Office of Enterprise Assessments
Office of Emergency Management Assessments
2016 Best Practices and Lessons Learned

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Acronyms

CAT	Consequence Assessment Team
CNS	Consolidated Nuclear Security, LLC
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U.S. Department of Energy
EA	Office of Enterprise Assessments
EAL	Emergency Action Level
EEG	Exercise Evaluation Guide
EM	Office of Environmental Management
EMInS	Emergency Management Information System
EOC	Emergency Operations Center
EPHA	Emergency Planning Hazards Assessment
ERO	Emergency Response Organization
HAZMAT	Hazardous Material
ICP	Incident Command Post
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC
LLNL	Lawrence Livermore National Laboratory
LSPT	Limited-Scope Performance Test
NNSA	National Nuclear Security Administration
NNSS	Nevada National Security Site
NPE	Natural Phenomena Events
PAC	Protective Action Criteria
PAR	Protective Action Recommendation
RAP	Radiological Assistance Program
TEL	Threshold for Early Lethality
Y-12	Y-12 National Security Complex

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EXECUTIVE SUMMARY

The Office of Emergency Management Assessments, within the Office of Enterprise Assessments (EA), evaluates specific areas of interest related to emergency management capabilities at U.S. Department of Energy (DOE) facilities. This report provides an overview of the six EA emergency management assessments conducted in 2016, including an analysis of observed conditions as compared to DOE requirements. The report provides best practices, lessons learned, and recommendations to DOE line management for improving the effectiveness of emergency management programs.

Revised DOE Order 151.1D, *Comprehensive Emergency Management System*, issued August 11, 2016, requires emergency management programs to be in full compliance within one year of the issuance date. This period of transition provides an opportunity for DOE line managers and contractors to consider the application of the past four years of best practices and lessons learned to enhance program effectiveness. Therefore, in addition to information identified in 2016, this report includes the previously-identified best practices and lessons learned from EA assessments in 2013 through 2015. EA provides this information to help line management understand the current state of DOE's emergency management readiness and offer insights for consideration when evaluating their sites' emergency management programs.

During 2016, EA focused on emergency management program elements that included the technical planning basis, readiness assurance, exercises, and plans and procedures. EA also evaluated the effectiveness of response elements via exercises and limited-scope performance tests. In most cases, site programs are established with the appropriate technical basis and emergency plans, implementing procedures and readiness assurance programs are in place, and mechanisms are capable of activating emergency response. Although most programmatic elements comply with DOE requirements, improvements are frequently warranted to increase the effectiveness of the programs.

In 2016, EA identified three best practices. The Nevada National Security Site and Waste Isolation Pilot Plant used an outside risk communication team (referred to as "mock media") to help identify improvements in emergency public information systems. At the Hanford Site, a corrective action associated with an emergency generator included an extent-of-condition review that led to sitewide improvements. The DOE field element and the managing contractor evaluated the applicability of the 2015 EA lessons-learned report at both the Pantex Plant and the Y-12 National Security Complex. As a result, lessons learned were incorporated into the annual emergency response organization refresher training at the Pantex Plant, and the Y-12 National Security Complex included the Area Mapping System in its exercise evaluation guide and technical basis documentation.

EA also developed eight lessons learned in the following three topical areas, based on issues identified in 2016 assessments:

Hazardous Materials Program Technical Planning Basis: EA identified one lesson learned in the area of the hazardous materials program technical planning basis. Emergency action level protective actions are intended to be consistent with calculated emergency planning hazards assessment determinations. At one site, the emergency action level procedures did not accurately incorporate information on the calculated distance for protective action criteria and threshold for early lethality. Inaccurate representation of this distance may result in field responders and sheltered employees being exposed to concentrations of airborne hazardous materials that could pose serious health effects.

Emergency Response Performance: EA identified three lessons learned in emergency response performance at some sites during exercises. The first lesson learned was the result of some sites incorrectly categorizing events, taking too long to make notifications, and incorrectly determining protective action recommendations. Improper classification of an event can result in inappropriate emergency response activities and incorrect protective action recommendations. Another lesson learned identified during exercises was the ineffective integration of the consequence assessment team (CAT) into emergency response activities and the inconsistent use of CAT products. The CAT teams need current and correct information in order to provide accurate analyses, and the emergency response organization needs the CAT products to make informed decisions for protecting responders and personnel. The third lesson learned in this area was that some sites did not demonstrate situational awareness because of poor communications and inadequate use of information management tools. The absence of a common operating picture may result in ineffective command and control of an event and decisions based on incomplete or inaccurate information.

Emergency Preparedness: EA identified four lessons learned in the area of emergency preparedness. First, a full-scale exercise at one site did not demonstrate the integrated emergency response capability or demonstrate protective actions. The restricted scope of the exercise was a missed opportunity for the site to implement, analyze, and evaluate response plans and procedures to improve the emergency management program. Second, during exercises, responders at some sites did not refer to procedures, and the response procedures were not always available, accurate, or complete. The absence of or reluctance to use standard operating procedures and checklists can result in inconsistent or incorrect response. Third, there continues to be inadequate corrective action implementation effectiveness, resulting in recurring issues and delays in program improvement. Fourth, some field element oversight of contractors was not comprehensive to improve the emergency management program. Continued weaknesses in site contractors' readiness assurance (evaluation and assessment, issues management, and corrective actions) for emergency management suggest programmatic weaknesses in the effectiveness of field element oversight.

EA also developed recommendations for each of the eight lessons learned identified in 2016 to aid in improving aspects of site emergency management programs. Key among these are:

- Site contractors should conduct a management assessment focused on the implementation of the corrective action process for emergency management issues to determine what improvements are needed to ensure that identified weaknesses are effectively addressed. The effectiveness review processes should include validation during exercises that corrective actions adequately address the original issue.

- Field elements need to focus oversight activities, including assessments of the contractor's readiness assurance program and review of contractor's self-assessments, on areas of weak performance until improvement is demonstrated. By sampling identified issues, field elements can confirm that the contractors' corrective actions are rigorously developed, implemented, verified, and validated and include extent-of-condition reviews when appropriate. Also, establishing and communicating performance expectations to contractors through formal contract mechanisms will allow field elements to hold contractors accountable for implementing an effective emergency management corrective action program.

Lessons learned identified by EA in other recent years covered several areas, including inconsistent rigor in technical planning among site hazardous material programs, the ability to issue timely and appropriate protective actions as a critical element of an effective emergency management program, and inconsistent technical planning bases that do not always identify a complete or accurate set of predicted exposures for

the analyzed scenarios postulating a hazardous material release. As noted in 2016, some sites continue to exhibit performance weaknesses during emergency management exercises. Previously, and again in 2016, EA also identified weaknesses in additional areas, including emergency response personnel not demonstrating proficiency or not using available tools to promote accurate and timely event classification, and CATs not adequately using modeling tools to confirm the accuracy and appropriateness of initial protective action decisions. At several sites, inadequate communications among response components degraded situational awareness among site personnel and responders, DOE Headquarters, and offsite response organizations. Because the 2016 lessons learned for three areas in the emergency response and preparedness elements were also identified in 2014 and 2015, EA recommends that line management review these previously identified lessons and associated recommendations to consider whether additional actions are warranted for their programs.

