protective actions in a timely manner. When a facility has an event, facility personnel contact the LANL operations center. The emergency manager determines the severity of the event and the need for protective actions, and then makes appropriate notifications. These actions can take up to 30 minutes or longer. During this time, adjacent facilities may be unaware of the need for protective actions. Notification of adjacent affected facilities should be practiced and demonstrated during exercises.

Assurance of Off-Hour Emergency Response: Based on the staff team's review, LANL does not have a documented duty roster for its ERO. A duty roster establishes a team of responders who are designated to be capable of responding in an actual event (e.g., they have to remain fit for duty; they must be able to meet a certain response time; and they have to carry a means of being notified such as a pager or cell phone). The staff team could not identify an

official mechanism for ensuring that constant coverage is maintained for key positions in the ERO, such as the emergency director, who is responsible for managing the EOC. The staff team notes that the Emergency Technical Support Center group has a formal process for ensuring coverage at all times, but it is the only group in the ERO that has such a procedure. Additionally, the staff team notes that as of February 2017, LANL had performed no exercises during off-hours at a defense nuclear facility in more than four years.⁹ As a result, the staff team concluded that LANL does not have assurance that necessary personnel will respond and be able to fulfill their functions during off-hours.

Site Emergency Exercise Program—Based on its review of the LANL emergency exercise program and its observation of drills and exercises, the staff team concluded that the LANL emergency exercise program was not effective in promoting improvements in demonstrated emergency response. The staff team noted that deficiencies in exercise design and the use of unnecessary simulations contributed to the ineffectiveness of the exercise program. The staff team determined that the emergency exercise program does not provide effective performance feedback and improvement and that an ineffective corrective action program has led to recurrence of emergency management issues.

Exercise Evaluation Criteria and Objectives: The staff team assessed exercise objectives and observed exercise critiques, and concluded that the objectives, as implemented, were not effective tools for critiquing performance. The staff team found LANL's development and assessment of exercise objectives to be unfocused, contributing to the limited effectiveness of the emergency management program.

At LANL, exercise objectives are weighted equally, and as such, the importance of certain actions over others cannot be distinguished. The exercise evaluation guidelines, used by LANL to evaluate completion of exercise objectives, do not identify critical activities or tasks (e.g., dose assessment decisions, protective actions, command and control, and offsite notifications). Without a defined set of critical activities, LANL has difficulty interpreting exercise results and will be challenged to prioritize and apply resources to response elements.

As designed and executed, the LANL emergency management program could meet all of its exercise objectives but still fundamentally fail to protect the workers and public. For example:

- During the September 2015 TA-55 exercise involving a simulated fire, an actual (non-exercise related) continuous air monitor (CAM) alarm sounded in the basement. The TA-55 operations center did not notice this CAM alarm for approximately 20 minutes. The failure to respond to this alarm was recognized in the AAR as an opportunity for improvement (OFI), and the exercise objective associated with receiving and documenting alarms¹⁰ was considered to have been met. Recognizing and responding to operational alarms is necessary to protect workers [10].

⁹ One no-notice, off-hours exercise was conducted in July 2015 at the Los Alamos Neutron Science Center, which is not a defense nuclear facility.

¹⁰ Objective LANL-TA55-OC.2—Given abnormal or emergency conditions, the Operations Center staff receives and document alarms and event notifications in accordance with TA-55-AERI-001, TA-55 Operations Center Alarm/Emergency Response Instructions.

- During the September 2015 EOC functional exercise, the staff team observed that the EOC did not deploy or manage the strategic field monitoring team. The strategic field monitoring team began monitoring prior to the activation of the EOC and independently determined where to monitor. The associated objective for the EOC to initiate and manage the strategic field monitoring team was declared met despite the EOC's failure to manage the field monitoring team.
- As previously discussed, during the April 2016 EOC functional exercise, the incident command and the hazardous materials response team failed to evacuate within an hour two workers who were sheltered in place inside the isolation zone. The associated objective was considered met despite exposing workers to a concentration of sulfuric acid that is approximately equal to the AEGL-2 value at which there is an increased probability that an exposed individual will have severe or irreversible health effects.
- During the August 2016 annual exercise, RCTs allowed clean and decontaminated patients to move through a contaminated area. The associated objective was considered met in the original version of the AAR despite a lack of radiation boundary control [11].¹¹

Targeting and retesting of specific response elements can be improved with identification of critical tasks. LANL identified in the fiscal year (FY) 2015 SEO Exercises self-assessment [12] that “there is no formal mechanism in place to ensure that failed objectives of an exercise...are reevaluated during a drill or through a selected functional test within a fixed time period following the exercise.” Determining which activities are critical to emergency response provides a natural framework whereby issues with specific response elements can be identified, allowing focused training and re-evaluation.

