Independent Oversight Review of Site Preparedness for Severe Natural Phenomena Events at the Los Alamos National Laboratory

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Acronyms

AEGL	Acute Exposure Guideline Level
BDBE	Beyond Design Basis Event
CDC	Consolidated Dispatch Center
CMR	Chemistry and Metallurgy Research
DEM	Duty Emergency Manager
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
EAL	Emergency Action Level
ECN	Emergency Communications Network
ED	Emergency Director
EDG	Emergency Diesel Generator
EMNRD	Energy, Minerals, and Natural Resources Department
EMS	Emergency Medical Services
EOC	Emergency Operations Center
EOD	Emergency Operations Division
EO-EM	Emergency Operations-Emergency Management
EO-EPP	Emergency Operations-Emergency Planning and Preparedness
EO-ER	Emergency Operations-Emergency Response
EOP	Emergency Operations Plan
EOSC	Emergency Operations Support Center
EPA	Environmental Protection Agency
EPHA	Emergency Planning Hazards Assessment
EPIP	Emergency Plan Implementing Procedure
ERO	Emergency Response Organization
ERPG	Emergency Response Planning Guidelines
ETSC	Emergency Technical Support Center
FERP	Facility Emergency Response Procedure
FIC	Facility Incident Command
FMT	Field Monitoring Team
FY	Fiscal Year
GETS	Government Emergency Telecommunications Service
HAZMAT	Hazardous Material
HSS	Office of Health, Safety and Security
IA	Institutional Agreement
IC	Incident Commander
JPA	Joint Powers Agreement
kV	Kilovolt
kW	Kilowatt
LAFD	Los Alamos Fire Department
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security, LLC
LAPD	Los Alamos Police Department
LASO	Los Alamos Site Office
LLEA	Local Law Enforcement Agency
MAA	Mutual Aid Agreement
MAR	Material at Risk
ML	Management Level
MOU	Memorandum of Understanding

NARAC	National Atmospheric Release Advisory Center
NFPA	National Fire Protection Association
NIMS	National Incident Management System
NNSA	National Nuclear Security Administration
OFI	Opportunity for Improvement
PAC	Protective Action Criteria
PBI	Performance Based Incentive
PF-4	Plutonium Facility – Building 4
PPE	Personal Protective Equipment
RAP	Radiological Assistance Program
SCBA	Self-Contained Breathing Apparatus
SOC	SOC, Inc.
SWANS	Site Wide Area Notification System
TA	Technical Area
TEEL	Temporary Emergency Exposure Limits
UC	Unified Command
UNMH	University of New Mexico Hospital
UPS	Uninterruptible Power Supply
USAR	Urban Search and Rescue

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1.0 PURPOSE

This report documents the independent review of the Los Alamos National Laboratory (LANL) preparedness for severe natural phenomena events, conducted by the U.S. Department of Energy (DOE) Office of Enforcement and Oversight (Independent Oversight) within the Office of Health, Safety and Security (HSS). The HSS Office of Safety and Emergency Management Evaluations performed this review to evaluate the processes for identifying emergency response capabilities and maintaining them in a state of readiness in case of a severe natural phenomena event.

This report discusses the scope, background, results, and conclusions of the review and identifies two findings and several opportunities for improvement (OFIs).

2.0 SCOPE

The scope of this review included the aspects of the emergency management program that relate to emergency preparedness for a severe natural phenomena event. The primary areas of interest were the identification of needed site response capabilities and their state of readiness. The LANL facilities of interest were the Emergency Operations Center (EOC) in Technical Area (TA)-69, the Alternate EOC consisting of two trailers and associated mobile equipment in TA-3, the Chemistry and Metallurgy Research (CMR) facility in TA-3, and the TA-55 Plutonium Facility – Building 4 (PF-4). The LANL emergency response functions of interest were fire response, security response, personnel decontamination, and field monitoring.

The scope of this review included portions of the following emergency management program elements:

- Technical planning basis
- Plans and procedures
- Emergency facilities and equipment
- Offsite response interfaces.

The National Nuclear Security Administration (NNSA) Los Alamos Site Office (LASO) manages LANL's resources; strives to minimize safety risks for Federal and contractor employees, the public, and the environment; and fosters quality and continuous improvement in LANL's operations. Los Alamos National Security, LLC (LANS) operates LANL and is responsible for the safety and reliability of the nuclear explosives package in nuclear weapons. LANL also possesses unique capabilities in neutron scattering, enhanced surveillance, radiography, and plutonium science and engineering.

A site-level emergency response organization (ERO) and some facility-level response teams comprise the onsite response capabilities. SOC, Inc. (SOC) provides protective force services for LANL through a subcontract with LANS, and the Los Alamos Fire Department (LAFD) provides fire department services through a cooperative agreement between NNSA and Los Alamos County.

For this review, Independent Oversight assessed both the comprehensiveness of the response capabilities identified by the site's analyses and the site's level of preparedness in terms of attaining and maintaining the needed response capabilities. Of particular interest was the site's preparedness for responding to plausible severe natural phenomena events. The scope of the review was consistent with Objectives 1 through 4 of HSS Criteria, Review, and Approach Document 45-51, *Emergency Management Program Inspection Criteria, Approach, and Lines of Inquiry, Targeted Review of Site Preparedness for Severe Natural Phenomena Events*. The purpose was to determine whether:

1) The site analyzes plausible scenarios representing severe natural phenomena events to determine capabilities needed for an effective emergency response.
2) The site has a means for determining quickly whether an event results in the loss of a significant quantity of hazardous materials (HAZMAT) and is beyond the site's capability to respond.
3) The site's emergency response capabilities are in a state of readiness to perform the required emergency response functions during plausible natural phenomena events.
4) The site's planning is adequate for obtaining and integrating offsite response assets for events beyond the site's response capability.

This assessment was accomplished by reviewing the documentation that establishes and governs the LANL emergency management program processes, such as emergency plans, procedures, safety basis documents, checklists, records, memoranda of understanding (MOU), and mutual aid agreements (MAAs); interviewing key personnel; observing a scheduled exercise; and performing walkdowns of facilities and equipment.

3.0 BACKGROUND

Numerous examples of severe and catastrophic events, such as earthquakes, tornadoes, floods, wildland fires, and manmade disasters, have emphasized the need to adequately plan and prepare for a large-scale event that could degrade or overwhelm a site's emergency response capability. DOE Order 151.1C, *Comprehensive Emergency Management System*, identifies the functional emergency response requirements for a DOE/NNSA site, and the emergency management guides associated with DOE Order 151.1C provide guidance for implementing the requirements. Emergency planners at DOE sites determine needed site emergency response capabilities based on site-specific attributes, such as types and forms of HAZMAT, demographics, and geography, using a variety of deterministic analyses. If the site has HAZMAT, the primary means for determining needed response capabilities is through an emergency planning hazards assessment (EPHA); however, other site response capability needs are further analyzed in the fire department's baseline needs assessments and security vulnerability assessments. The analysis contained in the EPHA should describe a spectrum of events that represent plausible HAZMAT release scenarios, such as operator errors, mechanical failures, fires, and explosions from unintentional or intentional initiators. Many of these scenarios are also analyzed in the facility-specific documented safety analysis (DSA) and used to reduce the risk from a nuclear facility's operations to acceptable levels; these scenarios are known as design basis events. However, when establishing a facility design, DSAs do not analyze events that exceed in severity the parameters defined for the design basis event. Such "beyond design basis events" (BDBEs) include severe natural phenomena events that represent the upper end of the consequence spectrum that DOE facilities are required to prepare for in accordance with DOE Order 151.1C. To prepare for a BDBE, emergency response staff must plan a means to provide for immediately protecting personnel, mitigating the consequences of a potential HAZMAT release, and establishing appropriate short-term recovery actions. Preparations include alternate emergency response facilities, redundant and diverse communications systems in case an event renders the primary facilities and equipment unavailable, and other site-specific planning and response capabilities needed for a comprehensive emergency management program.

However, some response capabilities that emergency planners may identify as necessary for the most severe and low-probability events would be a financial burden to maintain on site or could be rendered unavailable if such an event occurred. Therefore, emergency planners should predetermine a means to acquire these necessary capabilities from external sources, such as surrounding communities, state authorities, and offsite DOE and national assets. Consequently, preparation for such an event requires the site to establish documented agreements with offsite entities that identify the necessary capabilities, determine mechanisms to bring those capabilities to bear when and where they are needed, and develop procedures to receive and integrate them into the emergency response.

4.0 RESULTS

The following sections discuss the observations made by Independent Oversight during this review, keyed to the objectives in HSS Criteria, Review, and Approach Document 45-51.

4.1 Objective 1: Scenario Analysis

The site analyzes plausible scenarios representing severe natural phenomena events to determine capabilities needed for an effective emergency response.

4.1.1 Discussion

Independent Oversight reviewed the process documents that LANL uses to develop hazards surveys and EPHAs, as well as the hazards surveys, EPHAs, and DSA reports for the CMR facility and the TA-55 facility. The hazards surveys and EPHAs were reviewed to determine the accuracy and adequacy of analyses conducted for severe natural phenomena events. The DSA reports were reviewed to determine the consistency of the BDBEs identified and analyzed in both the DSA reports and the EPHAs for each facility. Additionally, the EPHAs were reviewed to determine whether these documents identified the needed emergency response capabilities for severe natural phenomena events, and served as the basis for event classification and pre-planned protective actions.

The LANL Emergency Operations-Emergency Planning and Preparedness (EO-EPP) Group developed emergency plan implementing procedures (EPIPs) that provide detailed instructions on the methodology, content, and format for developing the hazards surveys and EPHAs; however, Independent Oversight identified inconsistencies for assumed natural phenomena events among these EPIPs. The *Hazards Survey Procedure* (EPP-EPIP-352) identifies seismic events, wind, flood, and wildfire as natural phenomena events. Conversely, the *EPHA Process* EPIP (EPP-EPIP-295) identifies seismic events without fire, high winds, winter storms, high water, lightning, and hail as natural phenomena events. Further, neither EPIP discusses BDBEs, nor do the processes identify the natural phenomena events that would be representative of BDBEs. Although the hazard surveys and EPHAs are not consistent, these differences did not affect the adequacy of analyses conducted for the severe natural phenomena events in the hazards surveys and EPHAs.

The *EPHA Process* EPIP also defines protective action criteria (PAC)-2 and PAC-3 values for determining event classifications of alert, site area emergency, or general emergency. PAC-3 is based upon ≥ Acute Exposure Guideline Level (AEGL)/Emergency Response Planning Guidelines (ERPG)/Temporary Emergency Exposure Limits (TEEL)-3 for chemical releases and ≥ 100 rem for radiological releases. PAC-2 is based upon ≥ AEGL/ERPG/TEEL-2 for chemical releases and ≥ 1 rem for radiological releases.

The EO-EPP Group has developed hazards surveys that include descriptions of generic emergency events and conditions. The hazards surveys adequately identify site threats that could result from natural phenomena events (e.g., earthquakes, high winds/tornadoes, lightning strikes, floods, snowstorms, and wildfires) and that could lead to HAZMAT releases that affect the facilities. The hazards surveys also appropriately indicate the need for further analyses of HAZMAT in an EPHA for the CMR facility and TA-55 facility.

The EO-EPP Group developed an EPHA for the CMR facility that adequately analyzes severe natural phenomena events, consistent with the events analyzed in the CMR DSA report. Both documents consider a seismic event with a fire, high winds and airborne missiles, lightning strikes, wildland fires, and flooding as natural phenomena event scenarios, and the EPHA appropriately considers a seismic event with a full facility fire and collapse and a wildland fire as the severe natural phenomena events of concern. The seismic events analyzed in the EPHA go beyond the events analyzed in the DSA and assume a complete loss of confinement in all wings of the facility in conjunction with a fire. The EO-EPP Group considered, but did not analyze, flooding, high winds, and fire from lightning events (although the EPHA contains consequence analyses for fire scenarios) in the CMR EPHA and provided the following justifications for not analyzing these events:

- Flooding is not a threat due to the high mountain location and local topography.
- CMR is designed to withstand a design basis wind for the LANL area (117 miles per hour).
- The CMR lightning protection system provides three functions: protection of the building structure from lightning-induced fires, protection of personnel from lightning discharge, and protection of sensitive electrical equipment.

The EO-EPP Group also developed an EPHA for the TA-55 facility that analyzes severe natural phenomena events, comparable to the events analyzed in the 2008 TA-55 DSA report. Both documents consider seismic events, high winds and missiles, lightning strikes, and wildland fires, and the EPHA considers a seismic event with an explosion as the severe natural phenomena event of concern. The seismic events analyzed in the EPHA go beyond the events analyzed in the TA-55 DSA and assume a full-facility loss of confinement resulting from a building collapse, with the entire inventory of radioactive materials and hazardous chemicals in the facility released to the environment.

Nevertheless, Independent Oversight identified concerns with the seismic event consequence analyses conducted in the TA-55 EPHA for the PF-4 facility. The radiological material-at-risk (MAR) determinations for the PF-4 facility were obtained from the 2008 TA-55 DSA report and were used in developing the source terms for the consequence assessment analyses in the EPHA. However, the EPHA analysis for the PF-4 worst-case seismic event assumes that 100 percent of the MAR is in powder form and does not take into account the percentage of material in solid form that should not be considered releasable. As a result, the consequences are over-estimated, resulting in over-conservative dose consequences (i.e., PAC-3 exceeded by several orders of magnitude) beyond the site boundary that, in turn, make protective action decision-making problematic due to the large geographical area that would require protective actions. (See Section 4.1.2, **OFI 1-1**.)