EA will continue to annually report best practices and lessons learned identified during independent assessments of emergency management programs. In addition, as line management makes programmatic changes to address the new requirements of DOE Order 151.1D, EA will assess those changes, their implementation, and the sites' success in applying lessons learned to improve program performance in common recurring areas of weakness.

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1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Enterprise Assessments (EA) oversight program is designed to enhance DOE safety and security programs by providing the Secretary and Deputy Secretary of Energy, Under Secretaries of Energy, other DOE managers, contractor managers, Congress, and other stakeholders with an independent evaluation of the adequacy of DOE policy and requirements and the effectiveness of DOE and contractor line management performance and risk management in safety and security and other critical functions as directed by the Secretary. The DOE independent oversight program is described in and governed by DOE Order 227.1A, *Independent Oversight Program*, and EA implements the program through a comprehensive set of internal protocols, operating practices, assessment guides, and process guides.

The Office of Emergency Management Assessments, within EA, evaluates specific areas of interest related to emergency management capabilities at DOE facilities. This report is based on EA emergency management assessments conducted in 2016, including an analysis of observed conditions against the requirements in DOE Order 151.1C, *Comprehensive Emergency Management System*. The issuance of revised DOE Order 151.1D, *Comprehensive Emergency Management System*, on August 11, 2016, requires that changes to emergency management programs be in full compliance with this order within one year of the issuance date. This period of transition to new requirements presents an opportunity for DOE line managers and contractors to review and incorporate best practices and lessons learned into site programs. To support this opportunity, the report also refers to EA reports from 2013 to 2015 on emergency management best practices and lessons learned for line management's consideration in improving program or management effectiveness.

1.1 Report Scope

This report draws on the six EA assessments during 2016 at DOE and National Nuclear Security Administration (NNSA) sites that meet DOE Order 151.1C requirements for having an Operational Emergency hazardous material (HAZMAT) program and activities associated with the implementation plans to address Defense Nuclear Facilities Safety Board (DNFSB) recommendations related to emergency management. Table 1 lists the sites, the responsible program office for Federal oversight, the type of EA assessment, and exercise scenario information if applicable.

In addition, the scope of this report includes reference to applicable, previously identified best practices and lessons learned from EA assessments from 2012 to 2015, summarized in Appendices B and C of this report. EA's lessons-learned and site-specific reports documenting its activities and conclusions are available at https://www.energy.gov/ea/services/assessments/environment-safety-and-health-assessments.

Table 1 – Sites Assessed During 2016

Site	Program Office	Assessment Type	Exercise Scenario Synopsis
Hanford Site	Office of Environmental Management (EM)	Review of readiness assurance, training, and drills (emergency management program elements)	Not Applicable
Lawrence Livermore National Laboratory	NNSA	Limited-scope performance tests	Tritium release from a facility and transuranic waste release from a waste storage area with offsite consequences
Nevada National Security Site	NNSA	Full-scale exercise	Severe weather flooding with potential release from the hazardous waste storage facility and the radiological waste management complex
Waste Isolation Pilot Plant	EM	Full-scale exercise	Release of transuranic waste with offsite consequences
Waste Isolation Pilot Plant	EM	Review of technical planning basis	Not Applicable
Pantex Plant	NNSA	Focus on selected actions taken as part of the implementation plan in response to DNFSB Recommendation 2015-1	Not Applicable

1.2 Requirements and Guidance

EA conducts its assessments in accordance with DOE Order 227.1A and DOE Order 226.1B, *Implementation of DOE Oversight Policy*. This report is created under the authority of DOE Order 226.1B, which directs EA to distribute lessons learned resulting from independent oversight appraisals and/or corrective actions as part of the Department's corporate operating experience program. EA used DOE Order 151.1C as the basis for the emergency management program assessments because it identifies emergency preparedness and response requirements for DOE and NNSA sites and references an associated set of emergency management guides with implementing guidance. EA also considered relevant answers to frequently asked questions about the order developed by the NNSA Associate Administrator for Emergency Operations, Office of Plans and Policy. When EA evaluated a site's exercise or limited-scope performance test (LSPT), EA also used the site's exercise criteria, usually based on the site's procedures for implementing emergency plans.

2.0 BEST PRACTICES

A best practice is a safety- or security-related practice, technique, process, or program attribute observed during an appraisal that may merit consideration by other DOE and contractor organizations for implementation because it: (1) has been demonstrated to substantially improve the safety or security performance of a DOE operation; (2) represents or contributes to superior performance (beyond compliance); (3) solves a problem or reduces the risk of a condition or practice that affects multiple DOE sites or programs; or (4) provides an innovative approach or method to improve effectiveness or efficiency. During the 2016 assessments, EA identified three best practices, discussed below. Other DOE and NNSA sites should consider gathering additional information about these practices and evaluating their potential to benefit to the site's emergency management program. EA recognizes that its activities involved a sample of DOE sites and that other sites may also have effective, innovative approaches. Previous EA lessons-learned reports identified an additional 18 best practices, which are summarized in Appendix B. During 2016, EA observed sites implementing some of these previous best practices, such as using Exercise Builder software, the Emergency Management Information System (EMInS), and a site drill and exercise committee. Line Managers are encouraged to contact the identified sites directly for further information.

2.1 Risk Communications Evaluation Using "Mock Media"

During exercises, the Nevada National Security Site and the Waste Isolation Pilot Plant use an outside risk communication team to help identify improvements in emergency public information systems. The outside cadre of experienced public affairs professionals, referred to as the "mock media," simulate news media and social media coverage. Working both on site and virtually, the mock media develops newscasts, produces narrative videos, and postulates rumors through social media injects, thereby giving the exercise participants a realistic decision-making environment. The mock media also makes phone calls, conducts live on-camera interviews, and participates in news conferences and briefings. Throughout the planning process, a mock media representative works closely with the exercise director to ensure that all activities are properly coordinated. The use of professional, external resources is especially helpful in generating the exercise realism that is essential in improving effectiveness and efficiency for the senior emergency management officials and within the joint information center.

2.2 Extent-of-Condition Review in Response to Finding Regarding Emergency Generator

During EA's 2013 review of the Hanford Site's state of preparedness for severe events, EA identified a finding that the Patrol Operations Center generator had not been tested and maintained as a level-2 system, as required by National Fire Protection Association 72, *National Fire Alarm and Signaling Code*, for a system that provides power to an operator-staffed supervisory station. During 2016, EA confirmed that Hanford's corrective actions included issuing a procedure to evaluate backup power systems; performing evaluations; and performing a sitewide extent-of-condition review. That review identified 17 generators throughout the site that also needed evaluation, demonstrating the value of an approach to corrective action causal analysis that looks beyond addressing a single non-compliance. Extent-of-condition reviews are an effective element of causal analysis and a site-specific requirement of corrective action programs. EA highlights this action as a best practice to remind all DOE sites of the value of implementing an extent-of-condition review.

