Independent Assessment of Emergency Management at the Lawrence Livermore National Laboratory

December 2022

Office of Enterprise Assessments
U.S. Department of Energy

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Acronyms

ACFD	Alameda County Fire Department
ACRECC	Alameda County Regional Emergency Communications Center
COPS	Common Operating Picture System
CQT	Consequence Assessment Team
CRAD	Criteria and Review Approach Document
CRD	Contractor Requirements Document
DOC	Department Operations Center
DOE	U.S. Department of Energy
DWTF	Decontamination and Waste Treatment Facility
EA	Office of Enterprise Assessments
EAL	Emergency Action Level
ED	Emergency Director
EMDO	Emergency Management Duty Officer
ENF	Emergency Notification Form
EOC	Emergency Operations Center
EOS	Emergency Operations System
EPA	Environmental Protection Agency
EPHA	Emergency Planning Hazards Assessment
EPI	Emergency Public Information
EPIP	Emergency Plan Implementing Procedure
ERO	Emergency Response Organization
ES&H	Environment, Safety, and Health
FMT	Field Monitoring Team
GE	General Emergency
GIS	Geographical Information System
IC	Incident Commander
ICP	Incident Command Post
JIC	Joint Information Center
LEDO	Laboratory Emergency Duty Officer
LFO	Livermore Field Office
LLNL	Lawrence Livermore National Laboratory
LLNS	Lawrence Livermore National Security, LLC
LPD	Livermore Police Department
NARAC	National Atmospheric Release Advisory Center
OFI	Opportunity for Improvement
PA	Protective Action
PAC	Protective Action Criteria
PAG	Protective Action Guide
PAR	Protective Action Recommendation
PAS	Protective Action Sheet
PFD	Protective Force Division
RAP	Radiological Assistance Program
rem	Roentgen equivalent man
SIP	Shelter In Place
SNL-CA	Sandia National Laboratories – California
TIA	Timely Initial Assessment
TOC	Tactical Operations Center
TRU	Transuranic

INDEPENDENT ASSESSMENT OF EMERGENCY MANAGEMENT AT THE LAWRENCE LIVERMORE NATIONAL LABORATORY

Executive Summary

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) conducted an independent assessment of the emergency management program at the Lawrence Livermore National Laboratory. The assessment evaluated the effectiveness of both Lawrence Livermore National Security, LLC (LLNS) and the National Nuclear Security Administration Livermore Field Office (LFO) in managing and maintaining emergency response organization (ERO) performance during the site-level exercise conducted on August 17, 2022, as required by DOE Order 151.1D, *Comprehensive Emergency Management System*. Additionally, EA appraised the performance of the ERO at key decision-making venues to determine whether LLNS responded effectively to an operational emergency and whether appropriate response measures were taken to protect workers, responders, and the public.

EA identified the following strengths:

- LLNS significantly upgraded its emergency operations system since 2016, including a new emergency operations center, Common Operating Picture System, and protective action sheets.
- LLNS demonstrated an effective response for classifying the emergency, implementing initial preplanned protective actions, performing initial consequence assessment, and acquiring assets to support response at the scene.
- LLNS maintains an agile emergency public information section that disseminated timely, consistent, and accurate information. Specifically, the Public Information Manager requested the joint information center to be augmented with a subject matter expert possessing technical knowledge of transuranic waste and associated hazards to ensure that clear, concise plain-language updates were provided to the media and other stakeholders.
- The LFO Emergency Management Program Manager provided effective oversight of the LLNS emergency management exercise and had previously identified many of the weaknesses identified during this assessment and their related underlying causes.

EA also identified several weaknesses in the LLNS emergency management program, including the following four findings that warrant a high level of attention from LLNS and LFO management:

- Although significant improvements have been made to its emergency operations system, LLNS did not consistently demonstrate an effective emergency operations system during the exercise that obtained and maintained situational awareness and disseminated a common operating picture among response components and external partners, which negatively impacted protective action decision-making. (Finding)
- LLNS has not adequately integrated protective action decision-making with emergency classification and consequence assessment. During the exercise, the incident commander terminated predetermined onsite and offsite protective actions without fully understanding the basis for the actions and without using consequence assessment support involving modeling, field monitoring, and sampling before revising protective measures. (Finding)
- LLNS and LFO have not fully established an appropriate technical planning basis for the emergency management program through conservative consequence calculations performed for the purposes of incident classification, initial protective action determinations, response decision-making, and special planning (co-located facilities, special offsite populations, emergency planning zone determination). Specifically, the inappropriate use of a radioactive material protective action criteria of 5 roentgen equivalent man (rem) versus 1 rem for analysis of releases involving long-lived radionuclides, such as

plutonium, results in emergency planning hazards assessments that do not appropriately identify the classification of emergency incidents and initial protective actions that would adequately protect onsite and offsite populations consistent with the requirements of DOE Order 151.1D. (Finding)

- The concept of operations included in the LLNL emergency plan inappropriately places responsibility and authority on the Alameda County Fire Department (ACFD) incident commander and does not require LLNS participation in operational emergency decision-making following the implementation of initial preplanned protective measures and activities, which contributed to many of the response weaknesses. (Finding)

In summary, LLNS generally used appropriate plans and procedures to facilitate emergency response actions. LLNS significantly upgraded its emergency operating system, including a new emergency operations center and Common Operating Picture System, and the emergency public information section disseminated timely, consistent, and accurate information. The LFO Emergency Management Program Manager performs effective oversight of the LLNS emergency management program. However, LLNS and LFO demonstrated performance weaknesses during the exercise in several areas, including premature termination of onsite and offsite protective actions, and lack of situational awareness and dissemination of a common operating picture among response components. Most significantly, issues associated with the LLNS emergency operations system and the concept of operations between LLNS and the ACFD contributed to many of the performance weaknesses. The assessment determined that weaknesses in the technical planning basis for the LLNL emergency management program impact the protective actions to be taken to protect onsite and offsite populations in the unlikely event of a major release of long-lived radionuclides. Once implemented, EA will monitor corrective actions, as appropriate, and seek opportunities to evaluate future exercises and performance tests.