Overall, the EO-EPP Group has developed hazards surveys that identify site threats resulting from natural phenomena events, as well as EPHAs that analyze and document these events. The CMR and most of the TA-55 natural phenomena events were appropriately analyzed in their respective EPHAs; however, the TA-55 PF-4 severe seismic event did not appropriately consider the non-releasable form of radioactive material and thereby identified over-conservative dose consequences. The resulting dose consequence distances are larger than necessary and make the implementation of protective actions unnecessarily problematic.

4.1.2 Opportunity for Improvement

OFIs result when an Improvement Item identifies a practice where criteria are generally met, and the performance objective for a particular program element is being achieved, but performance could be improved or made more efficient by adopting DOE or industry practices. These recommended enhancements are referred to as OFIs.

This Independent Oversight review identified the following OFIs. These potential enhancements are not intended to be prescriptive or mandatory. Rather, these OFIs are offered to the site to be reviewed and evaluated by the responsible line management and accepted, rejected, or modified as appropriate, in accordance with site-specific emergency management program objectives and priorities.

OFI 1-1: To further improve natural phenomena event analyses, consider determining realistic TA-55 MAR values that appropriately consider only dispersible material forms (i.e., solids, powders, liquids).

4.2 Objective 2: HAZMAT Release Determination

The site has a means for determining quickly whether an event results in the loss of a significant quantity of HAZMAT and is beyond the site's capability to respond.

4.2.1 Discussion

Independent Oversight reviewed the emergency action level (EAL) statements contained in EPHAs for the CMR facility and TA-55 PF-4 facility to determine whether the EALs were based on the documented consequence analyses. The *Protective Action Guides* EPIP (EPP-EPIP-215), used by the incident commander (IC) to make initial protective actions and protective action recommendations, was reviewed to ensure that the EPIP EALs correlated with the EPHA EAL statements. The *Protective Action Guides* EPIP was also reviewed to determine its usability during plausible severe events (e.g., seismic event destroying multiple facilities on site) where the analysis concludes that such events would overwhelm or incapacitate the site's response capability. Additionally, Independent Oversight reviewed the *CMR Facility Emergency Response* procedure (FERP) (CMR-AERI-002) and the *TA-55 Emergency Procedures* (TA-55-AP-018) to determine whether the facility-specific protective actions correlated to those indicated in the *Protective Action Guides* EPIP. Finally, Independent Oversight observed a scheduled emergency exercise involving the application of EALs after a seismic event.

The *EPHA Process* EPIP adequately provides instructions on developing EALs. The EPHAs contain EAL statements that are developed for each of the analyzed events. For the natural phenomena events analyzed in the EPHAs, the EO-EPP Group developed EALs that are generally based on facility- or activity-specific symptoms and/or event initiators. The EO-EPP Group also developed generic EALs, for sitewide application when no facility-specific EAL is available, for the following events:

- Natural disasters (flooding, high winds/tornadoes, landslide, winter storm, wildland fires, and earthquakes)
- Fires and explosions
- Transportation accidents
- Loss of control of HAZMAT
- Radiation exposure events
- Safeguards and security operational emergencies.

The *Protective Action Guides* EPIP is the implementing document for facility-specific and generic EALs. Along with event classification, the EALs are linked to site protective actions and offsite protective action recommendations for analyzed events. EAL protective actions are identified in the form of a circular isolation distance around the release point and a larger downwind protective action distance. The downwind protective action distance has not been defined, but represents the area downwind of the incident and does not account for a possible shift in wind direction. It should be noted that LANL's approach to using the 1 rem value for radiological releases and AEGL/ERPG/TEEL-2 values for chemical releases to define a larger downwind protective action distance is not specifically endorsed by DOE Guide 151.1-4. This guide discourages the use of real-time weather data for initial protective actions and, due to concerns regarding the complexity and timeliness of protective action decision-making, recommends a 360-degree protective action distance utilizing the Environmental Protection Agency (EPA) Protective Action Guides and AEGL/ERPG/TEEL-2 values as the initial protective action boundary. (See Section 4.2.2, **OFI 2-1**.)

The *EPHA Process* EPIP provides instructions on updating the set of EALs when EALs change during periodic reviews or when necessary due to EPHA or facility changes. The EPIP states that the EO-EPP hazards assessment staff is responsible for updating the set of EALs and informing Duty Emergency Managers (DEMs) when changes are made. However, Independent Oversight determined that the EALs for the CMR and TA-55 PF-4 facilities have not been properly updated during the periodic reviews and revisions of the EPHAs. The EALs contained in the *Protective Action Guides* EPIP were not revised to incorporate the changes made to the CMR EALs when the CMR EPHA was completely revised in September 2011. Additionally, the periodic reviews did not identify differences between the EALs and the equipment in the CMR and TA-55 PF-4 facilities. (See Section 4.2.2, **OFI 2-2**.) For example, the EALs currently in the *Protective Action Guides* EPIP:

- Do not reflect the CMR EPHA isolation and downwind protective action distances for the majority of the events
- Do not provide EALs for two severe natural phenomena events (earthquake and wildland fire) in the CMR EPHA
- Use a criticality alarm system as an EAL entry indicator for a criticality event at CMR, even though CMR is not equipped with a criticality alarm system
- Do not use the PF-4 criticality alarm system as an EAL entry indicator for the criticality event analyzed in the TA-55 EPHA.

In addition, the generic natural disaster EALs do not provide sufficient information to accurately categorize and/or classify a severe natural phenomena event. (See Section 4.2.2, **OFI 2-2**.) For example:

- With the exception of the wildland fire general emergency EAL, the EALs are not based on the potential for or an actual uncontrolled release of HAZMAT that would exceed PAC levels for each identified event classification.
- The EALs are not linked to protective actions or protective action recommendations.
- The EALs for high winds/tornadoes only include the alert and site area emergency classification levels; however, analyses in the TA-55 and CMR EPHAs indicate that high winds resulting in missile penetration should be classified as a general emergency.
- The EALs for seismic events use unobservable ground acceleration values to distinguish the classification (i.e., alert, site area emergency, or general emergency) of the event. These EAL entry indicators are not useful to the IC tasked with making categorization and classification determinations. Further, the data provided during the observed exercise was expressed as the magnitude of the earthquake (i.e., 5.0 magnitude on a Richter scale), rather than as a ground acceleration value.

Because of these weaknesses, LANL does not have an adequate means for quickly determining whether an event occurring at the CMR facility, a criticality event at the TA-55 PF-4 facility, or a severe natural phenomena event at either facility involves a significant quantity of HAZMAT and requires implementation of corresponding onsite protective actions or issuance of appropriate offsite protective action recommendations. (See Findings, **F-1**.)

LANL's planning for onsite protective actions and offsite protective action recommendations provided in the EALs did not fully consider facility or site conditions for the analyzed events. (See Findings, **F-2**.) Specifically:

- The EAL tables contained in the *Protective Action Guides* EPIP indicate that the initial protective actions and protective action recommendations for all EALs dictate that personnel are to shelter-in-place within the protective action area. As previously discussed, the TA-55 PF-4 worst-case seismic event consequence analyses overestimate the potential for onsite and offsite populations to receive dose exposures in excess of PAC-3 levels. The resulting EALs do not incorporate the impact of the projected doses to personnel who remain in place or the loss of shelters due to the seismic event.
- The initial protective action for onsite personnel to shelter-in-place does not correlate with the *CMR FERP* procedure and *TA-55 Emergency Procedures*, which instruct facility personnel to evacuate the facility once the earthquake's shaking has stopped. Procedures further prohibit reentry into buildings after an earthquake without a structural analysis.
- The *Protective Action Guides* EPIP states that evacuation may be the only viable protective action choice in some situations; however, LANL has not developed a comprehensive protective action decision-making EPIP or process that incorporates the current technical bases and implementation challenges considered during the development of initial protective actions at the Laboratory.
- The *Protective Action Guides* EPIP does not include predetermined offsite protective action recommendations, coordinated with offsite authorities, with well-defined areas for evacuation and sheltering.

Overall, LANL uses a documented process to develop and update EALs through periodic reviews and EPHA revisions; however, Independent Oversight observed outdated and incorrect information in the current set of CMR and TA-55 PF-4 EALs. Further, the generic EALs for severe natural phenomena events are not based on the potential for or an actual uncontrolled release of HAZMAT and are not linked to protective actions or protective action recommendations. Additionally, the pre-planned protective actions for a TA-55 PF-4 seismic event are limited to shelter-in-place when there could be high radiation levels, and no effective shelters are available.

4.2.2 Opportunities for Improvement

OFIs result when an Improvement Item identifies a practice where criteria are generally met, and the performance objective for a particular program element is being achieved, but performance could be improved or made more efficient by adopting DOE or industry practices. These recommended enhancements are referred to as OFIs.

This Independent Oversight review identified the following OFIs. These potential enhancements are not intended to be prescriptive or mandatory. Rather, these OFIs are offered to the site to be reviewed and evaluated by the responsible line management and accepted, rejected, or modified as appropriate, in accordance with site-specific emergency management program objectives and priorities.

OFI 2-1: Consider describing the site meteorological system and providing a rationale for LANL's confidence in the system for obtaining reliable and representative real-time meteorological parameters that reflect the time of day, wind speed, and wind direction variability in sufficient time to develop and communicate effective protective actions.

OFI 2-2: To further improve EALs in the EPHAs and to address weaknesses identified in Finding F-1, consider:

- Ensuring that mechanisms are in place to encourage timely revision of EALs in the *Protective Action Guides* EPIP and all other relevant documents (e.g., timely initial assessment binders) when an EPHA has been revised and approved by LANL.
- Ensuring the *Protective Action Guides* EPIP reflects each EAL developed and included in the EPHAs.
- Developing generic natural disaster EALs based on the potential for or actual uncontrolled release of HAZMAT that would exceed PAC levels for each event classification.
- Ensuring that generic natural disaster EALs are linked to protective actions and/or protective action recommendations.
- Developing generic natural disaster EALs for each event classification, where appropriate.
- Ensuring that the generic seismic event EALs are linked to observable indicators to determine whether a potential or actual uncontrolled release of HAZMAT has occurred that would be representative of each event classification.
- Developing situation-specific EALs that indicate appropriate initial protective actions and protective action recommendations (sheltering or evacuation) for each scenario event analyzed.

4.3 Objective 3: Emergency Equipment and Facilities

The site's emergency response capabilities are in a state of readiness to perform the required emergency response functions during plausible natural phenomena events.

4.3.1 Discussion

Independent Oversight reviewed the systems and equipment associated with the LANL EOC and Alternate EOC, and three key emergency response functions (fire response, personnel decontamination, and field monitoring) that are among the critical functions needed for response to an emergency caused by a severe natural phenomena event. These systems and equipment include:

- Normal and backup power systems
- Communication systems
- Consequence assessment systems
- Habitability equipment
- Personal protective equipment (PPE)
- Radiation survey equipment
- HAZMAT detection equipment
- Decontamination equipment.

In addition, Independent Oversight reviewed response capabilities at the EOC and two LANL nuclear facilities (CMR and TA-55 PF-4), as well as the LANL protective force's planning for responding to a catastrophic event.

LANL relies on one fixed emergency response command center to coordinate and manage the response to an emergency. The EOC, located in a Property Protection Area at TA-69-33, serves as the emergency response center for LANL and Los Alamos County emergencies. The EOC is responsible for conducting, evaluating, coordinating, and managing the emergency response. If the EOC staff is required to relocate, an Alternate EOC consisting of two enclosed trailers and needed support equipment is deployed to one of three pre-designated, alternate locations or a location determined by the IC or the DEM. The Alternate EOC trailers and support equipment are stored in TA-3 within a fenced area in the LANL security complex. The storage location is approachable from three different roads and is close to support personnel who assist with deployment of the trailers.

Three emergency response functions provide critical capabilities needed to respond to a severe natural phenomena event at LANL. The LAFD provides fire department services to LANL through a cooperative agreement between LASO and Los Alamos County and is the third largest career fire department in the state of New Mexico. Five active fire stations are located throughout Los Alamos County, with two fire stations located on the LANL site. The department provides fire, rescue, emergency medical services (EMS), public education, and life safety services to the citizens and visitors of Los Alamos County as well as to LANL. LAFD also provides advanced nuclear grade industrial fire suppression and wildland fire suppression. Rescue services include vehicle and machinery rescue, confined space rescue, trench rescue, structural collapse rescue, and rope rescue. Additionally, LAFD provides emergency and non-emergency medical response, including advanced life support capabilities and personnel certified at the HAZMAT first responder operational level (defensive capability). The LANL Emergency Operations-Emergency Response (EO-ER) Group is responsible for responding to and mitigating HAZMAT emergencies at LANL.

The LANL EO-ER Group and LAFD provide HAZMAT decontamination in case of a large-scale contamination event at LANL. The decontamination equipment for both organizations is mobile and can be brought to the desired location within the LANL site.

LANL established an onsite field monitoring team (FMT) in fiscal year (FY) 2009. Located at TA-64-39, the onsite FMT identifies the boundary of the area impacted by a HAZMAT release and monitors for both radiological and chemical hazards. The onsite FMT provides critical monitoring data for use by decision-makers at the LANL EOC.

Normal and Backup Power Systems

Independent Oversight reviewed normal and backup power supplies for the EOC, the Alternate EOC, and two nuclear facilities – the CMR facility and TA-55 PA-4. The reliability of power was analyzed through a review of applied industry and DOE standards for the design, maintenance, and testing of emergency power supply systems. The capability to provide long-term emergency power was determined through a review of generator refueling plans. Battery systems were reviewed to determine their service times and to identify the equipment that would be lost in the event of a long-term loss of alternating current power. Independent Oversight reviewed design, maintenance, and test documents; interviewed personnel; and performed system walkdowns to make its conclusions.