Unnecessary Simulations: During its observations of drills and exercises, the staff team observed excessive use of simulation, a failure to use available tools, and a failure to validate the effectiveness of site notification systems. Not all aspects of an exercise can be practiced in a realistic manner, such as hazardous releases, fires, and natural phenomena events. Tabletop drills and exercises that incorporate simulation can be useful tools for practicing and demonstrating decision-making skills; however, emergency responders need to practice and demonstrate under situations as realistic as possible. It is imperative that responders actually perform their tasks because it allows thorough practice, demonstration of appropriate actions, and evaluation of their effectiveness. Excessive reliance on unnecessary simulations does not provide assurance that the emergency responders are capable of performing the desired response and can lead to inculcation of poor behavior.

- At the March 2016 TA-55 exercise, the staff team observed the responders execute an unplanned and uncontrolled simulation. The response organization traveled into the

¹¹ The AAR was re-issued following comments from NA-LA. In the revised AAR, this objective was determined to be Not Met [14].

isolation (evacuation) zone, downwind of the hazard, to establish the incident command inside the facility. The responders considered themselves as simulating being in a stand-off and upwind area. The simulation was approved by the exercise controllers after responders entered the isolation zone. The AAR [6] contends that a stand-off incident command post was considered and simulated. This unwarranted simulation and lack of exercise control allows responders to develop poor habits, reinforces poor decision making, and precludes the opportunity to practice proper response.

- In several exercises observed by the staff team, key responders requested unearned information, such as a graph or picture, from the controllers, rather than acquiring the information using the electronic tools and media that would be used in an actual event. Incident command players have become accustomed to being provided with the information they need, as opposed to seeking it. The staff team observed that many injects prematurely provided unearned information. For example, patient role players are often given a card that responders can simply pick-up and read to determine their medical conditions.
- The team observed that unnecessary simulation at LANL led to inadequate validation of the effectiveness of site notification systems during exercises. SEO establishes an ERO notification list specific to each exercise rather than using the ERO notification list that would be used during an actual event. A repeated concern raised during hot washes and critiques was that desired response rates (e.g., personnel reporting to the EOC) were not always achieved due to errors in the exercise specific notification list. LANL should use and test the actual ERO notification and activation phone list to validate that the ERO will be staffed as required during an actual event. Without exercising the actual notification system, LANL cannot have confidence that the ERO members will be notified for an actual event.

The staff team also observed that exercises at LANL frequently do not use visual indicators or alarm annunciators when real indicators or simple arrangements are available for use to improve realism of the exercise. For example, simple theatrical actions (e.g., smoke machines, inert materials for spills, recorded audio tracks) would improve the realism of drills and exercises. Similarly, LANL could use modified radiation instruments, fire alarms, and simulators to provide realism for the exercise participants.

Feedback and Improvement: Feedback and improvement is comprised of near-term activities, such as hot washes¹² and critiques after drills and exercises, and long-term activities, including documentation of the critiques, corrective actions to address deficiencies, and the determination of the effectiveness of corrective actions. The staff team has observed a lack of self-criticism in LANL's critique and exercise evaluation process and weaknesses in the

¹² A hot wash is the immediate "after-action" discussions and evaluations of an organization's performance following an exercise, training session, or major event.

corrective action program that result in the recurrence of issues.¹³ Self-criticism is a fundamental tenet of a learning organization, and the failure to be self-critical impedes the organization's ability to sustain and improve performance.

Hot washes are a valuable tool that should be used to solicit and provide immediate feedback on the performance of responders. Critiques should be thorough and well-organized; they should critically evaluate performance against objectives and identify actions needed to maintain a healthy emergency response program. The staff team has observed that hot washes and critiques after drills and exercises are not sufficiently rigorous to ensure effective feedback and improvement.