INDEPENDENT ASSESSMENT OF EMERGENCY MANAGEMENT AT THE LAWRENCE LIVERMORE NATIONAL LABORATORY

1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Emergency Management Assessments, within the independent Office of Enterprise Assessments (EA), conducted an assessment of the emergency management program at the Lawrence Livermore National Laboratory (LLNL). EA observed key decision-making venues during the exercise on August 17, 2022, to determine the effectiveness of the LLNL emergency response organization's (ERO's) response to an emergency. This assessment is part of a series of assessments of emergency management programs at sites throughout the DOE complex and was conducted in accordance with the *Plan for the Independent Assessment of the August 2022 Emergency Management Exercise Evaluation at the Lawrence Livermore National Laboratory, July – November 2022.*

LLNL is a government-owned, contractor-operated site. The National Nuclear Security Administration Livermore Field Office (LFO) provides Federal oversight of the LLNL emergency management program. Lawrence Livermore National Security, LLC (LLNS) is the prime contractor responsible for the site-level emergency management program. LLNS has a fixed-price subcontract with the Alameda County Fire Department (ACFD) for fire department emergency services at LLNL.

The exercise was based on a scenario in the *EPHA for Waste Storage Facilities* involving a spill of multiple drums of transuranic (TRU) waste resulting in a General Emergency (GE). The exercise was initiated by a simulated vehicle accident at the Decontamination and Waste Treatment Facility (DWTF). The simulated accident impacted approximately 80 drums, resulting in a release of contamination, implementation of onsite and offsite protective actions (PAs), and LLNL declaring a GE.

2.0 METHODOLOGY

The DOE independent oversight program is described in and governed by DOE Order 227.1A, *Independent Oversight Program*, which is implemented through a comprehensive set of internal protocols, operating practices, assessment guides, and process guides. This report uses the terms "best practices, deficiencies, findings, and opportunities for improvement (OFIs)" as defined in the order.

As identified in the assessment plan, this assessment considered DOE Order 151.1D, *Comprehensive Emergency Management System*, related requirements. EA also used the following sections of Criteria and Review Approach Document (CRAD) 33-09, Rev. 0, *DOE Order 151.1D Emergency Management Program CRAD*: 4.4, *Emergency Operations System*, 4.6, *Offsite Response Interfaces*, 4.7, *Emergency Categorization*, 4.8, *Protective Actions*, 4.9, *Consequence Assessment*, 4.11, *Notifications and Communications*, 4.12, *Emergency Public Information*, and 4.15, *Exercises*. The assessment included observation of the site's exercise controller/evaluator critique.

EA examined key documents, such as emergency plans and implementing procedures, the exercise plan, job aids, and other relevant programmatic documentation supporting the assessment of response elements. EA interviewed key personnel responsible for developing and executing the emergency management program and observed the conduct of the exercise and the initial evaluation activities, focusing on response processes and capabilities. EA further investigated potential causes of unexpected responses, such as ambiguous procedural guidance, technical planning basis, or concept of operations. EA used the criteria of CRAD 33-09, section 4.1, *Program Administration*, and section 4.2, *All Hazards Planning*, to

assess LLNS's concept of operations and technical planning basis, respectively. The members of the assessment team, the Quality Review Board, and management responsible for this assessment are listed in appendix A.

There were no items for follow-up during this assessment.

3.0 RESULTS

LLNS designed and conducted the exercise to evaluate the capabilities and the multiple functions of key onsite ERO groups. Accordingly, the exercise focused on the use of appropriate plans, policies, and procedures, as well as the actions of ERO members involved in management, direction, and command and control functions. LLNS conducted the exercise in a realistic, real-time environment within response facilities requiring actions by facility workers and the site-level ERO, but most offsite participation was simulated in a simulation cell.

The LLNS emergency plan and associated implementing documents outline the roles, responsibilities, and lines of authority for the ERO. Based on the emergency plan and associated implementing documents, the Alameda County Regional Emergency Communications Center (ACRECC) would receive the initial report of the emergency incident and initiate the response by the ACFD. The on-scene communicator would also travel to the incident command post (ICP) and contact the emergency management duty officer (EMDO), advising the EMDO of the incident. The EMDO would determine the categorization and classification of the incident, verify that the implemented PAs and protective action recommendations (PARs) are consistent with the technical basis for the emergency action level (EAL), activate the appropriate ERO, and initiate notifications. Upon categorization of a non-security-related operational emergency, the ACFD incident commander (IC) would assume the additional role of emergency director (ED), responsible for managing the overall site response to the emergency until relieved by the laboratory emergency duty officer (LEDO), who automatically becomes the ED when the emergency operations center (EOC) is declared operational.

Once the EOC becomes operational, the IC continues to manage the response at the incident scene and the ED maintains overall managerial command and control of LLNL's response and EOC operations unless formally assumed by the LFO emergency manager. The ACFD adheres to California's *Standardized Emergency Management System*, which expands the IC's responsibility and authority beyond the event scene and into the surrounding offsite community. For example, if an LLNL event results in a GE declaration, the IC is responsible for managing the onsite incident scene and the associated offsite response, specifically the determination and implementation of any offsite PAs for the surrounding public. In the event of a GE involving the release of hazardous materials (including radiological materials), the IC has immediate responsibility and authority for determining radiological safety impacts to the offsite public. If possible, the IC would establish a unified command with the Livermore Police Department (LPD) and Livermore Pleasanton Fire Department (LPFD), and LPD would activate its community mass notification system to request that residents shelter in place (SIP) or take other appropriate PAs, as determined by the unified command.

3.1 Emergency Operations System

This portion of the assessment determined whether the emergency operations system (EOS) provides centralized collection, validation, analysis, and coordination of information related to an LLNL incident response, and whether that information is used to obtain and maintain situational awareness and disseminate a common operating picture among response components to achieve a well-coordinated, well-understood, and effective response.

LLNS had improved EOS capabilities to collect incident information and to provide needed expertise for incident analysis from centralized, well-equipped facilities and to ensure the EOS was consistent with the operational concepts of the National Incident Management System. LLNS has significantly upgraded its EOS since the previous EA assessment in 2016 by:

- Constructing and implementing an EOC specifically designed to provide LLNL a dedicated facility that enables efficient management of an emergency impacting Site 200, Site 300, or both, by consolidating emergency operations management, fire alarms monitoring, communications, and response technical support into one location.
- Developing and implementing the Common Operating Picture System (COPS), an emergency information system, to provide orderly collection and dissemination of information among ERO teams, decision-makers, and organizations during the response and recovery phases of an emergency. COPS is available in the EOC, tactical operations center (TOC), department operations centers (DOCs), executive business coordination center, and in the joint information center (JIC). In addition, LLNS has provided field responders with access to COPS at the ICP.
- Training ACFD ICs (captains and battalion chiefs) resident at LLNL on LLNS-developed protective action sheet (PAS) information to improve the EOS, including event descriptions, PAs, and when to contact the EMDO to communicate that an operational emergency could be in progress. LLNS also trained the ACFD ICs to issue PAs as prescribed in PASs for onsite populations and to consider implementing PARs for offsite populations if prescribed in PASs for GE events.