Normal power (also referred to as offsite power) is commercial power distributed to LANL facilities. The Public Service Company of New Mexico provides 13.2 kilovolts (kV) normal power to the Los Alamos area from two substations. At CMR, each wing has two transformer-fed substations to step down the 13.2 kV to 480 volts and can supply each other through automatic bus-tie breakers, with the exception of wings 1 and 9 and the administration wing, which have only one substation each. At PF-4, normal power is distributed through either of the two offsite 13.2 kV feeds by means of four 13.2 kV/480 volt

substations. The EOC has one 13.2 kV/480 volt substation, and the Alternate EOC has a mobile generator that provides power.

Independent Oversight referenced DOE-STD-3003-2000, *Backup Power Sources for DOE Facilities*, as the benchmark for backup power supply inspections, testing, and maintenance. The standard applies to engine generators and uninterruptible power supplies (UPS), including their battery components used to provide backup power for equipment that protects the public, site workers, and the environment. The standard establishes general and detailed requirements for reliable backup and emergency sources regardless of the type of DOE facility in which the systems are used. Examples of equipment requiring backup power included in the standard are nuclear safety systems, radiation monitors and alarms, fire protection systems, security systems, data processing equipment, and emergency lighting. Independent Oversight recognizes that the standard states that the requirements apply only if contractual documents, procurements documents, or the authorization basis for a facility invokes the standard. LANL has not invoked the standard through these means, but references the standard in its *Conduct of Maintenance (P950) Operations and Maintenance Manual* (Criteria 505, 506, and 511) as the basis for some of its activities.

LANL has adequately planned for the long-term refueling of its diesel generators. LANL maintains and distributes diesel fuel via two refueling trucks that have 2000-gallon diesel fuel tanks. To refuel the trucks, LANL has two contracts in place, one at the Nambe Pueblo and one in the town of Española. As a third option, LANL can purchase fuel from any distributer using a "p-card" in case the contracted suppliers do not have diesel fuel available.

LANL has some capability to provide backup power through mobile generators, although additional planning and testing are warranted to ensure availability and compatibility with connecting loads. The LANL Maintenance and Site Services organization owns six mobile generators, ranging from 30 kilowatt (kW) to 350 kW. These generators are stored outside with their integral fuel tank filled and are available based on load priorities. The LANL Emergency Operations Division (EOD) also owns one mobile generator that is dedicated to the Alternate EOC. The Alternate EOC mobile generator is stored outside with the Alternate EOC equipment. Owner organizations periodically start their mobile generators and check fuel levels to ensure their operability; however, the owners do not install and test the mobile generators at specific facilities to ensure that the generators can connect and power all critical loads. During the construction of the EOC, LANL appears to have considered BDBEs by installing a redundant backup power receptacle for external power. However, Independent Oversight observed that the receptacle for the EOC is different from other receptacles at site facilities and could not confirm that an adapter for an appropriately sized generator is available for use at the EOC. (See Section 4.3.2, **OFI 3-1**.)

LANL has a systematic approach to the rigor of inspection and testing of backup power supplies that is based on grading equipment by its safety significance, but this approach warrants special consideration when grading equipment in a non-nuclear facility, such as the EOC, that has safety functions during emergency conditions. LANL establishes routine inspection, testing, and preventive and predictive maintenance of fixed emergency and standby power systems via a Management Level (ML) designator, as described in the *ML Determination* procedure (AP-341-502) and the LANL *Conduct of Maintenance (P950) Operations and Maintenance Manual*. LANL assigns an ML designation, ML-1 through -4, as a means to grade structures, systems, equipment, components, and associated activities based on their importance and associated risk to the protection of the public, environment, workers, security, and the LANL mission. The assigned ML designation establishes the basis for the extent of special oversight and control needed to assure that important functions or activities are performed correctly based on risk, with ML-1 denoting the highest risk and the most rigorous oversight and controls. The ML designator correlates with National Fire Protection Association (NFPA) Standard 110, *Standard for Emergency and*

Standby Power Systems, and NFPA Standard 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, and the safety significance of powered loads as follows:

- ML-1 safety class systems - NFPA level 1
- ML-2 safety significant system - NFPA level 1
- ML-3 defense-in-depth system - NFPA level 1 or 2 (depending whether life safety code equipment is powered)
- ML-4 standard industry practice for low-risk items.

LANL procedures state that low-hazard and office facilities and site utilities are normally assigned a ML-4 designation; however, in special cases (e.g., mission, security, worker safety, and environmental), there is an allowance for upgrading the ML designator. Independent Oversight observed some systems inappropriately designated as ML-4 at the CMR and TA-55 nuclear facilities and at the EOC. These include systems that perform life-saving functions during significant operational emergencies, such as warning employees of dangerous conditions, providing employees with protective action instructions, and enabling the ERO to remain at the EOC to perform planned functions. (See Section 4.3.2, **OFI 3-2**.)

Overall, LANL has normal and backup power sources for critical loads. LANL uses a systematic approach to testing and maintenance of fixed emergency and backup power supply systems that applies industry standards, provides additional power capability through mobile generators, and adequately plans for long-term refueling operations. However, LANL has not tested the use of a mobile generator at the EOC, and upgrades are warranted in the maintenance and testing of power supplies used to power important equipment used during operational emergencies.

Communication Systems

Independent Oversight reviewed the key communication systems used by the EOC, Alternate EOC, LAFD, decontamination team, and onsite FMT to communicate with each other; site personnel; the surrounding public; and offsite local, state, and Federal agencies and organizations. The primary and backup systems were examined, along with the processes for maintaining and periodically testing the systems to ensure operability. Independent Oversight also reviewed the availability of alternate means to perform critical tasks when a primary system is out of service due to a severe natural phenomena event. In addition, an emergency exercise involving the loss of telephone lines and the Internet due to a seismic event was observed.

The Los Alamos County Consolidated Dispatch Center (CDC) operates the 911 telephone system for LANL and ensures continuous operability of the system. The CDC has four incoming telephone lines for 911 calls from Los Alamos County, including calls originating on the LANL site. LANL works closely with the CDC to ensure that the master street and address guide for LANL personnel provides the correct location for 911 calls from site telephones. When personnel at LANL make a 911 call, the CDC contacts the LANL central alarm station and the LANL Emergency Operations-Emergency Management (EO-EM) Group if the situation warrants a response from the LANL emergency response assets. If the CDC has to evacuate, the dispatcher can route the 911 telephone lines to the Santa Fe County Dispatch Office, who will assume the dispatch duties. The CDC tests the 911 telephone system extensively including tests performed by the phone line vendor to ensure operability.

The LANL EOD has multiple mechanisms for providing protective action recommendations to Los Alamos County for consideration and implementation during emergencies that could affect the public immediately surrounding LANL. If an emergency occurs at LANL that could affect the public, the EO-EM Group contacts the CDC by telephone, radio, or e-mail and provides a protective action

recommendation. The CDC in turn contacts the Los Alamos County Emergency Coordinator or alternate and provides the protective action recommendation for action. Los Alamos County recently switched to a new hosted mass notification system, CodeRED®, as the primary system used to issue emergency instructions to the public because of difficulties using the previous mass notification system during the Las Conchas fire. CodeRED can be accessed using the Internet, telephone, or cellular phone and provides protective action instructions via the telephones in Los Alamos County (excluding LANL), as well as any cellular telephones and e-mail accounts that the public registers with the system. Los Alamos County also uses a low-power AM radio station to provide emergency information to the cities of Los Alamos and White Rock. Additionally, Los Alamos County can use the Emergency Alert System to broadcast emergency messages on all of the commercial radio stations in New Mexico. The EO-EM Group is in frequent contact with CDC on a variety of topics and the AM radio station broadcasts continuously, so no specific testing is performed.

The EOC is equipped with an Emergency Communications Network (ECN) node that permits classified videoconferences with DOE Headquarters and other NNSA site offices. The ECN allows the EOC to transmit live video, recorded video, and projected images to DOE Headquarters in both unclassified and classified modes. LANL has a second ECN node in TA-48 that could be used if the EOC ECN node is not working. The *EOC Emergency Equipment Operations and Testing* EPIP (ERO-EPIP-250) contains detailed ECN testing instructions. Additionally, DOE Headquarters conducts a comprehensive weekly test of the ECN with the LANL EOC.

The LANL EOC, Alternate EOC, LAFD, decontamination team, and onsite FMT are well equipped with telephones and facsimile machines. The EOC has an adequate number of telephones, including nine telephones authorized for classified conversations. The Alternate EOC, decontamination team, onsite FMT, and select members of the LAFD are equipped with cellular telephones. Five facsimile machines are available at the EOC, including two facsimile machines capable of transmitting classified information. The Alternate EOC has a facsimile machine available if a telephone line is accessible at the deployment location. The *Communications Contingency Plan (EM-PLAN-030)* allows the use of cellular telephones in the EOC as a backup communication option, which LANL successfully demonstrated during the observed exercise. The EOC and LAFD also have six satellite telephones available for use. Notably, most of the EOC staff have Government Emergency Telecommunications Service (GETS) cards that provide priority telephone access and Wireless Priority Service accounts that provide priority cellular telephone access during periods of severe network congestion or disruption.

EOD uses a rigorous testing methodology to ensure that the various telephones and facsimile machines at the EOC and Alternate EOC are functional when needed. The EO-EM Group uses a detailed and comprehensive testing methodology, described in the *EOC Emergency Equipment Operations and Testing* EPIP, on a quarterly basis to ensure that the various types of telephones and facsimile machines in the EOC will function as intended. For example, testing of the satellite telephone includes both receiving and making a call. Similarly, testing of the secure facsimile machine includes verification that information can be sent and received in the classified mode. In addition, the EO-EM Group performs a monthly inventory of the Alternate EOC equipment and monthly tests of the Alternate EOC cellular telephones to ensure operability and to confirm that the batteries are fully charged. Further, the EO-EPP Group performs a quarterly test with the personnel who have GETS card and Wireless Priority Service to confirm their ability to access the systems.

The EOC staff provides notifications to offsite organizations via telephone, facsimile, and e-mail. When a notification is warranted for offsite organizations, the EOC notification staff contacts each organization and provides the information listed on the *Operational Emergency Notification Form* (EM-FORM-009). Typically, the form is sent by facsimile or e-mail to each organization, followed by a telephone call to ensure that the organization received the information. During the exercise, Independent Oversight

observed that the notification staff adapted quickly to the loss of telephones and Internet and used cellular telephones to verbally provide offsite notifications. The EO-EM Group confirms the telephone and facsimile numbers and e-mail addresses for the offsite organizations and tests that the new numbers are valid every six months.

The LANL radio system provides a mobile communications link that allows interoperability with Los Alamos County responders. Radios are the primary method used for communications in the field. Over 3000 radios are in operation, consisting of hand-held units, vehicle-mounted units, and consoles. LANL uses a trunked radio system with 15 channels that includes the EOD emergency response personnel and the LANL protective force, along with the Los Alamos Police Department (LAPD) and LAFD, for interoperability during emergencies. Most of the LANL field emergency responders and all of the LAFD fire fighters use assigned radios on a daily basis, and the EO-EM Group monitors radio communications through several radio consoles. In addition, LANL can patch the radios of mutual aid responders into the radio system, and the LANL protective force performs weekly tests to confirm this ability. Further, the EO-EM Group stores a set of radios for deployment with the Alternate EOC and tests these radios monthly to ensure operability. The primary repeater for the radio system is located on Pajarito Mountain and a backup repeater is located on a water tower outside the EOC, providing a large coverage area that can reach as far as Albuquerque. LANL performs an alignment on the radio system repeaters twice per year; the remaining components of the radio system do not require periodic maintenance.

The ability of the LANL radio system to provide continuous coverage on site is limited in some cases. The radio system can continue to operate if the system controller fails and can operate in Simplex mode (limited to line-of-sight and limited range) if the repeaters fail. However, radio coverage in some buildings and in the canyons on site is problematic. LANL added internal repeaters to improve reception in some of these buildings, such as the EOC. LANL also has a small mobile repeater that can be brought to the ridge of a canyon during an emergency to improve radio coverage in the area. However, the mobile repeater has a limited range, and LANL is researching options to improve the radio coverage in canyons. In addition, the primary repeater site does not have a backup power supply. This became an issue during the Las Conchas fire, when a power outage occurred and compromised radio communications for several hours because the backup repeater has poorer line-of-sight than the primary repeater. To remedy the issue, LANL brought a portable backup power generator to the primary repeater site to restore power and return the radio system to full operation. Due to issues that occurred during the Las Conchas fire of June 2011 and the issue with radio coverage in canyons, LASO developed an FY 2012 performance-based incentive (PBI) (8.2.2.4.b) that requires LANL to complete a needs analysis and project plan for the trunked radio system. In response to this PBI, LANL has gathered input from all local EROs regarding their needs and is proceeding with the analysis and project plan.