- In exercises observed by the staff team, the hot washes lacked the robust level of self-critique and feedback that is necessary to improve performance. Specifically, discussions did not focus on the success (or failure) of completing objectives and tasks and how performance can be improved in the future. Additionally, the staff team identified other issues related to lack of full participation in the hot washes and critiques.
 - In the 2015 Los Alamos National Security, LLC (LANS) exercise program self-assessment [13], SEO identified that “not all...staff responsible for conducting facility-level exercises conduct a post-exercise formal critique” and noted that it was a “reissuance of [a] Finding identified in the [Fiscal Year] 2014 Exercises assessment.”
 - During the August 2016 exercise, the staff team observed that the unified incident command did not conduct a hot wash. As a result, many of the problems with the performance of the unified incident command were not identified and discussed;¹⁴ therefore, opportunities for immediate feedback were missed. Similarly, the AAR for the exercise noted an OFI stating that “a formalized and structured approach for conducting the [hot wash] should be implemented and proceduralized” [14].
- In general, the staff team observed that exercise deficiencies are inappropriately categorized as OFIs rather than findings.¹⁵ For example, the 2015 CMR annual exercise AAR [15] identified that the radios needed by the emergency response RCTs were locked in a room and were not accessible when needed to respond to the event. The AAR noted this as an OFI. The OFI noted the RCTs lacked the necessary tools or response kits for the event. The AAR states that no findings were identified. As a

¹³ This issue was also observed by EA-33 in its 2014 and 2015 lessons learned reports [23] [25], in which it noted that corrective actions implemented to address identified weaknesses at some sites do not consistently resolve or prevent recurrence of the issue and do not always lead to program improvements.

¹⁴ NA-LA noted this same issue in its evaluation of the August 2016 full scale exercise but considered it an observation, not a finding [29].

¹⁵ According to DOE Order 151.1D [30], findings are deficiencies that warrant a high level of attention on the part of management. If left uncorrected, findings could adversely affect the DOE mission, the environment, worker safety or health, the public, or national security. In contrast, OFIs are provided only as recommendations for line management consideration; they do not require formal resolution by management through a corrective action process.

result of their inability to retrieve their tools, the RCTs were unable to perform all of their essential emergency response functions.¹⁶ The staff team's opinion is that issues where individuals fail to perform essential functions, such as in this example, should be categorized as findings to ensure that those issues will be tracked and resolved.

- The EA-33 report of observations from the September 2015 EOC functional exercise [5] noted weaknesses in exercise evaluation processes, such as critiques, leading to an inaccurate evaluation of performance. For example, the report noted that “an evaluator recorded that the EOC was operational within an hour of activation when it was not.” The report also noted that “evaluators graded some criteria as not observed because they were not performed, rather than not met, because the responder actions should have been performed as an appropriate response to the event.”

The goal of an effective corrective action program is to identify and track issues and their resolution in a timely manner and to prevent their recurrence. An effective corrective action program also will address extent of condition and the common cause of the issues when appropriate. Based on repeated performance findings, LANL's corrective action program has not been effective for resolving these emergency preparedness and response deficiencies.

- The FY2015 SEO exercise program self-assessment [13] found that LANL had not entered all AAR findings and OFIs into the issue tracking system. If an issue is not entered into the issue tracking system, it may not be tracked and it may recur.
- Based on the staff team's review of the LANL emergency management issues, many of the corrective actions do not address the causes of the issues. Some corrective actions only address symptoms and do not ensure or validate the effectiveness of the actions for resolving important issues. For example, the staff team found repeated issues with errors in emergency exercise contact lists, resulting in ERO members not receiving a notification to respond. These issues are individually addressed by correcting the lists (addressing the symptom) rather than re-evaluating the system used to manage these lists (addressing the cause). Similarly, the staff team observed ongoing problems with radio communications during drills and exercises; LANL addressed these problems by acquiring new hardware but did not ensure that personnel were adequately trained on use of the equipment and that the equipment was appropriately maintained and accessible.
- Based on the staff team's review in April 2016, LANL lacks a comprehensive and implemented emergency drill program. LANL previously identified this as an issue. In the FY2015 training and drills self-assessment [16], four OFIs identified in the FY2014 self-assessment were not adequately addressed, resulting in little improvement to the program. For context, the FY2015 self-assessment states that “the SEO Training and Drills program still lacks formality regarding institution of a comprehensive and systemic training program (including a current training program