Although LLNS made significant improvements to its EOS, the implementation during the exercise was not effective and did not prevent the ineffective and inaccurate flow of information among response components that resulted in an incorrect common operating picture and a lack of situational awareness among the LLNL ERO. Importantly, the initial incident scene size-up by the ACFD did not accurately assess the significance of the radiological material release. Consequently, the ACFD and LLNS personnel did not determine the potential radiological consequences and disseminated incomplete and inaccurate information among the ERO on which to base response actions. Specific examples include:

- The LEDO received an initial situational awareness briefing from the EMDO that conveyed preliminary information from the on-scene communicator, stating that only two drums were breached and that the material release was contained inside building B696R room 1010 by closing a building rollup door. The LEDO shared the preliminary information with the LPD, further reporting that there was no offsite contamination or impacts, although this information was not supported with any verification by consequence assessment or field monitoring, as further discussed in section 3.5.
- At the time the LEDO conveyed the information to the LPD, the IC was given information that all 80 drums were breached, which was not communicated to the LEDO.
- Personnel at the ICP did not enter any information into COPS, and the ERO inconsistently populated COPS with known information or did not validate and correct some critical information posted.
- LLNS did not capture and share other important incident information using its Geographical Information System (GIS), as further discussed in section 3.3.

The ACFD IC and LLNS ERO incorrectly assessed the incident for 2 hours and 20 minutes, leading the exercise director to intervene and inject that responder assumptions on the material release were incorrect and that contamination was not confined to building B696R room 1010. LLNS did not demonstrate an effective EOS during the exercise that obtained and maintained situational awareness and disseminated a common operating picture among response components and external partners, as required by DOE Order

151.1D, att. 3, par. 4.b. (See **Finding F-LLNS-1** and **OFI-LLNS-1**.) Decision-makers did not have essential information, as discussed in the following sections of the report, which adversely affected the key response elements of incident notification, PA decision-making, and consequence assessment. In addition, EA attributes some of the EOS ineffectiveness during the exercise to issues related to the concept of operations between LLNS and the ACFD, as discussed in detail in section 3.10.

Emergency Operations System Conclusions

Overall, the LLNS EOS was consistent with the operational concepts of the National Incident Management System and had adequate capabilities to collect incident information and provide needed expertise for incident analysis from centralized and well-equipped facilities. However, LLNS and the ACFD did not effectively implement the EOS and provide decision-makers with essential information to achieve acceptable situational awareness and a common operating picture. In addition, the ineffective use of the information management system via COPS and GIS further added to the problem. Collectively, the ERO did not have the necessary understanding of the incident to provide an effective response.

3.2 Emergency Classification

This portion of the assessment determined whether the EMDO, as the predetermined decision-maker, classified the incident as promptly as possible, but no later than 15 minutes after identification and no more than 30 minutes from initial discovery.

LLNS has adequately established processes in its plans, procedures, and supporting systems for categorizing and classifying an operational emergency and effectively demonstrated its incident classification process during the exercise. The EMDO used the correct EAL and completed incident classification by declaring a GE within 15 minutes of discovery, based on incident information provided by the on-scene communicator. Once the EOC was operational, the ED and consequence assessment team (CQT) confirmed the accuracy of the GE classification.

Emergency Classification Conclusions

Overall, LLNS demonstrated an effective classification process including plans, procedures, EALs, and supporting systems.

3.3 Notifications and Communications

This portion of the assessment determined whether LLNS performed initial notifications promptly, accurately, and effectively, and whether the ERO maintained effective communications throughout the response.

3.3.1 Notifications

LLNS and the ACFD effectively completed onsite notifications in response to the postulated incident. After receiving a 911 call, ACRECC immediately notified the ACFD and LLNS field responders of the incident, and within 10 minutes of the 911 call, the ACFD battalion chief arrived at the scene and established the ICP. Upon incident classification, the IC directed a combination of onsite PAs (evacuation and SIP), which the on-scene communicator implemented via the Emergency Voice Alarm System, the primary means of providing LLNS employee notifications, by the LLNS Alarms' staff. In addition, the EMDO effectively notified the ERO to staff response centers (e.g., EOC) using the AtHoc® notification system, a digital notification system that uses multiple independent systems to relay appropriate event information.

Additionally, the EMDO effectively used AtHoc to notify the DOE Headquarters Watch Office, the city of Livermore, Alameda County, and the State of California by providing an initial emergency notification form (ENF); EMDO only verified receipt with the DOE Headquarters Watch Office. However, the LLNS notification process was not always effective in providing accurate information or incident updates to offsite organizations. For example, a separate faxed initial ENF sent to the DOE Headquarters Watch Office contained inaccurate information and excluded a reference to radiological material being involved in the incident. The EMDO self-identified this error but did not correct the faxed ENF or notify the DOE Headquarters Watch Office of the error. (See **OFI-LLNS-2**.) LLNS did not provide follow-up notifications when incident conditions changed, such as the termination of onsite and offsite PAs, contrary to DOE Order 151.1D, att. 3, par. 11. (See **Deficiency D-LLNS-1**.) Consequently, offsite agencies were not informed of significant changes in PAs.

3.3.2 Communications

LLNS and the ACFD have adequately established several state-of-the-art communication systems to support incident response, including AtHoc for notifications, COPS to share emergency response information among responders, and the GIS to provide mapping capabilities. COPS is available in the primary response locations, including the EOC, TOC, central alarm station, DOCs, JIC, and at the ICP to enable field responder access via mobile access. LLNS has also established a dedicated phone bridge line system (primary and backup) for periodic briefings that allows multiple decision-makers to conference about an incident.

However, LLNS did not effectively use the full capability of its communications systems during the exercise. As discussed in section 3.1, the on-scene communicator did not enter information in COPS from the ICP, and other ERO staff provided numerous entries that contained inaccurate information, such as the list of evacuated blocks. Similarly, the GIS mapping system was minimally used by the ERO for analysis and display of incident information. Although LLNS staffed the EOC with a mapping specialist, incident-specific mapping products to provide visual information of the incident were not produced, disseminated, or used. (See **OFI-LLNS-2**.) In addition, both the primary and backup phone bridge lines failed to operate during the exercise, resulting in a delay in shared situational awareness among the ERO and field responders, negatively impacting the common operating picture, as discussed in section 3.1. (See **OFI-LLNS-2**.)

Notifications and Communications Conclusions

Overall, LLNS effectively provided initial notifications and adequately established communication systems and processes to support incident response. However, LLNS did not perform follow-up notifications when significant changes in PAs occurred. In addition, LLNS did not effectively use the full capability of its communications systems during the exercise to support situational awareness and a common operating picture among the ERO and field responders.