The LANL DEM has a variety of methods for notifying employees of an emergency and facilitating the safe evacuation of employees, although some testing requirements are not documented in a procedure. A newly implemented mass notification system hosted by Twenty First Century Communications is the primary method the EO-EM Group uses for communicating emergency notifications and protective action instructions to onsite workers and is accessible through the Internet, telephone, or cellular telephone. The mass notification system includes information from an Oracle database for all onsite workers and sends messages to office telephones, cellular telephones, and e-mail accounts. The mass notification system can also be used to send messages to one or more assembly areas using the mapping feature to select message recipients within a specific geographic area. The mass notification system is used regularly for site announcements, such as snow closures and early dismissals, and periodic reminders are sent to employees to ensure that the Oracle database contains their correct contact information. The EO-EM Group is performing informal testing of the mass notification system to improve staff proficiency in sending messages, with a formal, documented testing program under development as part of a FY 2012 PBI (8.2.2.1.c) for developing internal procedures for maintaining EOC communications. Independent

Oversight observed the use of the mass notification system during an exercise, and the EOC staff was able to quickly develop emergency messages and select recipients. The exercise constraints prohibited the use of the Internet or telephone lines, so the mass notification system messages were sent using a laptop computer equipped with Internet access using the cellular telephone system. Due to low cellular signal strength, the time to transmit the messages was lengthy in some cases. The EO-EM Group also uses the mass notification system to quickly activate the ERO, but no requirement to test ERO notifications is documented in a procedure. When an emergency occurs, the EO-EM Group activates the ERO using the mass notification system that transmits a message to the various devices registered in the system for each ERO member (i.e., office telephones, cellular telephones, pagers, and e-mail). All responders assigned to the core team are notified, along with any other personnel needed for the specific type of emergency. The mass notification system records whether a positive response was received from each ERO member. If the mass notification system is unavailable, the EO-EM Group can contact the ERO members individually using a contact roster maintained in the EOC. As previously mentioned, the EO-EM Group is performing informal testing of the mass notification system, and a formal testing program, including ERO activation testing, is under development as part of FY 2012 PBI 8.2.2.1.c.

In addition to the mass notification system, the EO-EM Group uses dedicated Site Wide Area Notification System (SWANS) radios located in numerous facilities throughout LANL to provide emergency communications. Emergency communications can also be sent using the trunked radio system over a variety of channels, including the emergency channel, the "all radios" channel, or a facility-specific channel. To ensure that workers who are outdoors receive notifications, the EO-EM Group contacts several division offices via telephone to alert their employees; these include such groups as the protective force, site services personnel, and environmental monitoring personnel. Further, the EO-EM Group can contact hearing-impaired employees using a dedicated alphanumeric pager group to ensure that these employees receive emergency notifications. In case of an evacuation, Assembly Leaders at each assembly area report accountability information to the EOC using a SWANS radio (if available) or a cellular telephone. The SWANS radios are tested approximately twice per year, although the requirement to conduct these tests is not documented in a procedure. (See Section 4.3.2, **OFI 3-3**.)

LANL uses WebEOC® to share unclassified information about an ongoing emergency within the EOC and with DOE Headquarters; however, minimal information is entered into WebEOC, and the requirement to test the operability of WebEOC is not documented in a procedure. The ERO uses WebEOC to share emergency-related information via display on a large video wall in the EOC. LANL also shares information with DOE Headquarters via WebEOC. The State of New Mexico uses a different information management system and does not have access to WebEOC. During the observed exercise, Independent Oversight noted that only a board showing significant events was displayed and that the ERO did not rely on WebEOC as the primary source for emergency information. The EO-EM Group is implementing a new version of WebEOC in response to a LASO FY 2012 PBI (8.2.2.2) that requires LANL to expand the current capabilities of WebEOC towards an electronic submittal, tracking, and distribution system. LASO further specifies in the PBI several specific types of information to be included in WebEOC information boards, such as action items, maps, consequence assessment models, and on-scene resources. LANL has completed development of several of the WebEOC boards, and work on the remaining boards is under way. To ensure the continuous availability of WebEOC, the EO-EM Group placed the EOC computers into a special subnet that permits computer patches to be installed, but does not cause the computers to automatically reboot. Once the patches are installed, the EO-EM Group reboots the computers manually and then ensures that the computers are functioning as intended. The EO-EM Group tests WebEOC quarterly by logging in to the system, but this test requirement is not captured in a procedure. (See Section 4.3.2, **OFI 3-3**.)

Overall, communication systems (i.e., 911 calls, employee notifications, public warnings, offsite notifications, and ERO communications) are ready to facilitate information flow during severe natural

phenomena events. The redundancy in the communication systems for the critical emergency response functions increases the likelihood that one or more systems will be available for performing each function in case of any disruptions caused by a severe natural phenomena event. In addition, LASO developed PBIs targeted at resolving several communication system issues involving radio system coverage, backup power for the primary radio repeater, testing requirements for the mass notification system, and an expansion of WebEOC capabilities. However, the testing requirements for the SWANS radios and WebEOC are not documented in a procedure.

Consequence Assessment Systems

Independent Oversight reviewed the consequence assessment processes and dispersion modeling software programs to ensure that the site has established and maintained a consequence assessment system with overall responsibility for initial and ongoing emergency response and provisions for generating timely and useful information for decision-makers. Independent Oversight interviewed consequence assessment personnel to examine their understanding of the processes and dispersion software programs.

The LANL consequence assessment process ensures that timely and useful information is provided to assist emergency response decision-makers in making technically-based decisions to protect the site workers, the public, and emergency responders. Consequence assessment activities normally occur at the EOC Emergency Technical Support Center (ETSC). The ETSC staff offices are located within the EOC building, and during normal working hours, consequence assessment activities begin as soon as information about a HAZMAT release becomes available. The *ETSC Staff* EPIP (ERO-EPIP-125) provides detailed instructions for conducting consequence assessment activities and notes that the time taken to develop the timely initial assessment must be short with respect to the decision and response time needed for implementing protective actions (defined as minutes to an hour after event initiation). The EPIP also provides a step-by-step outline for performing a timely initial assessment that evaluates the onsite and offsite exposures from a HAZMAT release.

The ETSC staff conducts initial consequence analyses using source term data from the EPHAs or actual data from the release location, if known. Plume projection modeling is accomplished by appropriately using the Areal Locations of Hazardous Atmospheres (known as ALOHA) or Emergency Prediction Information Code (known as EPICode) dispersion modeling software programs for chemical releases and the HotSpot Health Physics Code dispersion modeling software program for radiological releases. The ETSC staff also conducts ongoing consequence analyses for both chemical and radiological releases using the National Atmospheric Release Advisory Center (NARAC) dispersion modeling software program. Additional software and programs are also available to the ETSC staff. The staff has the software capability to analyze fire and explosive effects; obtain real-time meteorological data using the geographic information system, meteorological monitoring stations, and the LANL Weather Machine website; and obtain real-time lightning tracking using a lightning detection system stationed in TA-15 or from the National Weather Service website.

ETSC staff can perform consequence assessment activities at the Alternate EOC, if necessary. Laptop computers are available that contain the same software and data as the EOC consequence assessment computers. As an additional backup method, all ETSC staff members have NARAC accounts and can develop projected plume plots by accessing any Internet-enabled computer if Internet connectivity is available.

In addition, ETSC staff use a graphic information system program called Depiction®. Consequence analyses from all of the EPHAs have been loaded into Depiction to provided timely isolation and protective action distances for the natural phenomena events analyzed in the EPHAs. Further, the ICs are

trained to use Depiction and can access the program on their laptops. Depiction provides the following information:

- All buildings within the isolation zone and downwind protective action areas
- All occupied buildings and the number of occupants during regular working hours
- Wind roses for day and night
- Emergency planning zone
- Scale bars in meters and miles for reference
- Compass ring for ease of use in determining wind directions
- Site boundary
- TA boundaries.

Although Depiction provides an easy way to graphically display the isolation zone and downwind protective action areas, the revised CMR EPHA consequence analyses have not been loaded into the program. Additionally, LANL has not developed an EPIP to address responsibilities, requirements, and operations associated with Depiction. (See Section 4.3.2, **OFI 3-4**.) Further, as discussed in Section 4.2 of this report, the use of real-time weather data for initial downwind protective actions is not endorsed by DOE Guide 151.1-4.

Overall, the LANL ETSC staff is ready to provide information on HAZMAT releases caused by a severe natural phenomena event. The ETSC staff can use various locations (i.e., EOC, Alternate EOC, and any Internet-enabled computer) to access dispersion modeling software, increasing the probability that consequence assessment activities can continue during severe natural phenomena events. However, no EPIP or process document has been developed to ensure the accuracy of the consequence analyses contained in Depiction.

Habitability Equipment

Independent Oversight reviewed the EOC, the TA-55 Operations Center, and the CMR Operations Center to identify any habitability systems and to evaluate system readiness.

None of the operations centers has an operable habitability system, although the EOC has an air filtration system and is equipped with carbon monoxide and carbon dioxide air monitors throughout the building. In 2011, a LANL self-assessment identified weaknesses in the EOC air filtration system that included weaknesses in the maintenance and testing of the filtration system, training of personnel to load and operate the filtration system, procedures for loading and operating the filtration system, and air monitoring capabilities for radioactive material and hazardous chemicals on site. LANL is managing, evaluating, and correcting these identified weaknesses using the LANL Issues and Corrective Action Management process (Issues and Corrective Action Management Report 2011-3734). In addition, LASO established a related PBI (8.2.3) for LANL to conduct an EOC functional requirement evaluation, including what type of air filtration is needed for the EOC (Performance Feedback and Improvement Tracking System # 2010-2004). Based on their conclusions, LANL will establish additional corrective actions as needed.

Overall, LANL does not have an operable habitability system. The EOC has an air filtration system, although a 2011 LANL self-assessment found significant weaknesses in the system. In response to the self-assessment and a LASO PBI, LANL is evaluating the habitability needs of the EOC.

Personal Protective Equipment

Independent Oversight reviewed the essential PPE used by the LAFD, decontamination team, and onsite FMT, along with the processes for any required maintenance and periodic testing of the equipment.

The EO-ER Group's PPE for HAZMAT responders and personnel undergoing decontamination is consistent with the identified hazards at LANL. PPE for the EO-ER Group responders ranges from DuPont and Kappler level A suits and Scott self-contained breathing apparatus (SCBA) units to level D turnout gear, all of which is stored on HAZMAT response vehicles and in bulk storage. The PPE for personnel undergoing decontamination includes such items as Saranex coveralls and surgical gloves, which are stored in the decontamination equipment trailer and in bulk storage. The EO-ER Group performs and documents a weekly inventory of the PPE stored on the response vehicles and in the decontamination equipment trailer. The air pressure of SCBA units stored in the decontamination trailer and on the response vehicles is checked weekly, and the inspection is documented. In addition, the EO-ER Group follows the manufacturer's guidelines for maintenance, inspection, and testing for the level A suits and SCBA units. The EO-ER Group refills the SCBA units using a breathing air compressor at TA-64 or a mobile unit on a trailer kept at TA-64, which can also refill the LAFD SCBA units. In addition, trained members of the EO-ER Group perform maintenance on the breathing air compressor as needed. Further, the quality of the breathing air used in the SCBA units is checked quarterly by an offsite laboratory. The EO-ER Group keeps records of the inspections, tests, and maintenance for the level A suits, SCBA units, and breathing air compressor.

LAFD fire fighters are equipped with PPE that is consistent with the identified hazards the fire fighters might encounter at LANL, and participate in a defensive capacity during HAZMAT emergencies. LAFD provides fire fighters with level B suits and anti-contamination clothing along with SCBA units. Three breathing air compressors are available at the LAFD fire stations to refill the SCBA units, which can also refill the LANL SCBA units, and are checked quarterly by a vendor. LAFD recently acquired level A suits as part of a training initiative to qualify LAFD fire fighters at the HAZMAT technician level. LAFD conducts periodic inspections of the SCBA units, including daily status checks, monthly equipment inspections, and annual pressure-testing.

The onsite FMT does not carry PPE during monitoring activities but has ready access to PPE if needed. The onsite FMT is instructed to not enter the initial isolation zone or enter areas in the downwind protective action area above established turn-back limits. If the onsite FMT needs PPE, the EO-ER Group can provide a variety of items, including Tyvek coveralls, Saranex coveralls, protective boots, and protective gloves. The onsite FMT members also have access to PPE as part of their normal duties as an industrial hygienist, radiological control technician, or health physicist.

Overall, appropriate PPE is available for HAZMAT responders, fire fighters, the onsite FMT, and decontamination activities that may be necessary for response to a severe natural phenomena event.

Radiation Survey Equipment

Independent Oversight reviewed the essential radiation survey equipment used by the onsite FMT organization, along with the relevant checklists and processes for any required maintenance and periodic testing of the equipment.

The onsite FMT monitors for the airborne radiological hazards for the most significant scenarios identified in the EPHAs (i.e., those that could lead to a site area emergency or general emergency) and appropriately maintains and calibrates the equipment, but does not ensure that needed equipment and supplies are readily available. LANL tasks the onsite FMT with collecting dose readings on site during

emergency events, but the onsite FMT is not authorized to collect dose readings off site. The onsite FMT radiological equipment, located in TA-64, consists of beta-gamma and alpha Geiger counters to detect ionizing radiation and multiple high-volume sampler pumps with two different filter sizes. The equipment meets the needs identified by the EPHAs. The onsite FMT conducts periodic inspections, operational checks, calibration, preventive maintenance, and testing of the various radiation detectors as required by the manufacturer's instructions and industry standards. Two check sources (strontium-90 and plutonium-239) are available to perform quick operability checks before using the equipment. However, the onsite FMT does not perform periodic inspection using inventory checklists to ensure that emergency equipment and supplies are readily available at designated locations. (See Section 4.3.2, **OFI 3-5**.)

Overall, an adequate quantity of operable and calibrated radiation survey equipment is available to respond to a radiological release caused by a severe natural phenomena event. However, the onsite FMT does not perform periodic inspections using an inventory checklist to ensure that emergency equipment and supplies are available when needed.

Hazardous Material Detection Equipment

Independent Oversight reviewed the HAZMAT detection equipment used by the onsite FMT and LAFD, along with the processes for calibrating the equipment.