¹⁶ This was also identified in the August 2014 site-wide annual exercise AAR, but was not determined to be an OFI or a finding [3].

plan), updated and implemented qualification standards, and a comprehensive and implemented drill program.” While these individual issues are OFIs and LANL is not required to track them to closure, in the aggregate they represent an issue worthy of being a finding, and should warrant a high level of management attention and be addressed with appropriate rigor.

- The staff team reviewed LANL’s self-assessments and corrective action tracking system and noted many examples of findings that are not receiving the attention and formality warranted by their significance. For example, the FY2015 ERO self-assessment [17] noted that LANL did not follow its improvement process when attempting to close a finding identified by NA-LA in FY2012. An email outlining a plan to close the finding was provided as evidence that the finding was closed. The evidence did not justify action closure; instead, it provided a plan, which had not been implemented, to close the finding. As noted in the self-assessment, the corrective action was ineffective, and the finding should not have been closed.
- Based on the staff team’s review, there were examples of findings in which the corrective actions were not properly executed. For example, in the FY2015 protective actions and reentry program self-assessment [18], a finding identified that methods, equipment, and personnel were needed to effectively monitor and control large potentially contaminated areas to prevent an emergency event from growing to include the entire site. As noted in the assessment, this finding was first identified in the FY2013 self-assessment as an OFI. This issue was originally entered into the issue tracking system with closure credited by completion of another issue; however, the corrective action for the other issue did not fully address this issue. Specifically, the corrective action did not address methods, equipment, and personnel needed to effectively monitor and control large potentially contaminated areas.

In general, the staff team observed that the contractor self-assessments have identified issues with corrective action implementation. The self-assessments also identified several issues associated with AAR findings that LANL had not entered into the issue tracking system and corrective actions that LANL had not validated for effectiveness. The staff team considers these failures to be a missed opportunity to address findings that are common in exercise AARs across the site. Corrective actions for these common findings would provide program improvements for future exercises and address common weaknesses in emergency preparedness and response.

Facility-Level Emergency Programs—Based on its observations, the staff team concluded that the LANL facility-level emergency programs are immature and inconsistently exercised, and the technical planning documents have unrecognized weaknesses.

Facility-Level Drill Programs: LANL does not have effective facility-level drill programs to ensure that facility personnel are able to identify abnormal conditions, take immediate actions, recognize emergency conditions, and make appropriate notifications. Additionally, LANL has not established a site-wide standard for determining the scope and frequency for training and drills based on each facility’s hazards.

- The staff team did not see evidence that LANL integrates the performance of operational and emergency drills. Emergency drill and exercise scenarios are often initiated by an operational event and, therefore, the responses are related. However, LANL's operational training and drills and emergency training and drills are developed and implemented independently. By performing these types of drills and exercises independently, LANL fails to practice and demonstrate the capability of the operational responders to coordinate with the emergency responders, as would be required in an actual event.
- Based on the staff team's review, LANL facilities are at varying stages in developing and implementing facility emergency training and drill programs. WETF and PF-4 have been conducting readiness assessments and have been executing a fairly aggressive schedule of training and drills. WETF has a documented process for developing, executing, critiquing, and conducting emergency drills at a prescribed frequency. PF-4 is conducting training and drills for restart of activities. Area G and the Waste Characterization, Reduction, and Repackaging Facility have recently commenced an emergency drill program. CMR is creating scenarios and the basis for a program.
- The staff team noted that the multiple operational and emergency drills conducted in WETF and PF-4 have been part of preparation for readiness reviews. The staff team is concerned that drills have been conducted to support re-start activities in the past but the drill programs were not sustained during ongoing operations. For example, as of February 2017, PF-4 has not conducted any drills for T-base 2 lathe activities since the conclusion of the federal readiness assessment; the last drill was in March 2015.¹⁷

Technical Planning Documents: LANL maintains facility hazard surveys and emergency planning hazards assessments (EPHAs) to evaluate the hazards, determine consequences, categorize and classify severity levels of accident scenarios, establish emergency planning zones, determine protective actions, and derive Emergency Action Levels (EALs). The staff team reviewed EPHAs and EALs and identified deficiencies in the accuracy of these documents, inconsistencies with facility operations procedures, and a lack of coordination with changes in the safety basis.