2.3 Effective Use of Lessons-Learned Report

The DOE field element required the managing contractor at Pantex and the Y-12 National Security Complex (Y-12) to complete a review of EA's 2015 emergency management lessons-learned report, evaluating whether the lessons learned were applicable and determining whether the sites needed to take

any additional action. The comprehensive review specifically addressed each of the nine lessons learned and their associated recommendations for applicability to both the Pantex Plant and the Y-12. Because of that review, new opportunities for improvement were generated for Pantex in the areas of conducting effectiveness reviews for corrective actions and incorporating lessons learned in annual emergency response organization (ERO) refresher training. New opportunities for improvement for Y-12 involved including information on the Y-12 Area Mapping System in the exercise evaluation guide and the technical basis documentation.

3.0 LESSONS LEARNED ANALYSIS

EA identified eight lessons learned from the assessments of emergency management programs in 2016. The underlying causal factors do not necessarily apply to all DOE sites, and many sites have developed and implemented actions to address similar observations at their sites. Nevertheless, the lessons learned and recommendations presented here provide additional insights into potential improvements at all sites. DOE and NNSA organizations and site contractors should evaluate how the following lessons learned and recommendations may apply to their operations and consider using them, as appropriate, in accordance with site-specific program objectives.

3.1 Hazardous Materials Program Technical Planning Basis

Lessons Learned Statement: Emergency action level (EAL) protective actions at one site are inconsistent with calculated emergency planning hazards assessment (EPHA) determinations, which could result in field responders and sheltered employees being exposed to HAZMAT.

Discussion: DOE Order 151.1C requires facilities, operations, and activities involved in producing, processing, handling, storing, or transporting HAZMAT to develop an Operational Emergency HAZMAT program. A key component of this program is the identification of the affected HAZMAT and the assessment of the consequences of an unplanned release or loss of control of that material, resulting in an EPHA. DOE Guide 151.1-2, *Technical Planning Basis*, describes accepted assessment techniques and recommends the use of quantitative analyses, both to determine exposures at specific receptors of interest (i.e., facility boundary, onsite receptor locations, site boundary, and offsite locations of interest) and to determine the maximum distance from release points at which exposures could exceed the applicable protective action criteria (PAC). The projected dose value for initiating protective actions, such as evacuation or sheltering, is 1 to 5 rem for a radiological release. Site personnel then use the results of these calculations to establish the areas where PAC may be exceeded, to serve as the basis for emergency classifications and the emergency planning zone, and (along with additional information) to determine the appropriate protective actions for personnel in areas that may have undesirable concentrations of airborne HAZMAT. The threshold for early lethality (TEL) applies to the general population and is intended to approximate the level of dose or exposure at which the sensitive groups within any large population would begin to show an increase in mortality. For radioactive releases, the TEL is a projected dose of about 100 rem.

At one site, EA observed that some EAL isolation zone distances did not reflect the EPHA's calculations of distance to TEL, and some results of calculations for distance to PAC and distance to TEL were transposed in the EPHA. Protective actions did not reflect the distance to TEL values calculated in the EPHA for fire scenarios involving tritium and for uranium releases associated with toxicological consequence calculations. In some tritium fire calculations, distance to TEL exceeded distance to PAC in the EPHA tables, and no explanation was provided for this unusual occurrence.

Analysis: DOE Guide 151.1-2 states that the results of EPHA consequence calculations are intended to be used directly to determine initial, pre-planned (default) onsite protective actions and offsite protective action recommendations (PARs) that are specific to each analyzed condition and EAL. As noted at one site, an inaccurate representation of the distance to PAC and TEL in the EAL may result in field responders and sheltered employees being exposed to airborne HAZMAT concentrations that could pose serious health effects.

Recommendation: Contractors and field elements should focus review activities to ensure EAL consistency with the EPHA determinations.

Contractors should consider the following actions:

- For self-assessments activities, include a review of consistency of EAL protective actions with the EPHA.
- Review all EPHA consequence assessment data tables to verify that the correct distance to PAC and distance to TEL are properly tabulated.
- Add a quality review of the EALs during periodic reviews to verify that the distance to TEL and PAC used in the EAL are the same as the EPHA results.

Field elements should consider the following actions:

- Focus line oversight activities to include a review of EAL protective action determinations.
- Review contractors' actions to ensure that the EALs and the EPHA are thorough, accurate, and comprehensive and that the EALs appropriately address PAC and TEL.

See Section 3.3 of this report for additional recommendations for improving field element oversight of emergency preparedness.

3.2 Emergency Response Performance

Lessons Learned Statement: During exercises, some sites did not correctly categorize the event, make timely notifications, or correctly determine PARs.

Discussion: DOE Order 151.1C states that events involving the actual or potential airborne release of (or loss of control over) HAZMAT from an onsite facility or activity require prompt and accurate classification as an Alert, Site Area Emergency, or General Emergency. Initial emergency notifications must be made promptly, accurately, and effectively to workers and emergency response personnel/organizations, appropriate DOE and NNSA elements, and other Federal, Tribal, state, and local organizations and authorities. DOE and NNSA facilities must notify state and local officials and the field element emergency operations center (EOC) and Headquarters Operations Center within 15 minutes and all other organizations within 30 minutes of the declaration of an Alert, Site Area Emergency, or General Emergency.

During 2016, EA observed issues in event classification at each of the three sites that conducted full-scale exercises or LSPTs. Neither of the sites that conducted a full-scale exercise met the 15-minute requirement for event classification, and one categorization was inaccurate. The site that conducted the LSPTs fared better, but one of the four LSPTs did not meet the 15-minute requirement for classification.

In one performance test the site staff had difficultly using the classification procedure, and the procedure itself needed more specific guidance on determining protective actions. Additionally, the PARs were incorrectly determined, or state and local officials were not notified within the required time at each of the sites. At one site, PARs were not issued until approximately one hour after the declaration of a General Emergency.

Analysis: Proper classification of an event and the subsequent determination of and notifications about the protective actions are two of the most important fundamental aspects of managing an emergency. EALs are a decision-making tool for quickly determining and conveying the seriousness of the emergency to workers, emergency responders, and other agencies and organizations. Proper event classification also leads to the appropriate choice of pre-determined protective actions that state and local officials should implement. Sites should emphasize the importance of these two activities during training and drills. When incorrect event classifications are observed, additional training in event classification training and communication of protective actions should be a priority in training programs.

Recommendation: Field elements and contractors should emphasize the importance of emergency classification and notification of protective actions and PARs. The following actions should be considered:

- Reinforce in training, drills, and exercises that initial categorization/classification must be made within 15 minutes and that initial notifications must be made within 30 minutes. Initial notifications are intended to include a description of the emergency; classification and categorization; date and time; casualties, injuries, and damage; and protective actions taken and/or recommended. Consider developing a template for notifications, and practice the determination of initial categorization/classification and the development of initial notifications as a performance-based aspect of training, qualification, and ongoing competency.

- Classification procedures should clearly specify levels (i.e., Alert, Site Area Emergency, and General Emergency) associated with any significant changes in the amount of HAZMAT.