3.4 Protective Actions

This portion of the assessment evaluated whether LLNL responders correctly identified and implemented predetermined onsite PAs and provided predetermined offsite PARs consistent with the hazards based upon the results of emergency planning hazards assessments (EPHAs).

During the exercise, the ICP staff effectively implemented the initial predetermined onsite PAs and initiated offsite PAs. In addition, the protective force division (PFD) lieutenant quickly cordoned off the areas surrounding the response, and the IC requested the blocking of the two offsite roads directly

adjacent to the site due to the proximity of the site boundary (0.14 miles). The ACFD entry team adequately established a decontamination corridor for personnel and equipment to exit the potentially contaminated DWTF fenced area.

However, LLNS has not sufficiently integrated PA decision-making with emergency classification and consequence assessment. Even though this exercise postulated a large area TRU waste contamination event that required the implementation of predetermined onsite and offsite protective measures (within the EAL), based on predetermined protective action criteria (PAC) exceeding 5 rem at 0.3 miles and 1 rem at 0.6 miles, the IC incorrectly released the initial predetermined onsite and offsite PAs without fully understanding why LLNS selected those measures and did not require consequence assessment support using modeling, field monitoring, and sampling before revising the PAs. Notably, the IC did not request information on the preplanned potential consequences, including the potential for significant contamination in onsite and offsite areas. The EPHA preplanning had projected contamination at the public-release level to approximately three miles. Nevertheless, the IC terminated onsite and offsite PAs prior to the EOC becoming operational based on incorrect initial reports and assumptions. Importantly, LLNS has not fully defined the process for the ACFD to terminate or revise predetermined PAs, contrary to DOE Order 151.1D, att. 4, par. 9.c, or to require the involvement of LLNS in the PA decision-making, as further discussed in section 3.10. (See **Finding F-LLNS-2-** and **OFI-LLNS-3**.) Consequently, workers and the public were permitted to reenter areas postulated to be potentially contaminated, without adequately defined contamination levels.

In addition, LLNS and ACFD PA decisions did not ensure the health and safety of responders and workers. The LLNS facility manager stationed two access control teams (DWTF workers) at the boundary of the DWTF fenced area, which is also the boundary of the threshold of early lethality (100 rem) for the scenario, without personal protective equipment or verifying the habitability through monitoring. The facility manager indicated that the teams used to fulfill this role were consistent with a DWTF response to an abnormal operational incident, such as a breach of a single drum. In contrast, LLNS has not documented in the emergency plan or emergency plan implementing procedures (EPIPs) the use of these workers to maintain access control during an emergency response. The IC also had responders at the ICP who potentially could have received a dose between 5 rem and 100 rem due to not verifying habitability or wearing personal protective equipment. Similarly, the onsite Emergency Voice Alarm message directed some building residents to evacuate and relocate to an outside area, which reduced their level of protection compared to the remainder of the site workers in SIP locations. LLNS has not fully defined predetermined PA processes for responders and workers that serve to minimize emergency-related consequences and maximize life-safety and health, contrary to DOE Order 151.1D, att. 3, par. 9.b. (See **Finding F-LLNS-2** and **OFI-LLNS-3**.) Consequently, LLNS and the ACFD did not verify that unprotected personnel at the ICP, DWTF access control points, and relocated workers could remain at those locations safely. (See section 3.10 for further discussion.)

Further, the EMDO did not specifically inform the IC of the EAL PARs for consideration, as defined in LLNS plans and procedures, to permit the offsite PAs to be implemented in a timely manner. The EMDO understood that once the correct PAS was provided to the IC, the IC would implement the associated onsite PAs and consider implementing the offsite PARs. The IC considered and initiated the predetermined offsite PARs only after being prompted by an exercise inject 28 minutes after the emergency GE classification. Furthermore, the EMDO did not compare the EAL PARs with those provided in the PAS, which were significantly less conservative than the EAL PARs provided to the offsite notification points (360-degrees versus downwind to 1,509 feet). (See **OFI-LLNS-4**.) Consequently, the implementation of untimely and less conservative offsite PAs represented a reduced level of protection for the offsite locations.

Protective Actions Conclusions

During the exercise, the ICP staff effectively implemented the initial predetermined onsite PAs and aided in cordoning off areas. In addition, the IC initiated offsite PAs by requesting the closure of surrounding offsite roads directly adjacent to the site. However, the IC incorrectly decided to release the initial predetermined PAs without fully understanding why LLNS selected those actions and did not require any consequence assessment support from LLNS before revising protective measures. Consequently, workers and the public were permitted to reenter potentially contaminated areas. Furthermore, LLNS did not adequately protect responders and workers by verifying the habitability at all response locations and by relocating some onsite workers to an outside location, potentially exposing the workers when all other onsite workers were directed to SIP.

3.5 Consequence Assessment

This portion of the assessment determined whether LLNS's consequence assessment activities provided a conservative, timely initial assessment (TIA); accurate projections using incident conditions; and supportive assessments throughout the emergency.

The CQT adequately performed TIA using the HotSpot dispersion modeling program, current meteorological conditions, and the worst-case source term from the facility EPHA. The CQT correctly verified the incident classification using EAL DWTF-02 GE and determined that initial PAs were bounding. Further, the CQT appropriately identified the corresponding worst-case source term from the EPHA and produced a plume projection during the TIA indicating that the projected radiation dose did not exceed the PAC of 5 rem beyond the site boundary. However, LLNS incorrectly used 5 rem as the PAC for radionuclides with long half-lives, such as plutonium. (See section 3.9 for further discussion.)

Following the TIA, the CQT conducted continuous ongoing assessment for the duration of the emergency as additional information became available. The CQT lead coordinated with the environment, safety, and health (ES&H) commander to determine the event-specific material at risk based on building inventory. The CQT used the National Atmospheric Release Advisory Center (NARAC) to corroborate consequence assessment results as part of near real-time consequence assessment activities. The NARAC projections confirmed that the projected radiation dose did not exceed the PAC of 5 rem beyond the site boundary. Both the HotSpot and NARAC projections indicated the possibility of contamination beyond the site boundary; however, the CQT did not prepare a deposition plume plot or brief the EOC on the possibility of contamination. Consequently, the CQT did not effectively support dissemination of a common operating picture among response components to support PA decision-making. (See **OFI-LLNS-5**.)