The onsite FMT monitors for the airborne hazardous chemicals for the most significant scenarios identified in the EPHAs and appropriately calibrates the detectors. The onsite FMT uses the MultiRAE, MiniRAE, multigas meters, and Dräger tubes to detect the airborne hazardous chemicals for the most significant scenarios identified in the EPHAs (i.e., those that could lead to a site area emergency or general emergency) – hydrogen cyanide, chlorine, hydrochloric acid, hydrofluoric acid, nitrogen dioxide, chromic acid, fluoboric acid, nitric acid, phosgene, and fluorine. The detectors are included in the LANL institutional industrial hygiene detectors pool with a computerized inventory system that ensures instruments checked out for field use are calibrated. In addition, fresh air calibrations are performed weekly on the various detectors. The supply of Dräger tubes is periodically refreshed, and expired tubes are removed from the inventory.

LAFD monitors for airborne hazardous chemicals and appropriately calibrates the detectors. LAFD uses the RKI Eagle and the MultiRAE to detect carbon monoxide, hydrogen sulfide, combustible gases and vapors, and oxygen-deficient and oxygen-rich atmospheres. In addition, the RKI Eagle can detect chlorine and ammonia, and the MultiRAE can detect volatile organic compounds. LAFD equips each fire truck with one of each detector, inspects the detectors at the beginning of each shift, and performs a fresh air calibration. LAFD calibrates the MultiRAE detector in house with the appropriate calibration kit. The RKI Eagle detector is sent to an offsite vendor for calibration.

Overall, an adequate quantity of operable and calibrated HAZMAT detection equipment is available to respond to a hazardous chemical release caused by a severe natural phenomena event.

Decontamination Equipment

Independent Oversight reviewed LANL's preparations for a large-scale contamination event, along with the relevant plans, checklists, and equipment.

The EO-ER Group is equipped to handle a large-scale contamination event by means of a decontamination tent system that can be set up near the scene of the emergency. The system is equipped with a water heater and a shower area that reduces the number of EO-ER Group responders needed to manually decontaminate personnel. The EO-ER Group denotes an area to perform initial surveys and

direct workers to the appropriate shower area. The shower area is screened for privacy, and personnel are available nearby to assist with decontamination efforts if needed. The EO-ER Group responders decontaminate and survey the workers before releasing them (or segregating them if they cannot be fully decontaminated, pending a decision on further actions). The EO-ER Group estimates that the decontamination team can treat approximately 20 people per hour. The EO-ER Group inventories the trailer containing the decontamination equipment weekly along with a check of the equipment's operational status. Further, the EO-ER Group ensures the operability of the decontamination tent system by conducting one drill annually and by using the system in training courses throughout the year.

LAFD is equipped to provide gross mass decontamination in support of a LANL large-scale contamination event. LAFD can conduct gross mass decontamination using the nozzles on the fire trucks to remove contamination from clothed workers. The LANL EO-ER Group is training LAFD fire fighters on the setup, use, and teardown of the LANL decontamination equipment so that in the future, LAFD fire fighters can assist LANL in large-scale decontamination efforts.

Overall, LANL is ready to respond to a large-scale contamination event that may result from a severe natural phenomena event.

Emergency Operations Center

Independent Oversight reviewed the EOC's documented capability to withstand analyzed severe natural phenomena events and its ability to survive and enable the ERO to remain in a safe environment, while performing its emergency response functions. Independent Oversight reviewed the design, maintenance, and testing documents for key systems; reviewed the operating and maintenance procedures and records; and performed walkdowns of the facility. Key systems of interest included emergency power supply systems, and facilities and equipment that enable the ERO to safely perform emergency response functions for long-term operations.

The EOC is designed to withstand a performance criteria 2 seismic event and perform long-term operations with the objective of being self-sufficient for two weeks. To enable long-term operations, the EOC is equipped with its own water supply, a stock of ready-to-eat meals, showers, sleeping quarters, a kitchen, and two 25,000-gallon diesel fuel tanks to fuel an electrical generator and boilers for heating steam. As previously mentioned, the EOC does not have an operable habitability system or air filtration system. If the EOC becomes unsafe, LANL has made provisions to relocate to an Alternate EOC consisting of two enclosed trailers and needed support equipment. The Alternate EOC is powered from a dedicated mobile 20 kW diesel generator. The mobile generator is start tested monthly and undergoes annual maintenance to ensure its operability.

The EOC is equipped with a backup power system designed to provide a reliable power source. The backup power supply system consists of a fixed 90 kW emergency diesel generator (EDG) and a UPS. The EDG power system is designed to automatically start and pick up all EOC loads upon loss of normal power. The current loading is less than 20 percent of the EDG's capacity. The UPS provides continuous power to critical loads in the Emergency Operations Support Center (EOSC) upon loss of normal power until the EDG starts and begins providing power. If the EDG fails to start, the UPS can provide power to the EOSC for a minimum of four hours. The EOSC loads include fire alarm monitoring and radio communications. The EOC is also equipped with a receptacle to plug in a mobile generator if needed.

Periodic inspection, testing, and maintenance of EOC backup power systems provide minimal assurance of its availability. LANL designated the EOC generator and UPS systems as ML-4 systems, a designation that allows less rigor and comprehensiveness in component testing. Testing can be performed using work orders rather than written procedures; portable measuring and test equipment is not required

to be in the LANL calibration program; a reduced frequency of inspections and tests is allowed; and record requirements are reduced when problems are identified. The generator undergoes monthly start and annual load tests, but LANL does not test some important functions, such as automatic start, automatic transfer switch, and loaded run. Similarly, the UPS system tests are limited to quarterly and annual battery surveillances. LANL does not test the UPS chargers, rectifiers, inverters, alarms, and automatic functions but is pursuing additional EOC UPS testing using an offsite vendor. (See Section 4.3.2, **OFI 3-2**.)

Overall, the EOC is a seismic performance category 2 facility equipped to be self-sufficient for two weeks. The EOC is equipped with backup power supplies, a long-term fuel supply, and a receptacle for mobile generator installation. If the EOC is not habitable, a mobile Alternate EOC consisting of two trailers and a mobile generator is available. However, testing and inspections of the electrical distribution system are minimal.

Chemistry and Metallurgy Research Facility

Independent Oversight reviewed the CMR facility's documented capability to withstand analyzed severe natural phenomena events and its ability to receive protective action information, implement planned protective actions, and conduct and report personnel accountability after a facility evacuation. Independent Oversight reviewed design, maintenance, and test documents for key systems; reviewed building emergency plans and response procedures; interviewed cognizant personnel; and performed walkdowns of the facility. Key systems of interest included communications, power supplies, and facilities and equipment used to perform protective actions, such as assembly stations, shelters, accountability mechanisms, ventilation system controls, and safe shutdown protocols.

The CMR facility was designed under the 1949 Uniform Building Code and was completed in 1952 as a research facility for analytical chemistry and plutonium, and uranium metallurgy. CMR is classified as a hazard category 2 nuclear facility, with principal hazards from radionuclide samples and decontamination activities as well as radioactive materials in storage. Due to CMR's aging structure, LANL reduced the risks associated with the facility by performing facility upgrades and restricting CMR operations over the years. Three of the six laboratory wings in the facility are no longer operational. Despite these risk reduction efforts, the CMR facility is beyond its design life and does not meet current seismic standards and safety requirements. LANL is currently operating CMR on a "run-to-replacement" approach in anticipation of the completion of the CMR Replacement project. (NNSA did not request funding for the CMR Replacement project in the FY 2013 budget and proposes deferring construction for another five years.)

CMR has minimal backup power capability to power critical loads and depends on the reliability of the site's normal power supply system. Backup power capabilities are limited to small ML-4 designated UPS units installed throughout the facility to provide power to critical loads. CMR does not have a fixed generator or a receptacle to install a mobile generator. Critical CMR loads are systems used to convey instructions to workers, provide emergency lighting to find exits, and conduct a timely accountability of personnel. They consist of:

- Badge readers for emergency personnel accountability
- Fire alarm system
- Facility control system (monitoring only)
- Emergency lighting
- Emergency notification paging system
- Public address.

The two most significant systems that would not operate during a loss of normal power are the exhaust ventilation systems and, to a lesser extent, the continuous air monitors. The exhaust ventilation systems are safety significant systems used to maintain cascading pressures from exterior rooms to interior rooms to gloveboxes and then out through filtered exhaust. The loss of exhaust ventilation systems could result in radioactive material contamination migrating in an undesirable direction. In addition, the loss of continuous air monitors removes the capability to detect airborne radioactive contamination and alert personnel of the hazard.

Testing and maintenance of CMR UPS units confirm that batteries are sufficient to evacuate personnel and perform personnel accountability, but UPS testing is not performed to meet industry standards for life safety systems. LANL designated the CMR UPS units as ML-4 systems that undergo the minimum set of tests. An outside vendor tests all CMR UPS units except the fire monitoring and alarm panel, using the manufacturer's recommended tests and inspections. LANL performs the fire alarm control panel test and inspection, and performs battery surveillances on stationary batteries, such as those used for backup power for emergency lighting and badge readers. LANL expects the fire alarm control panel UPS unit to last 24 hours and the facility control panel UPS unit to last 1.5 hours after a loss of normal power based on the system design and performance tests. Additionally, the UPS units are equipped with self-diagnosis features that provide trouble alarms that CMR personnel can respond to using response procedures. Nevertheless, the test and inspection regimen does not include a service test to determine whether the system can carry the required load for the required amount of time. (See Section 4.3.2, **OFI 3-2**.)

CMR has prepared a *CMR FERP* to establish the general facility emergency response actions and to train all facility employees on how to respond to emergencies. The *CMR FERP* informs employees of the spectrum of plausible CMR emergencies, explains how employees would be notified of emergency conditions, and provides instructions for performing protective actions and personnel accountability. The one natural phenomena event included in the *CMR FERP* is an earthquake. The *CMR FERP* directs employees to exit the facility as soon as the shaking from the earthquake stops; this action is consistent with the CMR *Operations Center Alarm/Emergency Response Instruction* (CMR-AERI-001), which instructs operations center personnel to sound the building evacuation alarm after feeling or being notified of an earthquake. LANL maintains its readiness to execute the *CMR FERP* by assigning an Emergency Planning and Preparedness Specialist with specific tasks that include maintaining the procedure, ensuring that the FERP is executable, and training the facility employees. Also contained in the FERP are instructions for facility occupants regarding evacuation routes, outside assembly station locations, shelter-in-place locations and actions, stay-put actions, and personnel accountability protocols.

LANL has developed a nearly complete set of planning documents to enable facility personnel, site-level responders, and the LAFD to make a timely and effective emergency response at CMR. The *CMR FERP*, the *CMR Emergency Response Operations* procedure (CMR-AERI-003), and the *Operations Center Alarm/Emergency Response Instruction* establish the local response actions for CMR events through mitigating small events or by integrating with the site ERO. The CMR procedures also define three CMR response teams – a facility incident command (FIC) team, a medical response team, and a spill response team – and identify the team membership, establish training requirements, describe roles and responsibilities, and identify emergency response facilities, equipment, and their designated locations. For external responders, the LANL building hazards run sheets, the *LANL CMR Complex Response Guide* (EPP-RES-001), and the LAFD CMR Pre-Incident Plans provide facility-specific information, such as building access points, protective gear required for entry, facility maps, fire water connection locations, detection and protection systems, hazards, occupancies, communication and response equipment within the facility, contact information for building managers, and assembly station locations. Missing from this extensive list are utility cutoff locations, which could be helpful for those not familiar with the facility. (See Section 4.3.2, **OFI 3-6**.)

The CMR facility and equipment adequately support the emergency response capabilities specified in procedures. CMR is equipped with an emergency notification paging system, a public address system, and electronic message boards to inform employees of protective actions. Operators can enhance shelter-in-place effectiveness by shutting down the building ventilation using local switches in the building basement and attic. CMR has five shelter-in-place areas within the facility and two designated assembly stations, one for personnel in street clothing and one for personnel in anti-contamination clothing. Muster areas are equipped with badge readers to perform personnel accountability. Equipment and supplies needed to shelter-in-place facility personnel and outfit the FIC, medical response, and spill response teams undergo monthly surveillances using the *CMR Facility Emergency Response Equipment Surveillances and Management* procedure (CMR-ASI-017) to ensure that storage cabinets have not been tampered with and confirm that equipment is in place and operable. At least twice a year, CMR personnel open the storage cabinets and perform a complete inventory of the contents.

The *CMR Operations Center Alarm/Emergency Response Instruction* serves as the facility safe shutdown procedure and is highly dependent on the expertise of the workers. If time does not permit the completion of safe shutdown activities, employees can immediately evacuate without serious consequences due to the nature of the operations, the confinement barriers used while performing work, and the small MAR quantities. Some radioactive material could migrate to undesirable areas, but of greater concern to facility managers are the wet pipe systems that could freeze if there were a loss of heating steam during cold weather.

Overall, LANL has reduced the risks associated with the CMR facility through facility upgrades, restricted operations, and termination of activities in some of the wings. Further, CMR and site-level emergency planners are prepared to respond to natural phenomena events so that personnel are protected and consequences are minimized. However, the CMR facility is beyond its design life expectancy and is not constructed to withstand current natural phenomena design standards. The CMR facility depends on the reliability of the site's normal offsite power supply, with a minimal backup power capability that is limited to UPS units and stationary batteries for some critical loads. Testing of backup power systems is minimal.

Technical Area 55 Plutonium Facility

Independent Oversight reviewed the TA-55 PF-4's documented capability to withstand analyzed severe natural phenomena events and its ability to receive protective action information, implement planned protective actions, and conduct and report personnel accountability after a facility evacuation. Independent Oversight reviewed design, maintenance, and test documents for key systems and building emergency plans and response procedures; interviewed cognizant personnel; and performed walkdowns of TA-55 equipment and areas supporting PF-4 emergency plans. Key systems of interest included communications, power supplies, and facilities and equipment used to perform protective actions, such as assembly stations, shelters, accountability mechanisms, ventilation system controls, and safe shutdown protocols.