- Include more focus on clarifying EALs during self-assessment and line oversight activities. Establish facility-specific protective actions and define vague terms, such as "immediate affected areas" and "nearby facility." Incorporate a discretionary EAL for an Operational Emergency Not Requiring Classification to provide flexibility when time-urgent decision-making identifies the potential need for additional support.

Lessons Learned Statement: During exercises, some sites did not fully integrate the consequence assessment team (CAT) into the emergency response or appropriately use the CAT products.

Discussion: DOE Order 151.1C requires assessing the potential or actual onsite and offsite consequences of an emergency. The order further states that consequence assessments must be timely throughout an emergency; integrated into the event classification and protective action processes; and coordinated with Federal, Tribal, state, and local offsite organizations. During two exercises, EA observed that the ERO did not always use consequence assessment results to make important decisions. During one site exercise, the ERO's decision-making did not use the plume projection data, which indicated that the incident command post (ICP) was located in an area that would exceed protective action limits for field responders. The ERO did not question the ICP location, and the CAT neither reconciled the discrepancies between plume projections and protective actions for field responders, nor briefed the EOC cadre on the projected consequences when different models projected significantly different results. At another site

exercise, the initial CAT assessment was delayed 2 hours and 15 minutes because the ERO did not inform the CAT of changing conditions, and even when the information did reach the CAT, it was incomplete.

Analysis: Although training and drill programs provide opportunities for the CAT to practice developing plume models, these programs do not always demonstrate why successful completion of all consequence assessment tasks is critical to the overall effective performance of the ERO. CATs do not always receive critical feedback during drills and exercises to correct performance issues. Thus, they may continue to provide the ERO with inadequate information for protecting the on-scene and nearby facility personnel and may be unable to recognize when protective actions are excessive for the postulated release. In addition, EROs do not fully integrate the CAT into the response. Training and drill programs are required to incorporate the full ERO team, including the CAT, so that the ERO can fully realize the integration and teamwork needed to respond during an actual emergency. EA noted similar lessons learned in 2014 and 2015 when CATs did not fully use the available modeling tools, successfully communicate the assessment results, or confirm that the initial protective actions were accurate, appropriate, and conservative.

Recommendation: Field elements and contractors should improve the integration of CAT assessments and the use of these assessments in key ERO decisions. Consider the following actions:

- Line management should communicate and emphasize, to the CAT team and the ERO cadre, the importance of CAT products in the overall emergency response.

- Emphasize consequence assessment in drills and refresher training by communicating the purpose and use of the consequence assessment products. Include exercise objectives and detailed evaluation criteria for CATs during exercises. Evaluation criteria should include:

    - The initial assessment should be completed within the required time to ensure that personnel can take timely protective actions.

    - Plume plots should clearly indicate the PAC and TEL concentration, dose areas of concern and concentrations, and doses at key receptor points to aid in protective action decision-making for workers and first responders.

    - The EOC staff should confirm the projected dose concentrations triggering protective actions and ensure that the ICP and staging area for offsite assets are in safe locations for unprotected personnel based on 360 degrees around the point of release.

    - The EOC staff should provide the incident commander with evacuation and/or shelter-in-place distances corresponding to PAC distances for all receptors of interest identified in the EPHA.

    - Real-time meteorological plume projections should be developed for all HAZMAT releases to determine event-specific estimates of the consequences.

- Consider the 2014 and 2015 EA lessons-learned recommendations. (See Appendix C of this report.)

Lessons Learned Statement: During exercises, some sites do not demonstrate continuous, effective, and accurate communications and do not effectively use information management tools among response components, leading to inadequately shared situational awareness among the site, DOE and NNSA Headquarters, and offsite organizations.

Discussion: DOE Order 151.1C requires contractors to provide effective communications among response organizations throughout an emergency and establish effective methods of communication among event scene responders, emergency managers, and response facilities. Additionally, effective implementation of the National Incident Management System requires communication within the ERO to provide a common operating picture of the emergency response and shared situational awareness among all teams. During the 2016 exercises and LSPTs that EA evaluated, responders frequently had inadequate communications and ineffective information flow processes for acquiring, recording, and disseminating timely and accurate event information among the ERO and offsite response organizations. Emergency planners did not define the information flow processes among command centers and field responders by documenting the responsibilities for collecting information and distributing validated information. Additionally, incident management tools did not enable the ERO to share important event information among the command centers and field responders. Although most sites have WebEOC as their incident management tool, only one site used the program effectively. At another site, the ERO entered only some significant event and status information into the tool instead of using the tool to capture, distribute, and assess all relevant emergency information among the entire ERO. Other significant communication and information management issues noted during exercises at individual sites include:

- Status boards and position logs were not fully utilized. The EOC cadre made minimal entries on the WebEOC significant event, position log, and mission/task assignment boards and did not capture or share the results of the verbal discussions and decisions. Inventory and map information received at the ICP was not shared on WebEOC, so the information took 2 hours and 15 minutes to reach the CAT for assessment. Local and state EOCs, as well as DOE Headquarters EOCs, did not have access to the WebEOC event.

- Numerous inoperable EOC computers and displays kept the ERO from accessing the EOC information management system.

- Some EOC staff were slow to develop information about the situation and consequence assessments to support the Emergency Director's decision-making, unnecessarily delaying EOC/ICP briefings and the declaration that the EOC was operational.

- Inconsistent dispersion model results were not addressed and reconciled with EOC staff members or provided to the incident commanders to identify pre-determined potential exposures.

Analysis: Situational awareness was obscured due to inadequate communication and less than optimal use of information management tools. Responsibilities for collecting specific event information were not clearly assigned, and the information flow processes were not formally defined. Offsite organizations were not provided with access to unclassified emergency response information that was needed for timely and accurate decision-making. Incident management tools, such as WebEOC, were inconsistently used.

These weaknesses contributed to the EROs' lack of a common operating picture of the emergency response and a shared situational awareness among all teams. Specific consequences of this lack of a common operating picture included decisions based on incomplete or inaccurate information, even when that information was readily accessible. Command and control of the event was sometimes ineffective in ensuring a timely and planned response strategy that all command centers understood. Incident commanders were unaware of the potential for radiological doses during the event, so the incident commander did not establish safe operating locations for the ICPs and staging areas. Accurate assessments were delayed because the CAT was unaware of updated inventories.

EA reported similar concerns in 2014 and 2015 lessons learned, noting the absence of a common operating picture and shared situational awareness due to inadequate communications and ineffective use of information management tools.

Recommendation: Field elements and contractors should improve communications and promote a common operating picture of the emergency response. Consider the following actions:

- Formally define the emergency information flow processes between the onsite and offsite response organizations and enable offsite access to unclassified emergency response information, such as notification forms, emergency status updates, plume projections, significant events data, and field monitoring data.

- Install, implement, and provide training and drills on an automated information management system and clearly assign the responsibility for capturing, validating, and disseminating specific event information.

- Perform periodic preventive maintenance and readiness checks on computer and information systems in the EOC.

- Expand and integrate incident management tools with other web-based information systems, including geographical systems, to ensure that ERO personnel have a shared situational awareness.

- Consider the 2014 and 2015 EA lessons-learned recommendations. (See Appendix C of this report.)