Furthermore, the CQT was not always proficient in evaluating potential consequences and sharing plume projection information. Consequence assessment was not integrated with PA decision-making, contrary to DOE Order 151.1D, att. 4, par. 10.a. (See **Finding F-LLNS-2**.) Consequently, PAs were terminated despite the potential for significant contamination levels in both onsite and offsite areas. The CQT did not effectively review plume models with the field monitoring team (FMT) coordinator to determine the scope and scale of needed field monitoring, as required by LLNS procedures. (See **OFI-LLNS-5**.) In addition, the CQT did not appropriately use NARAC or FMT results to determine whether ingestion pathway protective action guides (PAGs) may have been exceeded. *EPIP-Protect* requires the ED to consult with the ES&H lead and the CQT lead to issue PARs for the ingestion pathway (e.g., place animals within a certain distance of LLNL on stored feed or ensure that crops such as grapes are not harvested prior to testing) if it is determined that ingestion pathway PAGs may have been exceeded. (See **OFI-LLNS-5**.)

Consequence Assessment Conclusions

Overall, the CQT's consequence assessment activities provided a TIA and ongoing supportive assessments throughout the emergency. The CQT validated the correct selection of incident classification and used HotSpot to conduct TIA. In addition, the CQT coordinated with NARAC staff and effectively used NARAC throughout the emergency to corroborate the HotSpot consequence assessment results. However, the CQT did not effectively support dissemination of a common operating picture among response components or develop HotSpot or NARAC plume projections of potential deposition to support PA decision-making.

3.6 Emergency Public Information

This portion of the assessment determined whether emergency public information (EPI) staff provided accurate, candid, and timely information to workers, the media, and the public related to an LLNL incident response, and whether that information facilitated situational awareness to support a well-coordinated, well-understood, and effective response.

LFO and LLNS adequately implemented EPI processes to disseminate timely public information and warnings. In addition, LLNS activated the JIC as outlined in UCRL-AM-211854, *Emergency Public Information Plan*, and adequately responded to inquiries from the media and public concerning the incident, and supported the identification, control, and correction of rumors and misinformation on social media.

The EOC public information manager (PIM) maintained communication with LFO and LLNS personnel through the issuance of three email messages that delivered the requisite information to inform employees about emergency conditions, including facility status, response and recovery actions, and offsite activities. Of note, the PIM asked ES&H staff to augment JIC personnel with a subject matter expert possessing technical knowledge of TRU waste and associated hazards to ensure that clear, concise plain-language updates were provided to the media and other stakeholders. The inclusion of a procedure in the LLNS *Emergency Public Information Plan* to supplement the JIC with appropriately trained technical briefers helps to ensure accurate and current understanding of emergency actions and conditions. Additionally, the PIM requested public affairs personnel from Sandia National Laboratories – California (SNL-CA) to augment the EPI response capability. Further, the PIM used a preapproved press release from the *Emergency Public Information Plan* for a GE. While appropriately coordinated with the LLNL ED and the LFO emergency manager, due to the lack of situational awareness by the ERO, the news release did not reflect a full understanding of the potential offsite consequences associated with a GE declaration.

To achieve operational status, the JIC was activated at a temporary location (due to the unavailability of the primary JIC) and met minimum staffing requirements. Per the *Emergency Public Information Plan*, emergency information for news media, public consumption, and employee notifications was disseminated through and managed appropriately from the JIC in coordination with LFO and LLNS. JIC staff appropriately interfaced with simulated media and other stakeholders (city of Livermore, city of Pleasanton, LLNL daycare center) to convey routine response-related updates and appropriately coordinated news releases, employee updates, and other internal communications. Similarly, JIC staff maintained awareness of ancillary, unapproved information posted to social media and actively worked to dispel rumors and ensure that only approved response-related messaging was released.

Emergency Public Information Conclusions

Overall, EPI activities resulted in the issuance of routine communications with appropriate media counterparts and other stakeholders. LFO and LLNS followed EPI-related plans, procedures, and

checklist to ensure that the JIC disseminated relevant information to internal personnel, external stakeholders, and the media. However, the news release did not reflect a full understanding of the potential offsite consequences associated with a GE declaration.

3.7 Offsite Response Interfaces

This portion of the assessment evaluated the effectiveness of LLNS and LFO in establishing and maintaining interfaces with local, state, and Federal organizations responsible for emergency response.

LLNS adequately describes the offsite interfaces required during an emergency in its emergency plan and supporting documents. Once the EOC was activated during the exercise, the EOC liaison officer adequately performed the primary duty of communicating with offsite agencies as defined in LLNL-MI-830510, *Communicate with Offsite Agencies*, along with an accompanying checklist, EPO-Checklist-04, *Liaison Officer Checklist*. LLNS established an executive business communication center that provided updates to corporate officials and partners such as senior government officials and high-ranking elected leaders. LFO also effectively implemented the *LFO Emergency Management Checklist*, which contained actions for external communications with the DOE Headquarters Watch Office.

During the exercise, LLNS and LFO interfaced with NARAC, DOE Headquarters Watch Office, radiological assistance program (RAP), and SNL-CA. Other offsite agencies were simulated by the exercise simulation cell. The regional RAP team agreed to partially participate in the exercise by receiving the request to activate. However, the RAP team did not activate or deploy. The city of Livermore and area hospitals declined to participate in the exercise, and their roles were also simulated. A review of the simulation cell logs demonstrates that various ERO members contacted appropriate offsite agencies in accordance with their procedures and checklists. Most notably, the liaison officer simulated updating the Alameda County Office of Emergency Services, Alameda County Sheriff's Department, and LPD numerous times during the exercise. Finally, LFO completed the external communication steps in its checklist and effectively communicated with the DOE Headquarters Watch Office multiple times during the exercise.

NARAC was the only offsite element to participate in the exercise. All other offsite agencies were simulated or only agreed to receive a notification phone call, thereby preventing the assessment of LLNS's ability to interface with offsite agencies. LLNS did not invite the Alameda County Sheriff's Department or the Alameda County Office of Emergency Services to participate, despite offsite PARs affecting the Alameda County area of responsibility immediately adjacent to the site. (See **OFI -LLNS-6**.) Furthermore, the lack of RAP team involvement and difficulties in deploying LLNS FMTs prevented the assessment of LLNS's ability to coordinate with RAP, such as directing deployment location, exchanging radiological information, and general coordination. The city of Livermore, Stanford Healthcare-ValleyCare Hospital, and SNL-CA Public Affairs Office had all agreed to participate in the exercise, but subsequently declined.

Offsite Response Interfaces Conclusions

Overall, LLNS and LFO have plans, procedures, and checklists in place that adequately describe the offsite interfaces. During the exercise, LLNS and LFO appropriately implemented their procedures and checklists for the simulated interfaces. However, only one offsite agency agreed to fully participate in the exercise, preventing LLNS and LFO from fully testing the interface with offsite mutual-aid partners and other organizations that supplement or support response efforts.