PF-4, approved for plutonium operations in April 1978, is a reinforced concrete structure that LANL designed and constructed using the Uniform Building Code applicable at the time of construction. Periodically, building codes are updated with new design basis earthquakes based on recent studies. LANL has performed facility upgrades over the years to stay current with changes in design standards, including recent seismic upgrades to meet a new performance category 3 criterion of 0.52 peak acceleration from an earthquake; seismic response data had indicated that PF-4 would not meet the new criteria and modifications would be necessary. LANL completed installation of seismic upgrades at PF-4 for the new criteria while PF-4 is operated under a justification for continued operation to reduce risk.

LANL will operate PF-4 under the justification for continued operation until LANL can confirm with an analysis that the modifications meet the new performance category 3 criteria. PF-4 is classified as a hazard category 2 nuclear facility and the principal hazards are from plutonium processing and storage.

PF-4 has a reliable power distribution system. The power system consists of two offsite feeds, two EDGs, and two redundant UPS systems. The power distribution system meets seismic performance category 2 criteria and is a LANL ML-2 designated system. PF-4 also has a receptacle for installation of a mobile generator. One fixed EDG is rated for 1000 kW and the other for 750 kW. The power load for PF-4 is currently at 280 kW. LANL sized the UPS systems to provide continuous power to critical loads for up to 2 hours in case both EDGs fail to start. Critical PF-4 loads powered by the EDGs include:

- Ventilation system
- Criticality alarm system
- Paging system
- UPS systems.

Critical loads on the PF-4 UPS include:

- Criticality alarm system
- Paging system
- Facility control system
- Ventilation system
- Stack continuous air monitoring system
- Tritium stack monitors
- Accelerographs (seismic switches) for the electrical distribution system bus ducts.

In addition, dedicated batteries provide backup power for the PF-4 emergency lights and badge readers.

The ventilation system is the most significant system that would not operate during a loss of normal power because it is part of the PF-4 confinement system used to maintain cascading pressures from rooms to the gloveboxes. The facility control system and instrument air system are also needed for complete operability of the confinement system. The most significant consequences during a loss of confinement are from the plutonium heat sources. LANL recently placed the plutonium heat sources in safety class containers that will not rupture when overheated even if stored in air, in case there is a loss of the water normally provided for cooling.

LANL mostly uses criteria that are consistent with NFPA Standards 110 and 111 to test the PF-4 EDGs and UPS systems as NFPA level 2 equipment. EDGs are tested monthly using the TA-55 *Diesel Generator Monthly Surveillance* test procedure (TA-55-STP-801). Key features of the monthly test include automatic EDG starting, testing of the automatic transfer switch, and loading and running the EDG for at least 60 minutes with at least a 720-amp load. LANL tests the UPS systems using the TA-55 *UPS Voltage Check and Functional Load Test* procedure (TA-55-STP-204). The UPS test satisfies a technical surveillance requirement that specifies monthly verification of the proper UPS output voltage to the criticality alarm system and biennial performance verification of a 2-hour service test with the criticality alarm system loaded. In addition, LANL inspects, tests, and maintains the PF-4 batteries for such systems as the badge reader and emergency lighting in accordance with the criteria established for stationary system batteries described in the LANL *Conduct of Maintenance (P950) Operations and Maintenance Manual*. Although these tests verify that the most important features are functional, LANL does not perform additional tests such as hot and cold EDG starts, UPS failure mode testing, and full load

testing. Further, LANL has not performed a mobile generator installation test at PF-4. (See Section 4.3.2, **OFI 3-2**.)

LANL has prepared a nearly complete *TA-55 Emergency Plan* (TA-55-Plan-007) to establish the general area emergency response actions. The TA-55 plan is implemented for PF-4 personnel via *TA-55 PF-4 Emergency Procedures* (TA-55-AP-086) and for the remaining TA-55 personnel via *TA-55 Emergency Procedures*. These procedures serve as the basis for training TA-55 personnel. The procedures describe the spectrum of emergencies that can affect TA-55 including earthquakes, wildland fires, and severe storms. The procedures also describe the building alarms, explain how employees would be notified of emergency conditions, and provide instructions for performing protective actions and personnel accountability. The most significant natural phenomena event at TA-55 is an earthquake. The procedure directs employees to exit buildings as soon as the shaking from the earthquake stops; this action is consistent with the *TA-55 Alarm/Emergency Response Instruction* (TA-55-AERI-001), which requires verification of an orderly exit from PF-4. LANL maintains its readiness to execute the TA-55 emergency response procedures by assigning an Emergency Planning and Preparedness Specialist with specific tasks that include maintaining the procedure, ensuring that the procedures are executable, and ensuring that area employees receive training. Also contained in the procedures are instructions for building occupants regarding evacuation routes, outside assembly station locations, shelter-in-place locations and actions, and personnel accountability protocols. The protocol for personnel accountability at PF-4 applies a positive accountability process using the badge reader. Accountability for all other TA-55 personnel applies a negative accountability process in which the evacuees inform the FIC Accountability Officer if any employee's whereabouts are unknown. (See Section 4.3.2, **OFI 3-7**.)

LANL has developed a nearly complete set of planning documents to enable facility personnel, site-level responders, and the LAFD to make a timely and effective emergency response at PF-4. The *TA-55 Emergency Plan* and the *TA-55 Alarm/Emergency Response Instruction* established the local response actions for TA-55 events, consisting of either mitigating small events or integrating with the site ERO. The TA-55 procedures also define three TA-55 response teams – a FIC team, a medical response team, and a spill response team – and identify the team membership, establish training requirements, describe roles and responsibilities, and identify emergency response facilities, equipment, and their designated locations. For external responders, the *TA-55 PF-4 Building Hazard Run Sheet* and the *LAFD Pre-Incident Plans for TA-55-004* provide building-specific information, such as access points, protective gear required for entry, fire water connection locations, detection and protection systems, hazards, occupancies, communication and response equipment within the building, contact information for building managers, and assembly station locations. Missing from this extensive list are utility cutoff locations, which could be helpful for those not familiar with the facility. (See Section 4.3.2, **OFI 3-6**.)

The PF-4 facility and equipment adequately support the emergency response capabilities specified in plans and procedures. The PF-4 facility is equipped with an emergency notification paging system and a public address system to inform employees of protective actions. Operators can enhance shelter-in-place effectiveness by shutting down the building ventilation from the Operations Center. PF-4 has one shelter-in-place area (Building PF-3) and two designated assembly stations, one for personnel in street clothing and one for personnel in anti-contamination clothing. Muster areas are equipped with badge readers to perform personnel accountability. Equipment and supplies needed to shelter-in-place and outfit FIC, medical response, and spill response teams undergo monthly and quarterly surveillances using the *Monthly Emergency Preparedness Surveillance (Outside PF-4)* procedure and *Quarterly Emergency Preparedness Surveillance* checklists to ensure that storage cabinets have not been tampered with and confirm that equipment is in place and operable. At least twice a year, TA-55 personnel open the storage cabinets and perform a complete inventory of the contents.

The *TA-55 Alarm/Emergency Response Instruction* serves as the facility safe shutdown procedure and is highly dependent on the expertise of the workers. If time does not permit the completion of safe shutdown activities, employees can immediately evacuate without serious consequences due to the nature of the operations, the confinement barriers used while performing work, the form of the material, and the small MAR quantities. Some radioactive material could migrate to undesirable areas. For an earthquake event, the instruction provides specific directions on how to mitigate the consequences in case of breaches in the confinement system or leaks in the fire suppression system.

Overall, PF-4 is a robust facility that was constructed and maintained to withstand current natural phenomena design standards. LANL has recently installed modifications to upgrade PF-4 to meet a new design basis earthquake, but the seismic evaluation has not yet been completed to confirm that the upgrades will meet the new performance category 3 criteria. PF-4 has a reliable electrical distribution system that is adequately tested. Further, TA-55 and site-level emergency planners have prepared responses to natural phenomena events that ensure protection of personnel and minimize consequences. However, no positive means of personnel accountability is provided for TA-55 personnel outside of PF-4.

Protective Force

Independent Oversight reviewed the protective force response capabilities that are critical for response to an emergency caused by a severe or catastrophic natural phenomena event. Independent Oversight also reviewed the protocols used by offsite law enforcement for LANL events.

Overall, the protective force response capabilities are adequate for initial response to severe or catastrophic natural phenomena events; however, limitations in short-term recovery planning for severe and catastrophic events were noted. SOC provides the operational and manpower elements for the protective force, while LANS provides the planning and oversight elements. SOC organizes the protective force in shifts, with each shift under the supervision of a commander. Each shift contains all of the disciplines necessary for a full security response, including access control personnel and Special Response Team personnel. The protective force works under various agreements with Federal, state, and local law enforcement agencies (LLEAs) to ensure effective integration of supplemental personnel, equipment, and capabilities. Currently, an MOU is in effect between LASO Security and the LAPD for mutual assistance and incident response resolution. A new MOU related to offsite pursuit and recovery between LASO Security, the New Mexico State Police, and the LAPD is pending. This MOU replaces seven cancelled MOUs with surrounding LLEAs. LANL does not intend to use LLEAs to provide supplementary personnel inside the Protected Areas during an emergency event, so there are no pre-planned protocols with offsite agencies for support to the protective force. The MOU between LASO Security and the LAPD contains some minimal planning regarding the Federal Bureau of Investigation; however, there is no documented planning that defines roles, responsibilities, logistical requirements, and procedures to be used during an event at LANL that requires Federal Bureau of Investigation intervention. Lastly, although LANL has recently begun planning for reconstituting the site after a severe or catastrophic event, no written response plan has been developed to guide security operations after a catastrophic event with severe consequences. (See Section 4.3.2, **OFI 3-8**.)

Overall, the protective force is ready to provide full security services and integrate supplemental law enforcement personnel in case of a severe natural phenomena event or catastrophic event. However, there is no written response plan to guide security operations after a catastrophic event with severe consequences.

4.3.2 Opportunities for Improvement

OFIs result when an Improvement Item identifies a practice where criteria are generally met, and the performance objective for a particular program element is being achieved, but performance could be improved or made more efficient by adopting DOE or industry practices. These recommended enhancements are referred to as OFIs.

This Independent Oversight review identified the following OFIs. These potential enhancements are not intended to be prescriptive or mandatory. Rather, these OFIs are offered to the site to be reviewed and evaluated by the responsible line management and accepted, rejected, or modified as appropriate, in accordance with site-specific emergency management program objectives and priorities.

OFI 3-1: To ensure that a mobile generator is available and able to connect and power EOC loads, consider performing a functional test of this capability.

OFI 3-2: To further ensure the reliability through testing of equipment used for life saving activities, consider upgrading the ML designations at CMR and the EOC and expanding the UPS testing at CMR and PF-4 for the systems that protect personnel. Specific equipment to consider includes:

- Fire monitoring and alarm systems UPS
- CMR facility control system UPS, emergency lighting UPS, exhaust ventilation system power sources, and continuous air monitor power sources
- PF-4 UPS and EDGs
- EOC EDG, automatic transfer switch, and UPS.

OFI 3-3: To strengthen the EO-EM Group testing of EOC equipment, consider:

- Adding the tests of the SWANS radios to the *Notifier Levels I, II, III* EPIP (ERO-EPIP-160).
- Adding the quarterly tests of WebEOC to the *EOC Emergency Equipment Operations and Testing* EPIP.

OFI 3-4: To ensure the accuracy of the graphic displays using Depiction during emergency events, consider:

- Developing an EPIP to address responsibilities, requirements, and operations.
- Revising the pre-loaded EPHA consequence analyses when EPHAs are updated.

OFI 3-5: Consider developing a radiation survey equipment checklist and performing periodic inventory checks to ensure that necessary emergency equipment and supplies are readily available during emergency events.

OFI 3-6: To further enhance the building hazards run sheets and emergency response guides, consider adding the location of utility cutoff valves.

OFI 3-7: To strengthen the personnel accountability process at TA-55 (except PF-4), consider implementing a positive accountability system that incorporates building occupant rosters and supervisor/managers for determining if personnel in the area are missing.

OFI 3-8: To strengthen response and short-term recovery activities for a severe or catastrophic event at LANL, consider:

- Expanding the definition of a severe event to include catastrophic events caused by natural phenomena, manmade disasters, and terrorism that result in severe consequences.
- Incorporating critical planning objectives for a severe event response, that include saving lives, safeguarding and securing special nuclear material, protecting public health and safety, restoring critical infrastructure and critical services, and mitigating future property and environmental damage.
- Increasing the depth and scope of severe event planning to provide the operational framework for implementing the security response strategies contained within the site emergency plan.
- Including planning provisions to facilitate the integration of state and Federal resources and capabilities in support of a site response to a severe mass casualty/evacuation event.

4.4 Objective 4: Offsite Response Interfaces

The site's planning is adequate for obtaining and integrating offsite response assets for events beyond the site's response capability.

4.4.1 Discussion

Independent Oversight reviewed the site's planning and interactions with offsite response authorities and organizations responsible for protecting the public and augmenting site response resources. Further, this review looked at the routine dialogue and interfaces with organizations needed to establish and maintain emergency response roles, responsibilities, capabilities, and information needs, consistent with the requirements of the National Incident Management System (NIMS). Independent Oversight also examined written support agreements with offsite response agencies and organizations, evaluated related response plans, and assessed the adequacy of response and short-term recovery procedures after a severe or catastrophic event.