3.3 Emergency Preparedness

Lessons Learned Statement: A full-scale exercise at one site did not simulate the release of radiological or HAZMAT, did not require protective actions, had no simulated injured personnel, and required minimum participation by the EOC cadre, CAT, and offsite agencies.

Discussion: DOE Order 151.1C requires a formal exercise program to validate all elements of the emergency management program. Consistent with that purpose, planners should develop exercise plans that will validate the use of response tools, such as the means to identify released HAZMAT, event categorization and classification processes, protective action decision-making, and consequence assessment tasks.

During 2016, EA evaluated two challenging exercises and one less-challenging exercise. One site exercise tested many aspects of an integrated emergency response that allowed the ERO to respond to an Operational Emergency and integrate response activities with DOE Headquarters and local, state, and Federal agencies. Another site conducted two LSPTs, both of which involved a release of radiological material requiring plume modeling by the CAT, the development of both onsite and offsite protective actions, and the treatment of injured personnel. The site effectively conducted the LSPTs by responding to simulated, realistic emergency events and conditions in a manner that replicated an integrated emergency response to an actual event.

A full-scale exercise at another site was scoped to require minimal involvement of the EOC cadre. Also by design, and contrary to the concept of a full-scale exercise, this exercise involved minimal participation by offsite agencies and the EOC CAT, and the scenario did not include any simulated radiological or HAZMAT release necessitating offsite PARs or onsite protective actions. Additionally,

the exercise planning process did not culminate in an exercise plan that guided the ERO toward the desired response or a set of exercise objectives sufficient to evaluate the expected performance.

Analysis: Full-scale exercises are complex, resource-intensive performance tests designed to involve multiple agencies, organizations, and jurisdictions and validate many facets of preparedness. In order to test and demonstrate the integrated emergency response capability, a full-scale exercise involving site-level ERO elements and resources is intended to be conducted annually, use an Operational Emergency scenario, and include a demonstration of protective actions. Nevertheless, not all full-scale exercises took advantage of the opportunity to implement, analyze, and evaluate plans, policies, and procedures. Instead, one exercise had:

- Minimal participation from offsite agencies
- Minimal activities for the EOC cadre and CAT
- No simulated radiological or HAZMAT release requiring onsite protective actions or offsite PARs
- No simulated injured personnel.

Ultimately, the restricted scope of the one evaluated full-scale exercise was a missed opportunity for the site to implement, analyze, and evaluate response plans and procedures to improve the emergency management program.

Recommendation: Field elements should ensure, and contractors should develop, the scope of full-scale exercises to take advantage of all opportunities for improving emergency management. Consider the following actions:

- Ensure that participants are fully engaged and tested and that their performance is evaluated, including their interaction with offsite organizations.

- Exercise a wider range of EOC cadre and CAT responsibilities, and practice determining and implementing onsite protective actions and transmitting offsite PARs.

- Consider routinely evaluating rescue, triage, and treatment of injured personnel.

- Exclude only those exercise objectives not expected to be performed during the exercise.

Lessons Learned Statement: During exercises, responders at some sites did not refer to procedures, and the response procedures were not always available, accurate, or complete.

Discussion: DOE Order 151.1C requires the establishment of an emergency management program that provides centralized collection, validation, analysis, and coordination of information related to an emergency. Furthermore, the order requires the use of standard operating procedures and checklists to establish communications and coordination with the incident command, obtain and maintain situational awareness, and disseminate a common operating picture among response components and external partners.

At one site, EA observed several weaknesses in the implementing documentation, including the absence of guidance for the EOC cadre in effectively using tools and resources to improve situational awareness; inconsistencies in the Senior Federal Official duties and authorities; and ambiguous pre-determined protective actions. Further, the site's emergency public information program manual did not adequately identify who approves public releases. At another site, although representatives were involved in the release of situation reports and news releases, approval mechanisms were inconsistent, and the expected

means of approvals were not procedurally established. EA also observed, at a third site, that the CAT had no guidance for dealing with modeling results that did not agree, selecting release durations and weather data to use as modeling input parameters, determining the application of consequence assessment results, and briefing the EOC cadre on consequence assessment results.

Analysis: Response procedures do not always contain sufficient details on roles and responsibilities or give clear implementing instructions and in some cases do not exist. Responders also do not always refer to procedures, which should contain detailed and useful instructions. Although EA recognizes that procedures cannot exist for all situations, some procedures and guidance should exist for known or expected situations. These procedures and checklists must be reviewed, addressed in training, and used during drills and exercises. If using these decision aids appears to present problems, corrections and suggested improvements must be captured and addressed in the site's corrective action program. Additionally, if ERO members identify the need for a new checklist item or procedure, these comments must also be captured, documented, and implemented.

Recommendation: Field elements and contractors should focus on procedure usability and requirement flowdown during their self-assessments and line oversight activities. Consider the following actions:

- Review response plans, procedures, checklists, and other implementing documents and solicit input from ERO members to ensure that the documents give enough details on roles, responsibilities, and instructions.

- Ensure that response procedures establish appropriate requirements for procedure compliance (e.g., mandatory use of checklists and required data entry into WebEOC) and that ERO members understand them.

- Evaluate and develop new implementing procedures for situations or actions that are known or expected to exist, specifically in the areas of consequence assessment and emergency public information.

Lessons Learned Statement: 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.

Discussion: DOE Order 151.1C requires corrective actions to address issues identified during internal and external evaluations, including exercises, in order to support continuous improvement. The order also states that corrective action plans must be developed within 30 working days and include an independent verification and validation process. DOE Order 226.1B further requires an issues management process that includes, for findings of higher significance, a thorough analysis of causal factors, timely corrective actions that address the cause and prevent recurrence, effectiveness reviews, and maintenance and tracking of the issues. Similarly, the recently issued DOE Order 151.1D now requires the completion of corrective actions for defense nuclear facilities to include a verification and validation process, independent of those who performed the corrective action, to verify that the corrective action has been put in place and to validate that the corrective action has been effective in resolving the original finding.

In 2016, EA followed up on 12 previous findings at three sites. At all sites assessed, the findings were appropriately entered in a corrective action system, some corrective actions were taken, and the sites had

performed verification and validation before closing the items. However, six of the findings at two of the sites were closed without resolving the original issues.

Analysis: Contractors continue to have difficulty preventing recurrence of identified issues. In 2016, all the previous findings that EA reviewed had been assigned corrective actions and tracked to closure, and the closure process included effectiveness reviews. Even so, 50% of these findings had been inappropriately closed, some without resolving the original issues. In other instances, the effectiveness reviews were not rigorous enough or had too narrow a scope. As noted in the 2014 and 2015 EA lessons-learned reports, the corrective actions that contractor personnel develop for some issues identified during assessments and exercises often do not ensure adequate resolution of the issues.