3.8 Exercise Design, Conduct, and Evaluation

This portion of the assessment evaluated the ability of the LLNS exercise program to validate emergency response capabilities and test and validate emergency plans and procedures for hazards identified in the EPHAs.

LLNS procedures provide adequate guidance to effectively test response elements and response capabilities. LLNS appropriately designed and conducted an exercise that postulated a large area contamination event requiring the implementation of predetermined onsite and offsite PAs based on preplanned PAC. The scenario was based on a credible EPHA GE event, and the exercise tested a broad spectrum of response elements. LLNS adequately challenged the ERO and tested many of the response elements and some of the capabilities outlined in LLNL-MI-829326, *LLNL Emergency Programs Organization Five-Year Drill and Exercise Plan, Fiscal Years 2022-2026*. The exercise also provided an opportunity for LLNS to validate several ERO positions and capabilities, including the EMDO, the LEDO, ACRECC, LLNL Alarms, the EOC, ACFD, facility personnel, radiological controls, PFD, and LLNL Public Affairs Office. LLNS started the exercise with simulated meteorological conditions and then quickly transitioned to actual weather conditions to test the ability of exercise participants to effectively respond to realistic changing meteorological conditions. The scenario tested notifications and communications with offsite agencies including SNL-CA and the DOE Headquarters Watch Office.

LLNS effectively controlled the exercise via message injects and a simulation cell. In addition, LLNS deployed enough controllers to cover the venues, with most controllers also acting as evaluators. The controller organization appropriately issued injects, including an inject to drive SNL-CA's predefined exercise play. The simulation cell also provided realistic feedback to exercise participants.

The LFO Emergency Management Program Manager provided effective oversight of the LLNS emergency management exercise and identified two of the exercise weaknesses and their related underlying causes. These weaknesses included: (1) the EOS did not function appropriately to provide adequate situational awareness of the incident, and (2) the ACFD IC improperly and unilaterally lifted PAs. Additionally, after the exercise, most venues conducted hotwashes to allow player input into the exercise evaluation process. Hotwashes were not conducted at ACRECC, LLNL Alarms, the ICP, and the JIC. (See **OFI-LLNS-7**.) LLNS conducted a virtual exercise debrief the day after the exercise to identify strengths and issues. Evaluators provided the exercise director with timely input using the exercise evaluation criteria.

Exercise Design, Conduct, and Evaluation Conclusions

Overall, LLNS procedures provide adequate guidance to effectively test response elements and response capabilities. LLNS demonstrated the ability to design, conduct, and evaluate an exercise, and selected and designed the exercise around a plausible EPHA scenario. The exercise tested the objectives identified in the exercise plan. LLNS adequately controlled the exercise with a controller organization and simulation cell. After the exercise, LLNS conducted exercise debriefs; however, some venues did not conduct player hotwashes.

3.9 Technical Planning Basis

This portion of the assessment determined whether LLNS has established a technical planning basis for the emergency management hazardous materials program that appropriately uses the PAGs promulgated by the Environmental Protection Agency (EPA).

While preparing for the exercise evaluation, EA identified a concern with the emergency management technical planning basis that included a significant error in EPO-EPHA-WSF, *EPHA for Waste Storage*

Facilities. LLNS had accurately documented the bounding spill scenarios for buildings R625R and B696R that resulted in projected doses above the radiological PAC beyond the site boundary; however, the corresponding fire scenarios did not produce results exceeding the PAC. EA evaluated the modeling data in the EPHA and discovered an error involving the fire scenario inputs to the HotSpot modeling code. The Hotspot general fire model approximates a large, circular fire with the same area as the postulated fire and requires the radius of the circle representing the fire to be input. However, the EPHA process did not identify that an analyst mistakenly entered the area of the building as the radius of the fire. The incorrect use of the building area instead of the radius of the fire resulted in overestimating the dispersion and underestimating the consequences. EA modeled the release scenarios in HotSpot using the correct radius, and the results showed the potential for significant radiological consequences exceeding the radioactive material PAC both onsite and offsite. EA provided the information on the two fire scenarios to LFO and LLNS representatives, who initiated prompt compensatory measures consisting of revisions to the EPHA, EALs, and PASs.

In addition, LLNS and LFO have not fully established an appropriate technical planning basis for the emergency management hazardous materials program through conservative consequence calculations performed for the purposes of incident classification; initial PA determinations; response decision-making; and special planning for co-located facilities, special offsite populations, and emergency planning zone determination. LLNS and LFO incorrectly use a radioactive material PAC of 5 rem for analysis of some releases, instead of 1 rem as required by DOE Order 151.1D, att. 4, par. 2.d(3)(a). (See **Finding F-LLNS-3**.) Consequently, LLNS's use of a 5 rem PAC for long-lived radionuclides, such as plutonium, is not conservative, does not provide appropriate protection decision points to onsite and offsite populations, and does not prompt LLNS emergency responders or offsite authorities to take conservative actions to limit or prevent adverse health and safety impacts to workers and the public.

DOE Order 151.1D establishes that PAGs promulgated by the EPA must be used as the PAC for radioactive material. DOE Guide 151.1-1B, *Comprehensive Emergency Management System Guide*, clarifies the intent of DOE Order 151.1D requirements and states "the terms PAG and EPA Protective Action Guides used in the Order should be interpreted as a projected dose equivalent of 1 rem."

PAGs are promulgated in EPA-400, *PAG Manual: Protective Action Guides (PAGs) and Planning Guidance for the PAC*. Table 2.1 of EPA-400 states that PAs should be initiated at 1 rem with exceptions based on whether a special population is involved or when evacuation is impeded. The intent of the order is that PAs begin at 1 rem with a decision-making process to determine whether a special circumstance, as outlined in EPA-400, is present.

LLNL's use of 5 rem as the radioactive material PAC for long-lived radionuclides has resulted in inadequate preplanning of PAs that are relied upon to protect onsite and offsite populations. Examples include:

- Two EPHAs covering LLNL nuclear facilities do not appropriately identify the classification of emergency incidents involving long-lived radionuclides by basing incident classification on the PAC of 5 rem. The *EPHA for Waste Storage Facilities*, reviewed during the exercise evaluation, would have nine additional GE scenarios if the appropriate PAC of 1 rem were used.
- Initial PAs, based on data presented in EPHAs, would not protect onsite and offsite populations consistent with DOE Order 151.1D. The *EPHA for Waste Storage Facilities* and corresponding EALs are based on the projected 5 rem dose distance. Data presented in the EPHA indicates that PA distances for analyzed releases would more than double if the appropriate PAC of 1 rem were used. For example, during the evaluated exercise, personnel were to SIP to a distance of 1,509 feet;

however, personnel would have been required to SIP to a distance of 3,117 feet if a PAC of 1 rem were used.