Offsite Interactions

The *LANL and LASO HAZMAT Program Emergency Plan* (EO-DO-PLAN-100) documents a clear and comprehensive understanding of required offsite relationships and includes detailed listings of Federal, state, and local response organizations with emergency response or regulatory control responsibilities relevant to LANL; however, some issues related to offsite field monitoring were noted. LANL invites these organizations to participate in site-level exercises designed to test offsite interfaces and capabilities and regularly incorporates offsite participation in exercises, including:

- One functional exercise in FY 2009
- One state-only evaluated functional exercise at the Material Disposition Area B in FY 2010
- One functional exercise in FY 2011
- Two exercises to date in FY 2012.

Likewise, LANL holds regular interface meetings with offsite response organizations to exchange information and address any response issues before an emergency occurs. LASO and LANS are members of the Los Alamos County Local Emergency Planning Committee, which also includes representatives from Los Alamos County, the U.S. Forest Service, the National Park Service, and local emergency volunteer groups. The committee meets to review, analyze, and discuss emergency planning, preparedness, and response issues. In addition, the Los Alamos Public Safety Association meets monthly

to discuss emergency response issues related to Los Alamos County. Members include personnel from LASO, LANS, Los Alamos County, the LANL protective force, and local representatives of several Federal agencies. Furthermore, the Interagency Wildfire Management Team meets every two weeks to discuss fire response issues related to wildland-urban interface. Members of the team include the National Park Service, the U.S. Forest Service, LANS, LASO, and Los Alamos County.

The EO-ER Group also provides HAZMAT emergency response support to the surrounding communities, based on available resources at the time of request. Examples of LANL support during the past three years include:

- Hazardous Device Team training activities for Federal, state, and local organizations (39)
- HAZMAT training activities for Federal, state, and local organizations (15)
- HAZMAT responses to the surrounding communities (15)
- HAZMAT community outreach activities (10).

Offsite authorities are aware of the availability of assistance from many of the DOE/NNSA national assets. The most visible asset is the Region 4 Radiological Assistance Program (RAP), which covers five states and participated in 44 different offsite interactions during the last two years, including:

- Radiological response training for Civil Support Teams who assess suspected weapons of mass destruction attacks
- Participation in several DOE/NNSA exercises involving integration of RAP with the State of New Mexico assets
- Participation in a Kansas nuclear power plant emergency exercise
- Radiological and nuclear security support for several significant and high profile events held within Region 4
- Coordination with the State of New Mexico on several actual events.

The *DOE Region 4 RAP Response Plan* emphasizes that the primary responsibility for an emergency or incident involving radioactive material remains with the party having custody of the material. The plan provides the preferred way to activate RAP in response to an NNSA-related event; a request from LANL; a request by another Federal agency; or request by a state, tribal, or local government. After an incident involving the offsite release of radiological materials from the LANL site, either LANL or the State of New Mexico can request RAP assistance. Notably, Los Alamos County stated that when radiological field monitoring is needed, the county expects the LANL EOC to facilitate activation of RAP as the primary offsite monitoring capability, which may include the 13-person RAP team located at LANL. However, written guidance does not define how the LANL DEM processes local requests for RAP assistance, including how to request an NNSA asset before the LANL EOC is operational. (See Section 4.4.2, **OFI 4-1**.) Of less significance, the State of New Mexico Department of Homeland Security and Emergency Management is not familiar with a key DOE asset, NARAC, which is a consequence assessment model that provides rapid predictions of the transport, diffusion, and deposition of radionuclides or other toxic materials released into the atmosphere and dose projections for people and the environment.

Most importantly, LANL and the state do not have offsite FMTs. Additionally, LANL has no written plan or procedure that defines how the Laboratory accomplishes offsite monitoring of actual or perceived offsite radiological and chemical hazards and risks to the public and the environment. Furthermore, there is no protocol or procedure that integrates LANL field monitoring concepts of operation with other potential monitoring teams, which may include State of New Mexico agencies, the New Mexico National

Guard 64th Civil Support Team, the DOE Region 4 RAP, EPA Region VI, or other Federal agencies. (See Section 4.4.2, **OFI 4-2**.)

Overall, LANL appropriately interacts with offsite response agencies and organizations capable of augmenting site response resources. However, LANS has not developed an offsite monitoring capability for radiological and chemical releases.

Support Agreements

LANL has planned and prepared for the integration of offsite response assets as part of the ERO structure. The *LANL and LASO HAZMAT Program Emergency Plan* describes and identifies the mechanisms for integrating local agencies and other external organizations; however, further clarification on mutual aid and emergency response is needed with Los Alamos County. The integration mechanisms include policy letters and agreements and MOUs between DOE and external agencies. Local agencies entering into agreements include area hospitals, LAFD, and LAPD. State agencies operating under agreements include the New Mexico State Police, the State Office of Emergency Management, and the State Fire Marshal. LANL also has agreements with Federal agencies other than DOE that are within or near the LANL emergency planning zone, such as the U.S. Forest Service, the Bureau of Land Management, and the National Parks Service.

Other support agreements are in place to identify the resources, the onsite personnel authorized to request offsite resources, and the offsite individuals authorized to implement the arrangement. In accordance with the *LANL and LASO HAZMAT Program Emergency Plan* and other site response documents, the DEM or LAFD Battalion Chief makes most requests for assistance. Appropriate protocols are in place and routinely tested by LANS to acquire needed support from response agencies and organizations. For example, LANS maintains up-to-date listings of pre-designated offsite points of contact, including organizations, names, and telephone numbers. Additionally, LANL benefits from a statewide MAA with all government entities, widely referred to as the *Intrastate Mutual Aid Act* (Chapter 12-10B). This act makes it unnecessary for LASO and LANS to execute mutual assistance agreements with all potential offsite response organizations, though it does not prohibit such agreements if needed.

LASO shares responsibility with LANS for the initiation, maintenance, renewal, and writing of MOUs, memoranda of agreement, MAAs, institutional agreements (IAs), and joint powers agreements (JPAs) directly related to emergency management, emergency response, and law enforcement. The Laboratory notifies tribal organizations of events that could affect their area or people, although LANL has no stand-alone MOUs with any tribes. Current LANL agreements include:

- MOU between LASO and LAPD for mutual assistance and for incident response and resolution
- MOU between LASO and the State of New Mexico concerning HAZMAT mutual assistance and response
- IA between LANS and Los Alamos County for operation of the CDC in Los Alamos County
- MOU between the U.S. Forest Service, the National Park Service, and LASO for assistance with wildland fire mitigation during wildland fire season.

In addition, LASO established an MOU between LASO and the Los Alamos Medical Center for mutual assistance and emergency support, including the acceptance and treatment of radiologically, chemically, or biologically contaminated, or potentially contaminated, injured patients from LANL. The Los Alamos Medical Center is the closest major hospital to LANL and is the primary hospital that would treat injured personnel. The emergency department staff handles arrangements for transferring patients who need treatment beyond what is available locally. If a mass-casualty incident occurs at LANL, the Los Alamos

Medical Center coordinates with other area hospitals to transfer and subsequently treat patients, depending on the type of injury and extent of contamination.

Similarly, LASO has MOUs with St. Vincent Regional Medical Center, Española Hospital, and University of New Mexico Hospital (UNMH) for mutual assistance and emergency support, including the acceptance and treatment of radiologically, chemically, or biologically contaminated, or potentially contaminated, injured patients from LANL. UNMH, located in Albuquerque, New Mexico, is the nearest level 1 trauma center, and St. Vincent Hospital, located in Santa Fe, is the nearest level 3 trauma center. Both hospitals are accessible by ambulance and medical helicopter, although the ground transportation time to the St. Vincent Medical Center is approximately 45 minutes and to the UNMH trauma center is expected to exceed 90 minutes. Several air ambulance services are available for LANL patient transport to UNMH and St. Vincent Medical Center, depending on flight weather conditions.

LAFD has six ambulances to cover EMS needs within the county and LANL. Los Alamos County does not have a formal MAA with the adjacent counties for EMS support, nor have agreements been established with adjacent counties for response to LANL. However, when local government has exhausted its EMS resources (e.g., personnel and ambulances), the New Mexico State EOC can assist local officials with deployment of additional resources. In addition, the New Mexico Department of Health coordinates with local governments, as necessary, for other resources (e.g., ambulances or medical helicopters) located outside the initial response region. Nonetheless, LAFD does not rely on any additional ambulance support within the first hour of a response.

Several important agreements have expired or have been cancelled without comparable planning documents being issued. These agreements covered critical areas of emergency response and recovery that could limit the effectiveness of some emergency response activities with local agencies and organizations. For example, an MOU with the New Mexico State Police has not yet been signed to replace the MOU with LAPD for offsite pursuit and recovery (expired July 27, 2010) or six other cancelled MOUs with surrounding LLEAs. In addition, the agreement with Los Alamos County for mutual aid and emergency response expired on April 23, 2010, leaving uncertainty regarding cooperation and coordination during emergency events within Los Alamos County, including the county's use of the EOC and other support services. Importantly, LASO recognizes the need for a new agreement that clarifies the simultaneous use of the EOC by LANL and Los Alamos County (discussed further under Offsite Response Planning, below), offsite HAZMAT response, and offsite radiological emergency response, which were not clear in the previous agreement. LASO has attempted to reach a new agreement with the county but has not been successful. (See Section 4.4.2, **OFI 4-3**.)

Overall, LANL has planned and prepared for the integration of offsite response assets as part of the ERO structure. However, the expiration or cancellation of a few important offsite agreements could limit the effectiveness of some emergency response activities during a severe or catastrophic event.

Offsite Response Planning

The Laboratory documents existing provisions for interfacing and coordinating with Federal, state, and local agencies responsible for offsite emergency response in the *LANL and LASO HAZMAT Program Emergency Plan*. An overarching factor in response planning is the location of LANL, which is in a remote area of New Mexico where the only significant developments in Los Alamos County are the Laboratory facilities and the associated residential communities and commercial areas. Consequently, any mutual aid responders would likely require an hour or more to respond to a LANL event, given that adjoining portions of Sandoval, Rio Arriba, and Santa Fe counties are underdeveloped. In general, very limited planning and coordination, specific to LANL events, is documented among LASO, LANS, the State of New Mexico, and Los Alamos County. A severe event is likely to affect both the site and the

surrounding community, exacerbating the need to use scarce assets in the most prudent manner to accomplish national response priorities (safety of human life, stabilizing the situation, and minimizing adverse impacts on the environment). The *State of New Mexico All-Hazard Emergency Operations Plan (EOP)* provides the State of New Mexico's planned responses to all hazards identified in the hazard identification and risk assessments found in the *New Mexico Natural Hazard Mitigation Plan* and the *New Mexico Human Caused Hazard Mitigation Plan.* Further, the EOP defines the roles and responsibilities associated with the mitigation, preparedness, response, and recovery efforts directed at natural disasters, manmade hazards, attacks, and other catastrophic events that affect the State of New Mexico.

The *State of New Mexico All-Hazard EOP* also includes a Catastrophic Incident Appendix, which describes the state's approach for responding to catastrophic disasters. The state considers a catastrophic event as any natural or manmade incident, including terrorism, that results in extraordinary levels of mass casualties; evacuations of whole regions; or damage or disruption severely affecting the population, infrastructure, environment, and/or government functions. The appendix provides a basis for State of New Mexico departments, agencies, and offices having emergency functions to formulate supporting procedures. Additionally, the appendix makes a key assumption that during a catastrophic incident response, the Federal government will work to ensure the rapid and efficient delivery of resources and assets, including special teams, equipment, and supplies that provide critical lifesaving support and incident containment capabilities. In addition to the EOP, the *State of New Mexico Department of Homeland Security and Emergency Management Disaster Recovery Plan* provides guidance for coordinating state support to local and tribal governments, non-government organizations, volunteer agencies, and the private sector to enable community recovery from short-term and long-term disasters. The plan outlines state recovery responsibilities and coordination with Federal agencies during recovery operations, as well as outlining certain Federal recovery programs.

The *County of Los Alamos All-Hazard EOP* describes how Los Alamos County will address emergencies and disasters within its jurisdiction, including the Laboratory. The plan assigns responsibilities for emergency preparedness and planning and for coordinating emergency response activities before, during, and after emergencies. Significantly, the plan identifies the LANL EOC as the primary EOC for the county, suggesting that both the county and LANL can concurrently use the same facility to focus on response actions distinct to each without adversely affecting individual response decisions and actions. The alternate county EOC is located in the LAPD facility.

Wildland fires are an expected event at the Laboratory and are routinely identified in authorization basis documents as an 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: the Water Canyon Fire in 1954, the La Mesa Fire in 1977, the Dome Fire in 1996, the Oso Fire in 1998, the Cerro Grande Fire in 2000, and the Las Conchas Fire in 2011. As a result, LANL has completed significant planning for wildland fires with Federal, state, and county agencies. Most importantly, LASO entered into a JPA, renewed in 2008, with the State of New Mexico Energy, Minerals, and Natural Resources Department (EMNRD) 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 EMNRD and Los Alamos County further documents the commitment to wildland fire suppression and interagency cooperation. Important aspects of the JPA related to LANL include the following:

- The respective Federal agencies are responsible for wildland fire protection on lands under their jurisdiction.
- Federal agencies can request National Guard assistance for wildland fires only through the EMNRD, 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 JPA.

LASO management was not aware of the Lead Federal Manager concept for emergency response, as promulgated in a March 24, 2003, memorandum from the Deputy Secretary of Energy. That memorandum designated the Sandia Site Office Manager as the Lead Federal Manager for situations in the state of New Mexico that may involve the resources of the entire state. The designation was intended to eliminate confusion among state and regional officials regarding who represents the DOE/NNSA during emergencies, although there is no agreement with LASO to implement the concept.

Overall, the Laboratory documents appropriate provisions for interfacing and coordinating with Federal, state, and local agencies responsible for offsite emergency response. Additionally, LANL has completed noteworthy planning for wildland fires with Federal, state, and county agencies.