Recommendation: Contractors should consider conducting a management self-assessment of corrective action validation and verification and the effectiveness review process to address significant emergency management program weaknesses. Consider the following actions:

- Review site issues management processes and procedures with respect to the veracity of root cause analysis and the validation and verification of corrective actions. This review should focus on:
    - Ensuring that causal factors are logical and comprehensive, and that corrective actions address all aspects of the causal factors.
    - Evaluating all proposed corrective actions to ensure that they will prevent recurrence of the issue, and clearly specifying the objective evidence required to close the corrective action.
    - Ensuring that corrective actions incorporate measurable activities for validating effectiveness.
- Ensure that the effectiveness review process verifies, through an independent review, that the corrective actions effectively resolved the causal factors and will prevent recurrence. Consider having an independent group, such as the Quality Assurance organization or an independent peer review team, perform the effectiveness review.
- Include in exercise objectives the validation of the effectiveness of corrective actions for significant issues.
- Consider the 2014 and 2015 EA lessons-learned recommendations. (See Appendix C of this report.)

Lessons Learned Statement: Enhanced field element oversight of the contractor's readiness assurance is necessary to improve the emergency management program.

Discussion: A robust contractor readiness assurance program, overseen by the field element, is intended to ensure that issues are self-identified and corrected. DOE Order 151.1C states that the field element provides the first (lowest) level of line management oversight of DOE and NNSA facilities, sites, and activities and is responsible for conducting assessments of facility emergency management programs at least once every three years; reviewing contractor self-assessment programs annually to ensure compliance with DOE directives and policy; and implementing corrective actions and lessons learned based on actual emergency responses and on findings from evaluations, assessments, and appraisals. The field element also annually reports the results of assessments, including a self-assessment, in the Emergency Readiness Assurance Plan.

Under the new DOE Order 151.1D, field element managers are responsible for reviewing and approving site, facility, and activity corrective action plans for external findings identified during evaluations, assessments, drills, exercises, and actual emergencies and, based on site, facility, and activity performance, periodically reviewing corrective action programs for internal findings to ensure programmatic effectiveness.

Analysis: Continued weaknesses in site contractors' readiness assurance (evaluation and assessment, issues management, and corrective actions) for emergency management suggest programmatic weaknesses in the effectiveness of field element oversight. As noted in the 2014 and 2015 EA lessons-learned reports, and again in 2016, some contractor corrective actions have not resolved or prevented recurrence of the identified issues. Repeated concerns have been cited in the areas of delayed emergency classifications, notifications, and PARs; ineffective use of consequence assessments; and need for improvement in emergency response situational awareness among DOE and NNSA Headquarters and offsite organizations and across the site. In addition, the field elements' self-assessments of their oversight programs, as required by DOE Order 226.1B, have not been uniformly effective.

Recommendation: Field elements should consider increased focus on the following during assessments:

- Confirming that the contractor's exercise program validates all elements of the emergency management program over a five-year period; that the annual site-level exercise is designed to test and demonstrate the site's integrated emergency response capability; and that the contractor has implemented an emergency management self-assessment program that effectively identifies problem areas

- The effectiveness of actions to improve areas of weak performance until improvement is demonstrated (including confirmation that the contractor's corrective actions are rigorously developed, implemented, verified, and validated and that extent-of-condition reviews are performed when appropriate)

To improve field element oversight programs, consider:

- Requesting technical support from the program office and/or the Associate Administrator for Emergency Operations to augment field element technical expertise when assessing the contractor's readiness assurance program and EPHAs.

- Including external experts or peers in annual self-assessments.

Appendix A
Supplemental Information

Office of Enterprise Assessments Management

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Appendix B
Previously Identified Best Practices

Office of Enterprise Assessments Lessons Learned from the 2015 Emergency Management Assessments

- **Drill and Exercise Planning.** Consolidated Nuclear Security, LLC (CNS) effectively uses Exercise Builder (a software tool for developing emergency management exercises and drills, sponsored by the U.S. Department of Energy (DOE) Associate Administrator for Emergency Operations, Office of Emergency Plans and Policy) from the start of initial exercise planning, through execution and evaluation of the exercise and completion of the after-action report. Importantly, the pre-loaded Exercise Builder baseline generates the exercise objectives and the exercise evaluation guides (EEGs), including response steps and evaluation checklists and criteria. This approach ensures that each exercise objective has associated evaluation information, such as the stated objective, the applicable evaluation criteria from the emergency management guide, and an evaluator checklist. CNS has also tied the evaluation criteria to the evaluator's checklist, which cites the applicable reference from the CNS plan or procedure in the EEG. CNS updates the EEGs after each change to an emergency management plan or procedure, and the organizations responsible for completing the objective's action statement concur in the EEGs. Overall, this approach has significantly reduced the time required to prepare drill and exercise packages and after-action reports, while also increasing consistency and improving the effectiveness of the drill and exercise process. CNS can now produce comprehensive drill and exercise packages in a matter of hours or days instead of weeks.

- **Drill and Exercise Conduct.** At Y-12, CNS uses a site-level drill and exercise committee to support the CNS exercise coordinator. The committee coordinates the Y-12 drill and exercise schedules with members' organizations, provides input to scenario development, serves as an experienced group of controllers or evaluators familiar with the areas assigned during drills and exercises, and reviews drill and exercise after-action reports for technical and factual accuracy. In addition, committee members facilitate critiques at each venue immediately after a drill or exercise, using a prescribed protocol to foster critical assessments and to gather and document participants' observations. CNS also conducts a formal evaluator and controller debrief after each drill or exercise to determine whether the responders accomplished the individual exercise objectives, based on a synthesis of all observations and information gathered during the activity. By establishing a long-term committee to perform these critical functions, CNS has significantly improved the effectiveness and efficiency of its drill and exercise program.

Office of Enterprise Assessments Lessons Learned from the 2014 Emergency Management Reviews

- **Situational Awareness.** CNS effectively used the Emergency Management Information System (EMInS) at Y-12 to maintain emergency response organization (ERO) situational awareness during its 2014 annual exercise. EMInS linked the site's response facilities with the field responders and fostered interoperability with the offsite emergency operations centers (EOCs) (local, state, and DOE Headquarters) to capture, distribute, and assess emergency information that expedited rapid and accurate decision-making. The site has integrated EMInS with its web-based geographical information system to provide the ERO with maps, data, and analysis tools for the site, the surrounding area, and the interiors of many onsite buildings. Also, the site developed other response tools, such as an automated damage assessment process that incorporates prioritized damage assessment analyses and mapping, to help the ERO use available resources effectively.

Independent Oversight Lessons Learned from the 2013 Targeted Reviews of Emergency Preparedness for Severe Natural Phenomena Events at Selected Department of Energy/ National Nuclear Security Administration Nuclear Facilities

- **Disaster/Self-Help Program.** The Lawrence Livermore National Laboratory (LLNL) disaster/self-help program provides additional resources during a mass casualty incident through the efforts of approximately 150 first-aid trained volunteers located throughout the main site. These volunteers can also perform triage at the assembly points (a unique capability among the sites reviewed), administer first aid (using the first aid kits stored at each assembly point), and transport injured personnel to the onsite medical facility.