- Use of 5 rem as the radioactive material PAC does not ensure appropriate consideration for the consequences associated with radioactive contamination. During the evaluated exercise, the CQT verified that the projected 5 rem dose did not extend beyond the site boundary, prompting the CQT to believe there were no consequences of concern beyond the site boundary. Modeling data indicated the potential for radioactive contamination levels greater than 50,000 disintegrations per minute (dpm)/100 square centimeters (cm^2) beyond the site boundary and contamination levels exceeding the ingestion phase PAG extending to approximately 5 kilometers. Use of a radioactive material PAC of 1 rem would more closely align radiation dose consequences with contamination levels of concern.

Technical Planning Basis Conclusions

Overall, LLNS has not fully established an appropriate technical planning basis for the emergency management hazardous materials program. Consequently, LLNS's use of 5 rem versus 1 rem as the radioactive material PAC does not permit the ERO or offsite authorities to take appropriately conservative actions for the protection of workers and the public.

3.10 Concept of Operations

This portion of the assessment determined whether LLNS has applied the response requirements contained in the DOE Order 151.1D contractor requirements document (CRD) to the ACFD to the extent necessary to ensure compliance.

LLNS has documented its general concept of operations relative to the ACFD response in the LLNL emergency plan based on a fixed-price subcontract with the ACFD for fire department emergency services at LLNL. In addition, the ACFD operates the ACRECC located on site, a fully staffed dispatch facility that is operational 24 hours a day, 7 days a week. The ACRECC is the primary dispatch center for the ACFD (including onsite fire department services at LLNL).

However, LLNS has not appropriately flowed down the response requirements of the CRD to the ACFD. The ACFD subcontract does not require ACFD to abide by the LLNL emergency plan and applicable LLNS response procedures. In addition, the absence of an incident command EPIP and the lack of previous LLNL exercises designed to demonstrate an effective response capability for GEs involving radiological material releases contributed to erroneous decision-making during the exercise. The inadequate flowdown of requirements and an unclear process for obtaining and maintaining situational awareness and disseminating a common operating picture among response components was key to the EOS issues, as previously discussed in section 3.1. Further, the LLNS concept of operations does not reflect that, regardless of the performer of the work (i.e., LLNS or ACFD as its subcontractor), LLNS is responsible to ensure that it and its subcontractors comply with the requirements of the CRD. To the contrary, LLNS inappropriately delegated significant decision-making responsibilities to ACFD without exercising an effective role in the ERO to ensure compliance with requirements.

Consequently, this concept of operations, and the associated weaknesses in flowdown of requirements to ACFD and in LLNS involvement in some ERO decision-making, contributed to several important implementation weaknesses and errors. Examples include (see sections 3.1, 3.4 and 3.5 for additional detail):

- The IC made incorrect decisions regarding termination of protective measures and did not allow for LLNS to integrate consequence assessment (modeling and field monitoring) with PA

decision-making relative to the decision to terminate PAs. Consequently, the CQT did not effectively support development of a common operating picture among response components, and PAs were terminated despite the potential for significant contamination levels in both onsite and offsite areas.

- LLNS did not question the IC's incorrect decision to terminate onsite PAs or provide consequence assessment to support the IC's decisions.

- Like onsite PA decision-making, the IC terminated offsite protective measures and released offsite roadblocks without recommendations or technical assistance from LLNS personnel. Most importantly, the IC did not fully recognize the potential consequences of the radiological incident, which preceded LFO and LLNS not having an accurate understanding based on the IC's size-up of the incident. The lack of situational awareness and understanding of the potential contamination resulted in the CQT not evaluating the incident for potential radiological contamination impacts that could have significantly extended beyond the site boundary and could have required LLNS to issue PARs for the ingestion pathway if it was determined that ingestion pathway PAGs may have been exceeded.

Significantly, the LLNL emergency plan does not describe an effective concept of operations for the role of ACFD in support of LLNS and its ERO. In addition, LLNS has not effectively applied the requirements of the CRD relative to ACFD to the extent necessary to ensure the contractor's compliance with the requirements, including an effective concept of operations for several ACFD emergency response actions, as required by DOE Order 151.1D, att. 1. (See **Finding F-LLNS-4** and **OFI-LLNS-8**.) Consequently, the ACFD's decision-making reflected inadequate planning for LLNL nuclear facilities requiring special response planning and the concept of operations does not reflect the important role of LLNS in ensuring ACFD compliance with requirements.

Concept of Operations Conclusions

Overall, the concept of operations between LLNS and the ACFD inappropriately places responsibility and authority on the IC and does not require LLNS participation in operational emergency decision-making following the implementation of initial preplanned protective measures and activities. LFO agreed with this conclusion during validation. LLNS has not effectively applied the requirements of the CRD relative to ACFD, and the LLNS concept of operations does not ensure that it and its subcontractors comply with the requirements of the CRD. Consequently, the ACFD IC implemented a response strategy inconsistent with the postulated incident. Importantly, the IC's strategy did not consider the extent of potential contamination that coincided with this GE declaration or the potential impacts to offsite populations. Due to a lack of situational awareness and common operating picture, the IC inappropriately terminated both onsite and offsite PAs without determining the safety of the areas through monitoring and collaboration with LLNS.

4.0 BEST PRACTICES

No best practices were identified during this assessment.

5.0 FINDINGS

Findings are deficiencies that warrant a high level of attention from management. If left uncorrected, findings could adversely affect the DOE mission, the environment, the safety or health of workers and the public, or national security. DOE line management and/or contractor organizations must develop and implement corrective action plans for findings. Cognizant DOE managers must use site- and program-specific issues management processes and systems developed in accordance with DOE Order 226.1, *Implementation of Department of Energy Oversight Policy*, to manage the corrective actions and track them to completion.