- The staff team noted that the indicators of the emergency provided in the EALs and associated EPHAs do not appear to be validated or realistic for the scenarios. Area G's EALs include multiple fire scenarios where smoke detection and heat sensors are listed as an indication in various domes. Review of the fire hazards analysis for Area G [19] shows that these areas do not have smoke detection or heat sensors installed. The staff team conducted a walk down of the facility to confirm the lack of smoke detectors and heat sensors. The various conflicting information on indicators causes the staff team to question the validity of the listed indicators in the EAL.

¹⁷ The staff team notes that LANL requires that a subset of workers in PF-4 (specifically fissile material handlers) perform an operational drill every two years for training and qualification.

- CMR has EAL criticality events that list “visual or direct observation” as the only source of indication.¹⁸ However, the staff team notes that a criticality alarm may be the only source of indication to notify workers of a criticality event because a criticality event might not be visually observable.
- Facility-level response is not aligned with the EALs, resulting in conflicting protective actions. For example in the June 2016 Area G exercise, the EALs for Area G Dome 375¹⁹ stated that the protective action for workers at Dome 375 within 30 meters of the fire was to evacuate; for other Area G workers, the protective action was to shelter-in-place. In contrast, the facility procedures deferred a decision on action to the shift operation manager [20], who ordered an evacuation of Area G personnel through the release plume during the exercise.
- The staff team observed that the personnel assigned to maintaining EPHAs do not coordinate their work with personnel responsible for maintaining the safety basis. As a result, LANL may not update technical planning documents in a timely manner when new information is determined to be relevant to the safety posture of a facility. The Board’s January 7, 2016, letter identified this concern for the TA-54 Area G Site EPHA [21] following the May 2014 discovery that the inappropriately remediated nitrate salt waste posed a release hazard that was significantly different than documented in the approved safety basis. The discovery, which was considered a potential inadequacy of the safety analysis (PISA), should have initiated an update to the EPHA. This PISA was not addressed in the EPHA until LANL issued an EPHA addendum in March 2016 [22].

Shelter-in-Place Drills: As documented in the Board’s January 2016 letter, not all LANL facilities have effectively demonstrated sheltering personnel in place through drills and exercises. The November 2015 SEO training and drills self-assessment identified a finding related to a requirement to periodically shelter-in-place [16]. The self-assessment notes that “although shelter drills are occurring throughout LANL, there is no process to ensure that LANL is conducting shelter drills on a periodic basis for occupied buildings.”²⁰ This was also a complex-wide issue noted in the EA-33 lessons learned report for 2014 [23].

Conclusion. Based on its review and observations, the Board’s staff team found weaknesses in: (1) federal oversight of LANL’s emergency preparedness and response program; (2) LANL’s demonstrated emergency response during drills and exercises; (3) LANL’s site emergency exercise program; and (4) LANL’s facility-level emergency planning and drill programs.

¹⁸ EAL Scenarios TA-03-0029-CRIT-7-RD-1 and TA-03-0029-CRIT-7-RD-2 from ERO-EPIP-215, R11 [26].

¹⁹ EAL TA-54-0375-RNS-02 in the Area G EPHA Addendum [22].

²⁰ Subsequently, LANL reissued its Emergency Management Plan [28] to require that “a hands-on...shelter in place drill is conducted once every three years for all occupied buildings. A discussion-based drill...may be conducted every three years for buildings with fewer than 10 occupants to satisfy the triennial requirement.” However, the staff team has not observed execution of the new plan and cannot validate its effectiveness.

While some of DOE's actions to address the Board's Recommendation 2014-1, *Emergency Preparedness and Response*, may provide a framework for LANL to improve its emergency preparedness and response capability, the staff team believes the concerns noted above exist due to inadequate oversight and implementation of requirements at LANL. As a result, the staff team believes that these areas of concern merit attention from NNSA and LANL.

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