- **Employee Notification Systems.** Hanford uses a wide variety of methods to notify employees of an emergency. The Hanford Emergency Alerting System uses six methods to communicate information and protective action instructions to workers (located at the site and in town): (1) outdoor warning sirens, which cover personnel working outdoors in the more densely populated areas of the site; (2) AM radio station, which covers all major site roadways; (3) message boards, which instruct commuters at the site entrances to tune to the AM radio station; (4) pop-up computer messages, which display on all computers connected to the Hanford local area network; (5) telephone notifications, which include all office telephones; and, (6) tone alert radios, which cover remote work locations. Most of these systems can be activated from two locations, at the site and in town. Additionally, duty officers can broadcast emergency information over the two-way commercial radio system used by operations personnel, and building emergency directors can activate facility sirens at their respective locations, if equipped.

- **ERO Activation System Accessibility.** To activate EROs, several sites use communication systems that can be accessed through multiple routes. The systems used at LLNL, Portsmouth Gaseous Diffusion Plant, and the Nevada National Security Site (NNSS) can be accessed from any telephone. The NNSS system can also be accessed via the internet, and the LLNL system can be operated using the remote backup system in Tennessee.

- **Amateur Radio Operators.** Two sites have incorporated licensed amateur radio operators as another means of communication during an emergency. LLNL has a memorandum of agreement with a group of its employees who are licensed amateur radio operators to provide additional radio services at their various onsite ERO venues during an emergency. Within its onsite fire department, Portsmouth Gaseous Diffusion Plant uses licensed amateur radio operators, who have additional radio frequencies programmed into their hand-held radios, as an added radio resource during an emergency.

- **Enhanced Paramedic Capabilities.** NNSS paramedics can directly administer chelation therapy to workers using protocols reviewed by DOE's Radiation Emergency Assistance Center/Training Site and approved by the State of Nevada. This capability allows administration of the chelation drugs as soon as possible after a suspected or known internal contamination, thereby increasing the potential effectiveness of the treatment. NNSS paramedics can also collect forensic samples (blood, hair) after criticality events using approved protocols to help reconstruct the dose received by workers.

Independent Oversight Lessons Learned from the 2012 Targeted Reviews of Emergency Preparedness for Severe Natural Phenomena Events at Selected Department of Energy/National Nuclear Security Administration Nuclear Facilities

- **EOC Occupancy Planning.** Los Alamos National Security, LLC (LANS) has established a 14-day EOC occupancy duration for planning purposes to allow undisrupted management of a long-term event. The Los Alamos National Laboratory (LANL) EOC is equipped with ready-to-eat meals, beds, showers, a kitchen, and a dedicated standby generator and water supply.

- **Structure Integrity.** Savannah River Nuclear Solutions, LLC implements a periodic inspection program to ensure maintenance of Savannah River Site structures for seismic and tornado shelter qualifications.

- **Standby Power Generator Testing.** CNS has a comprehensive generator-testing program at Y-12 that includes periodic testing of fixed and mobile generators, applying the methodologies described in DOE-STD-3003-2000, *Backup Power Sources for DOE Facilities*. Additionally, CNS maintains mobile generators in a state of readiness for cold weather operations.

- **Diesel Fuel Analysis Program.** Savannah River Nuclear Solutions, LLC implements a comprehensive diesel fuel-sampling program at the Savannah River Site to meet industry standards. This program includes fuel analysis upon receipt from the supplier, in bulk storage tanks, on site distribution trucks, and in generator fuel supply tanks.

- **Site Evacuations.** Battelle Energy Alliance, LLC has extensively prepared for implementing site evacuations at the Idaho National Laboratory. Commuter and site buses, operator cross-training as bus drivers, communications, personnel accountability protocols, and staged prophylactics are covered in Battelle Energy Alliance, LLC plans.

- **Communication Systems.** LANS and Babcock & Wilcox Conversion Services, LLC provide EOC cadres with Government Emergency Telecommunications Service cards at LANL and the Paducah Gaseous Diffusion Plant for priority telephone access and Wireless Priority Service accounts that provide priority cellular telephone access during periods of severe network congestion or disruption. Wireless Priority Service proved to be particularly useful at LANL during a wildland fire by allowing users to place cellular telephone calls when the system was overloaded.

  CNS and LANS use protocols that minimize disruption of EOC information management systems when computer patches are distributed on the sitewide network. CNS limits the automatic distribution and installation of sitewide computer patches at Y-12 to a few EMInS workstations for testing. Once testing is complete and any issues are resolved, the patches are then manually installed on the remaining EMInS workstations. Similarly, LANS uses a subnet for the LANL EOC computers that allows computer patches to be installed, but does not cause the computers to automatically reboot. When new patches are installed, the computers are rebooted manually and checked to ensure that they are functioning as intended.

- **Personal Protective Equipment.** Although CNS does not intend for field monitoring technicians to enter a plume or receive an exposure, CNS provides Y-12 teams with respiratory protection in case the teams unexpectedly encounter hazardous material.

- **Decontamination Equipment.** LANS and CNS have portable decontamination equipment that can be rapidly deployed and set up near an incident scene to minimize the spread of contamination and facilitate decontamination of personnel. LANS and CNS use decontamination tent systems equipped with heated water and shower nozzles at LANL and Y-12, respectively. These sites estimate that approximately 20 to 30 people can be decontaminated per hour using these methods. Additionally, the sites ensure the operability of the portable decontamination equipment and maintain proficiency by conducting annual drills.

- **Offsite Monitoring and Integration with National Nuclear Security Administration (NNSA) Assets.** The most mature DOE site relative to planning for offsite monitoring and integration with NNSA assets is Y-12. The site has signed an Agreement in Principle with the State of Tennessee that includes specific requirements for offsite field monitoring and consequence assessment. Thus, the site has implemented a rigorous offsite monitoring capability that integrates its offsite field monitoring team and the Region 2 radiological assistance program (RAP) team to provide a large pool of monitoring personnel. The state has also established a large pool of counterparts from departments within the state government. Initially, the site EOC directs the offsite field monitoring team; however, as state resources become operational, the state EOC director requests the transfer of command and control of the site field monitoring team to the state. Furthermore, the state EOC

director develops a consolidated field monitoring strategy that incorporates all offsite monitoring assets. If the state EOC director determines a need for additional monitoring assets, he/she may request further support from DOE RAP, the state civil support team, and the Environmental Protection Agency. In accordance with state and site procedures, the state requests RAP assistance through the site EOC. Detailed state and site plans, procedures, and instructions are in place to implement the offsite field monitoring process and provide information to state and NNSA decision-makers. The site has validated this capability during numerous exercises with the state, including full-participation exercises involving RAP and the National Atmospheric Release Advisory Center.

- **Response Planning for Wildland Fire Events Beyond the Site's Capabilities.** LANS has a robust planning and preparedness program for wildland fires within the DOE and NNSA complex. These events are an expected occurrence at LANL, and authorization basis documents routinely identify them as a potential initiator of a facility fire and/or a potential threat to the facility or its operations. In the last 60 years, the region has experienced six major wildfires. Thus, LANS has completed significant planning for wildland fires with Federal, state, and county agencies. Most importantly, the Los Alamos field element entered into a joint agreement with the State of New Mexico Forestry Division, the U.S. Forest Service, the U.S. Department of Interior, Bureau of Indian Affairs, Bureau of Land Management, National Park Service, and the U.S. Fish and Wildlife Service for interagency fire protection. In addition, a separate agreement between the State of New Mexico and Los Alamos County further documents the commitment to wildland fire suppression and interagency cooperation. Important aspects of the joint agreement related to LANL include the following:

  - Federal agencies are responsible for wildland fire protection on lands under their jurisdictions.