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Finding F-LLNS-1: LLNS did not consistently demonstrate an effective EOS during the exercise that obtained and maintained situational awareness and disseminated a common operating picture among response components and external partners. (DOE Order 151.1D, att. 3, par. 4.b)

Finding F-LLNS-2: LLNS has not fully defined the process for lifting or adjusting PAs after they have been implemented; LLNS consequence assessment was not integrated with PA decision-making; and LLNS has not developed an effective process to issue all PAs. (DOE Order 151.1D, att. 3, par. 9.b and att. 4, pars. 9.c and 10.a)

Finding F-LLNS-3: LLNS has not developed a technical planning basis that appropriately uses the PAGs promulgated by the EPA for radioactive material releases. (DOE Order 151.1D, att. 4, par. 2.d(3)(a))

Finding F-LLNS-4: LLNS has not effectively applied the requirements of the CRD relative to ACFD to the extent necessary to ensure LLNS compliance with the requirements, including an effective concept of operations for several ACFD emergency response actions, which resulted in incorrect decision-making by the ACFD IC and LLNS during the exercise and reflects inadequate planning for LLNL nuclear facilities requiring special response planning. (DOE Order 151.1D, att. 1)

6.0 DEFICIENCIES

Deficiencies are inadequacies in the implementation of an applicable requirement or standard. Deficiencies that did not meet the criteria for findings are listed below, with the expectation from DOE Order 227.1A for site managers to apply their local issues management processes for resolution.

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Deficiency D-LLNS-1: LLNS did not provide follow-up notifications when incident conditions changed. (DOE Order 151.1D, att. 3, par. 11)

7.0 OPPORTUNITIES FOR IMPROVEMENT

EA identified eight OFIs to assist cognizant managers in improving programs and operations. While OFIs may identify potential solutions to findings and deficiencies identified in assessment reports, they may also address other conditions observed during the assessment process. These OFIs are offered only as recommendations for line management consideration; they do not require formal resolution by management through a corrective action process and are not intended to be prescriptive or mandatory.

Rather, they are suggestions that may assist site management in implementing best practices or provide potential solutions to issues identified during the assessment.

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OFI-LLNS-1: To improve interoperability among the LLNL field responders and ERO, consider implementing the following:

- Analyzing the field and ERO information flow dynamics to define the critical paths of key information and to identify expected actions for achieving and maintaining situational awareness among all teams.
- Adapting an information flow structure that assigns specific responsibility for each key information set, including responsibility for verifying and validating essential incident information collected in the emergency information system (COPS or its replacement) and other response records.
- Incorporating detailed guidance and direction for information management in the emergency plan, implementing procedures, and response checklists.
- Ensuring that the information flow structure provides verification and validation of essential incident information for all onsite response teams, including the EOC, DOCs, TOC, JIC, and ICP.
- Providing unclassified emergency information system access to offsite EOCs (local, state, and DOE Headquarters) to provide a full common operating picture of the emergency response and shared situational awareness, including information such as notification forms, emergency status updates, plume projections, significant incident data, and field monitoring data.
- Adding other response tools to the emergency information system, such as the National Nuclear Security Administration Production Office's automated damage assessment process that incorporates prioritized damage assessment analyses and mapping to assist the ERO in effectively using available resources.

OFI-LLNS-2: Consider improving notification and communication practices by:

- Ensuring that the information contained in the initial ENF provided to stakeholders is consistent between the emailed and faxed forms by printing and faxing the initial ENF that was emailed rather than completing two separate forms.
- Ensuring that GIS maps are developed for all EOC activations by revising the EOC mapping specialist checklist to specify that incident maps showing items of interest (e.g., the location of incident command) are required to be developed and posted into COPS.
- Developing a routine testing and maintenance procedure for critical notification and communication systems.

OFI-LLNS-3: To improve PA implementation and integration of consequence assessment with PA decision-making at the ICPs, consider developing an EPIP that includes:

- The process for releasing PAs prior to the EOC becoming operational.
- The PA requirements for initial responders, including facility personnel used for access control, that define habitability, monitoring, and personal protective equipment requirements.
- The role of the incident support team liaison to stay with the IC to provide input on ES&H considerations related to the response hazard and response plan development.

- The process for PFD support in implementing offsite PAs at the direction of the IC with the agreement of offsite authorities.
- The inside locations for evacuees when other site workers are directed to SIP.

OFI-LLNS-4: To ensure that consistent and conservative PAR information is provided to the IC and offsite agencies, consider defining and documenting the interface between the EMDO and IC relative to notification and verification of EAL predetermined PARs.

OFI-LLNS-5: To achieve a more consistent and complete consequence assessment that supports dissemination of a common operating picture among response components, consider revising the consequence assessment procedure by:

- Adding instructions for the CQT lead to brief the EOC cadre on all posted plume plots and the content of briefings, such as model capabilities, limits, and product information.
- Adding instructions on the preparation and briefing of both dose and deposition plots for releases involving radioactive material.
- Adding instructions on the plume model information provided to the FMT coordinator for use in determining the scope and scale of field monitoring activities.
- Adding instructions for determining when ingestion pathway PAGs may be exceeded and associated actions.

OFI-LLNS-6: To improve the validation of coordinated response requiring the implementation of offsite protective actions by surrounding populations, consider formally offering offsite response organizations the opportunity to participate in an exercise every three years.

OFI-LLNS-7: Consider revising procedures to ensure that hotwashes are conducted at all venues to allow player input into the exercise evaluation process.

OFI-LLNS-8: To improve the emergency response concept of operations between LLNS and ACFD, consider the following:

- Ensuring the contractual flowdown of DOE Order 151.1D requirements to the ACFD to the extent necessary to ensure the subcontractor's compliance with the requirements.
- Revising the LLNL emergency plan to clearly describe and document the concept of operations implemented by LFO, LLNS, the ACFD, and offsite agencies using California's *Standardized Emergency Management System* structure and requirements of DOE Order 151.1D applicable to each organization.
- Defining the functions, responsibilities, and authorities between the ACFD and LLNS ERO teams to ensure jurisdictional boundaries and areas of potential overlap.
- Developing a comprehensive command and control procedure approved by both LLNS and ACFD to implement the integrated concept of operations written in the emergency plan.
- Requiring a general concept of operations that restricts the ACFD IC, as an initial responder, from modifying or terminating the predetermined PAs developed by LLNS unless there is convincing evidence that they are inadequate, or without the approval of LLNS.

- Establishing formal methods of communication and protocols to facilitate the flow of decision-making information to the city and county EOCs, requiring LLNS participation in decision-making following the implementation of initial preplanned protective measures and activities.
- Developing a coordinated plan or protocol that implements an integrated response among LLNS, the ACFD, and the city of Livermore to a hazardous material event at LLNL that results in a GE declaration.

Appendix A
Supplemental Information

Dates of Assessment

Onsite Assessment: August 2-4, August 16-18, September 13-15, 2022

Office of Enterprise Assessments (EA) Management

John E. Dupuy, Director, Office of Enterprise Assessments
William F. West, Deputy Director, Office of Enterprise Assessments
Kevin G. Kilp, Director, Office of Environment, Safety and Health Assessments
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Kevin M. Witt, Director, Office of Nuclear Safety and Environmental Assessments
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