  - Federal agencies can request National Guard assistance for wildland fires after a declared emergency by the Governor of New Mexico.

  - Due to security restrictions, offsite agencies must obtain permission before responding to a wildland fire on property owned and occupied by LANL.

  - Presidentially-declared emergencies and disasters and other emergencies under the Federal Emergency Management Agency's authority are covered under the joint agreement.

Appendix C
Previously Identified Lessons Learned

The Office of Enterprise Assessments' (EA's) analysis of previous lessons learned found that, in most cases, site programs are established with the appropriate technical basis, emergency plans and implementing procedures are issued, readiness assurance programs are in place, and mechanisms are capable of activating emergency response. Although many of the programmatic elements comply with U.S. Department of Energy (DOE) requirements, improvements were frequently warranted to increase the effectiveness of programs.

EA's lessons learned covered several areas, including inconsistent rigor in technical planning among site hazardous material (HAZMAT) programs, the ability to issue timely and appropriate protective actions as a critical element of an effective emergency management program, and inconsistent technical planning bases that do not always identify a complete or accurate set of predicted exposures for the analyzed scenarios postulating a HAZMAT release. In addition, some sites continue to exhibit performance weaknesses during emergency management exercises. EA also identified weaknesses in several other areas, including emergency response personnel not demonstrating proficiency or not using available tools to promote accurate and timely event classification, and consequence assessment teams (CATs) not adequately using modeling tools to confirm the accuracy and appropriateness of initial protective action decisions. At several sites, inadequate communications among response components degraded situational awareness among site personnel and responders, DOE Headquarters, and offsite response organizations.

EA annually reports best practices and lessons learned identified during independent assessments of emergency management programs. As line management makes programmatic changes to address the new requirements of DOE Order 151.1D, EA will assess those changes, their implementation, and the sites' success in applying lessons learned to improve program performance.

HAZMAT Program Technical Planning Basis

- Analysis methodologies for emergency planning hazards assessments (EPHAs) at some sites result in overly conservative protective actions that can negatively impact the response to an Operational Emergency. (2015)

- EPHAs do not always document the source term information needed to develop emergency action levels (EALs) or to serve as a response reference document. (2014)

- Few DOE or National Nuclear Security Administration (NNSA) sites adequately implement severe natural phenomena events (NPE)-specific EALs that ensure rapid notification and implementation of protective actions and protective action recommendations. (2014)

- Some EPHAs omit predicted exposures at receptors of interest, and CATs do not quickly calculate predicted exposures at receptors of interest after a HAZMAT release. (2014)

- The technical planning basis for sites with lesser hazards is not always well founded, and the preparedness documentation is incomplete. (2014)

- Exercises typically do not include the response to EPHA bounding scenarios, which represent the upper end of the consequence spectrum and require a clear understanding of the interactions with offsite organizations. (2014)

Emergency Response Performance

- During exercises, some emergency responders did not demonstrate the necessary proficiency or use the available response tools to promote effective performance. (2015 and 2014)

- During exercises, some CATs did not fully use the available modeling tools; successfully communicate the assessment results; or confirm that the initial protective actions were accurate, appropriate, and conservative. (2015 and 2014)

- During exercises, some sites did not demonstrate continuous, effective, and accurate communication and use of information management tools among response components, leading to inadequately shared situational awareness among the site, DOE and NNSA Headquarters, and offsite organizations. (2015 and 2014)

- Site emergency response organizations (EROs) rely heavily on an experience-based, rather than process/procedure-based, approach to decision-making for emergency responses, leading to ineffective implementation of the emergency plan based on individual knowledge of a given situation. (2014)

- Site processes are ineffective in identifying and tracking the locations and status of injured people and completing personnel accountability in a timely manner. (2014)

- Emergency planners and responders do not adequately consider exposure times for personnel in a plume when determining whether consequence assessments and modified protective actions are timely. (2014)

Emergency Preparedness

- 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. (2015 and 2014)

- Exercises do not validate all elements of the emergency management program over a five-year period at some sites. (2015)

- Some exercise evaluations do not provide the sites with an effective and reliable assessment of ERO performance. (2015)

- Emergency management personnel at some sites do not share lessons learned within their ERO and with other sites. (2015)

- Line management self-assessments at some sites do not fully evaluate the adequacy of emergency management programs. (2015)

- Site exercise evaluators do not evaluate performance critically. (2014)

- Sites do not always use exercise planning activities effectively to improve the emergency management program. (2014)

- Emergency planners do not provide periodic drills for all workers who may have to take shelter-in-place protective actions. (2014)

- Most DOE and NNSA contractors have incomplete planning for response and short-term recovery activities for a severe NPE. (2013)

- Sites do not require periodic exercises designed to ensure that the ERO can adequately respond to a mass casualty incident. (2013)

- Most of the sites' training and drill programs do not address NPEs affecting multiple facilities, and some sites have not provided adequate EAL training to all ERO personnel. (2013)

Independent Oversight Lessons Learned from the 2013 Targeted Reviews of Emergency Preparedness for Severe Natural Phenomena Events at Selected Department of Energy/ National Nuclear Security Administration Nuclear Facilities

- Few DOE or NNSA sites have adequately evaluated whether command facilities are appropriately equipped to detect airborne HAZMAT that could be released on site and whether air intake filtering capabilities, if needed, are adequate to enable ongoing emergency operations at the command centers.

- Most sites do not fully consider the impact of a severe event on their ability to relocate to alternate command centers or on the habitability of the alternate command centers.

- Backup power sources are often not evaluated by an authority having jurisdiction to establish the required system capabilities and the appropriate test and maintenance program.

- Sites have not complied with applicable National Fire Protection Association codes and standards for ensuring the capabilities and reliability of backup power sources used at operator-staffed supervisory stations.

- Sites have not consistently complied with applicable National Fire Protection Association codes and standards for powering emergency egress lighting. Where known deficiencies existed, some facilities have not provided compensatory measures to ensure adequate illumination for a safe evacuation during loss of power.

- Limitations in the formality and thoroughness of some testing practices diminish the robustness of communication systems.

- Some sites cannot ensure that all workers receive prompt initial emergency notifications, including instructions to take protective actions.

- Few sites have adequately addressed the requirements that consequence assessments must be coordinated with Federal, state, local, and Tribal organizations, and that effective planning for offsite field monitoring capabilities must be implemented to assist state and local governments. Several sites have insufficient offsite response planning that may result in an unclear understanding of the actions expected of each interface agency and the information needed to respond effectively.

- Some sites have little or no onsite capability for potential technical rescue scenarios after a severe NPE and have not completed adequate planning to acquire resources from outside resources.

- Most sites lack documented agreements with air ambulance providers to clarify whether they will transport contaminated injured patients.