Response and Recovery Operations

LANL appropriately uses hazards surveys, EPHAs, and other technical basis documents to identify the requisite skills and disciplines needed for mitigation of most emergency events at the Laboratory; however, Independent Oversight noted limitations in response and short-term recovery planning for severe and catastrophic events. The LANL Emergency Plan captures the concept of operations that the DEM and other key on-shift personnel immediately transition to an ERO after an operational emergency is declared. The DEM serving as the interim Emergency Director (ED) has full authority and responsibility to implement the emergency plan during the response to an operational emergency. Procedures, desk aids, and checklists require the DEM either to initially perform or to oversee the following minimum functions:

- Detect or assess the emergency event or conditions.
- Categorize and classify (as necessary) the emergency event or conditions.
- Perform initial notifications.
- Implement onsite protective actions.
- Issue offsite protective action recommendations.
- Initiate response by appropriate emergency resources (such as fire, rescue, medical, security, HAZMAT personnel, and mutual aid).

The DEM transitions to become the IC to direct the tactical response at the event scene, transferring the ED function to the EOC when operational. Typically, the LAFD Battalion Chief and the lead SOC protective force officer form a unified command (UC) with the IC to manage and control all response activities at the event scene. The UC coordinates the activities of multiple response elements at the scene (i.e., fire, rescue, medical, spill containment, and mutual aid) and makes on-the-spot decisions. The division of authority and responsibility between the IC and the ED position is clearly established and maintained, allowing the IC to focus on the tactical aspects of the response. Either the IC or the ED can initiate a request for non-Federal offsite assistance. For Federal response, the LASO Manager or the LASO Emergency Directorate Representative makes the request; if they are unavailable, the DEM can directly contact the necessary organizations for assistance. Typically, all non-Federal requests for assistance are made to Los Alamos County, which in turn contacts the New Mexico State EOC to implement the Intrastate Mutual Aid System.

The effectiveness of the LANL Incident Command System and its ability to integrate with external response resources was tested during the Las Conchas Fire in the summer of 2011. Overall, the Las Conchas Fire after-action report concluded that the response was effective in recalling the ERO, declaring an operational emergency, integrating with offsite authorities, operating in the UC structure, notifying employees and authorities, and implementing protective actions, consistent with the requirements of NIMS. The fire significantly tested the LANL ERO's depth and its interfaces with multiple organizations from Los Alamos County, the State of New Mexico, and Federal agencies for more than a week.

A variety of hazards, including earthquakes, manmade accidents, and terrorist activities, may result in the need for urban search and rescue (USAR) and would involve the location, extraction, and initial medical stabilization of victims trapped in confined spaces due to a structural collapse. In this case, LAFD is capable of limited technical rescue involving collapsed structures and maintains a small cache of supplies to support the capability; however, the LAFD is not considered a USAR team. The closest USAR team is New Mexico-Task Force One, a 70-person Federal Emergency Management Agency USAR task force based in Albuquerque, New Mexico, with a publicized 4-hour dispatch time. The New Mexico State EOC would coordinate a USAR response by the task force to LANL.

A baseline needs assessment process performed in accordance with DOE Order 420.1B, *Facility Safety*, using the LANL hazard surveys and EPHAs, determined the necessary onsite fire and rescue support resources. Additionally, the assessment concluded that LAFD is capable of responding to most emergencies at LANL using only LAFD assets. In accordance with the Cooperative Agreement, minimum LAFD staffing levels account for multiple types of events, including an EMS incident in conjunction with a major event response, as well as contingencies for a second incident response. A minimum staffing level of 24 personnel is required for LANL, as calculated in the baseline needs assessment, which considers incident escalation and an incident injury involving contamination. Importantly, Los Alamos County does not have a formal MAA with the adjacent counties for county municipal area fire fighting, nor have agreements been established with adjacent counties for response to a LANL emergency. However, LAFD periodically initiates a few mutual aid requests for response by available adjacent county resources. In turn, LAFD provides mutual aid to the adjoining counties and Federal agencies when requested, limited to resources available at the time of request. As a result, most severe natural phenomena and catastrophic events will likely have only the LANL resources for initial response and short-term recovery operations. (See Section 4.4.2, **OFI 4-4**.)

LANL describes emergency event recovery operations in the *Re-entry and Recovery* EPIP (ERO-EPIP-240), which includes the recovery plan template used by the recovery organization. Recovery planning is routinely tested, and most functional exercises require some degree of recovery plan preparation. However, potential severe and catastrophic events postulated for LANL do not have site/facility-specific catastrophic event response plans and procedures that include short-term recovery plans considering infrastructure damage and outages that may impede the normal response of onsite or offsite responders. (See Section 4.4.2, **OFI 4-5**.) Lastly, LANL has recently begun conducting exercises that focus on severe natural phenomena events but do not postulate severe and catastrophic event consequences that result in significant structural damage or building collapse and generate resource requirements that LANL and the LAFD cannot meet. (See Section 4.4.2, **OFI 4-6**.)

In summary, LANL is located in a remote area of New Mexico where the only significant developments in Los Alamos County are the Laboratory facilities and the associated residential communities and commercial areas. Collectively, the LAFD and LANL emergency response resources constitute the primary response force for emergency events at LANL. Additionally, any mutual aid responders would likely require an hour or more to respond to a LANL event, given that adjoining portions of Sandoval, Rio Arriba, and Santa Fe counties are underdeveloped. LANS uses hazards surveys, EPHAs, and other severe event analyses to establish the offsite response assets that may be needed and has completed

noteworthy planning for wildland fires with Federal, state, and county agencies. However, LANS has not completed planning for response and short-term recovery to a severe natural phenomena or catastrophic event, has not developed an offsite monitoring capability for radiological and chemical releases, and has conducted few exercises focused on the response to a catastrophic event affecting multiple HAZMAT operations and support facilities. In addition, there is minimal planning for how infrastructure damage and outages might affect offsite responders' abilities to support an emergency response to LANL, which under the best of circumstances is already considered excessive by LANL due to the remote location of the Laboratory.

4.4.2 Opportunities for Improvement

OFIs result when an Improvement Item identifies a practice where criteria are generally met, and the performance objective for a particular program element is being achieved, but performance could be improved or made more efficient by adopting DOE or industry practices. These recommended enhancements are referred to as OFIs.

This Independent Oversight review identified the following OFIs. These potential enhancements are not intended to be prescriptive or mandatory. Rather, these OFIs are offered to the site to be reviewed and evaluated by the responsible line management and accepted, rejected, or modified as appropriate, in accordance with site-specific emergency management program objectives and priorities.

OFI 4-1: Consider providing additional guidance to the DEM and LANL EOC related to utilization of RAP resources by:

- Including a notification protocol that defines the process for requesting DOE/NNSA radiological response assets in support of the site, county, or state via the LANL ED.
- Integrating DOE RAP into the LANL EOC ETSC, when requested.
- Planning for a significant offsite monitoring effort that includes a phased response by the Federal Radiological Monitoring and Assessment Center that initially provides a Consequence Management Response Team to augment RAP.

OFI 4-2: To strengthen the offsite field monitoring capability to determine the offsite impacts of a LANL HAZMAT release, consider:

- Establishing a LANL offsite FMT that is initially directed by the LANL EOC.
- Emphasizing the prime objective for offsite monitoring is to verify the absence of an airborne plume and identify the boundaries of the area contaminated with HAZMAT deposition (i.e., bound the plume).
- Ensuring monitoring capabilities include airborne sampling, direct measurement of the radiation dose rate or contamination levels, observation or measurement of chemical contamination, and sampling and appropriate chemical or radiological analysis of air, water, soil, and vegetation.
- Developing standard operating procedures for offsite monitoring that include staffing and assignment of responsibilities, control of field teams, and specific sampling and monitoring protocols to be used.
- Coordinating field monitoring concepts of operation with other potential monitoring teams that may include State of New Mexico agencies, New Mexico National Guard 64th Civil Support Team, DOE Region 4 RAP, EPA Region VI, or other Federal agencies.

OFI 4-3: To ensure continued cooperation and coordination of emergency events at the Laboratory and within Los Alamos County, consider:

- Expediting approval of the new agreement with Los Alamos County for mutual aid and emergency response.
- Ensuring the agreement addresses the multi-use EOC issues, offsite HAZMAT response, and offsite radiological emergency response.
- Conducting emergency exercises, based on the agreement for mutual aid and emergency response, to test concurrent activation, staffing, and operation of the LANL EOC and the Los Alamos County EOC, collocated in TA-69-33.

OFI 4-4: To improve response and short-term recovery reaction times for a severe or catastrophic event at LANL, consider:

- Accelerating the application and delivery of state and Federal resources and capabilities, in accordance with the National Response Framework, by pre-planning likely requests for assistance to scenarios that overwhelm LANL and Los Alamos County emergency response capabilities (e.g., EMS, USAR, fire fighting, HAZMAT response, and field monitoring).
- Developing an incident action plan template for a multi-agency response at the Laboratory that includes a statement of objectives, NIMS/Incident Command System organization, tactics and assignments, and supporting materials (e.g., maps, communications plan, medical plan, traffic plan, and special precautions).
- Predetermining the types of additional resources needed by the site, the availability of those resources, and logistical requirements once the resources arrive at the site.
- Triggering self-help response, which includes the identification of roles and responsibilities, life-saving skills among workers, and locations of medical and life sustaining supplies currently on site.

OFI 4-5: To continue to improve site-specific planning for severe and catastrophic events at LANL, consider:

- Developing a catastrophic event plan, as an appendix to the site emergency plan, for catastrophic events caused by natural phenomena, manmade disasters, and terrorism resulting in severe consequences.
- Integrating the site catastrophic event plan with applicable related state and Federal catastrophic event plans.
- Integrating other site-specific emergency planning documents, as appropriate, as annexes to the emergency plan (e.g., the heightened security conditions response plan or continuity-of-operations plan).
- Including the planning assumptions that these severe and catastrophic events overwhelm site and local response capabilities, adversely impact site safeguards and security measures, cause a long-term outage of critical site infrastructure and systems (e.g., power, water, and communications), and cause secondary events such as fires or landslides.
- Developing facility- or organization-specific emergency response procedures, matrices, or checklists needed to implement the catastrophic event plan. Key site organizations and functions to consider include protective force operations, power and utilities, fire protection, telecommunications, shift operations, and critical facilities/operations.

OFI 4-6: To continue reinforcing the LANL ERO and offsite responder skills and capabilities related to severe and catastrophic events, consider:

- Continuing to include catastrophic event plan scenarios in the LANL drill and exercise program.

- Conducting tabletop exercises with appropriate Federal, state, and local response agencies and organizations that would respond to a catastrophic event caused by natural phenomena, manmade disaster, or terrorism.
- Updating response plans and procedures to reflect information extrapolated from catastrophic planning workshops, drills and exercises, and lessons learned from past disasters.

5.0 CONCLUSIONS

This review focused on a detailed assessment of selected emergency management programmatic elements with an emphasis placed on LANL's processes for identifying emergency response capabilities and maintaining them in a state of readiness to respond to a severe natural phenomena event. Independent Oversight noted numerous positive program attributes demonstrating that LASO and LANS continue to improve LANL's emergency management program and thus ensure that site responders can effectively respond to a wide range of potential initiating events. Although the necessary framework has been established, Independent Oversight identified two findings that indicate specific emergency management requirements are not being met, as well as several OFIs suggesting approaches to further strengthen the emergency management program.

The LANL hazards surveys and EPHAs appropriately identify applicable emergency events and conditions and consider severe natural phenomena events. In addition, the CMR and most of the TA-55 natural phenomena events were appropriately analyzed in their respective EPHAs. Further, LANL uses a documented process to develop EALs.

With few exceptions, LANL provides systems and equipment that are adequately maintained, inspected, and tested. For the most severe natural phenomena events, backup power supplies should allow the implementation of protective actions and enable workers to evacuate buildings. In addition, LANL is well equipped to communicate between emergency response venues and with site workers; the surrounding public; and offsite local, state, and Federal agencies and organizations. Redundant communication systems increase the likelihood that LANL can still perform critical tasks if outages result from a severe natural phenomena event. LASO is actively encouraging improvements through PBIs aimed at resolving several communication system issues. Further, initial and ongoing consequence analyses are conducted using appropriate and approved dispersion modeling software, and the Alternate EOC is equipped to perform consequence analyses. LANL is evaluating the functional needs of the EOC to determine whether a habitability system is needed. Appropriate PPE is available for responders to a severe natural phenomena event, and onsite FMTs are equipped with an adequate quantity of radiation and hazardous chemical detection equipment. Also, LANL is prepared to manage a large-scale contamination event. Finally, the protective force is ready to provide full security services and integrate supplemental law enforcement personnel in case of a severe event.

The EOC is equipped to be self-sufficient for two weeks with backup power supplies, a long-term fuel supply, and a receptacle for a mobile generator installation. An Alternate EOC consisting of two trailers and a mobile generator is also available if needed. LANL's emergency response capabilities at PF-4 and the CMR facility are sufficient to properly implement protective actions and account for personnel except in the case of a severe earthquake. The PF-4 facility (built in 1978) has been updated to meet current natural phenomena design standards and should withstand all but the most severe natural phenomena events. LANL has developed safe shutdown procedures for both facilities in order to minimize the impact of natural phenomena events, such as an earthquake. A few limitations were noted for the CMR and TA-55 facilities. The CMR facility has not undergone recent facility upgrades in anticipation of moving the CMR operations to a new facility. (NNSA proposes deferring construction of the CMR Replacement project for five years.) Although both facilities have well-equipped and trained response teams, the facilities will likely not have viable shelters to implement the planned protective action of

shelter-in-place in case of an earthquake. TA-55 does not have a positive means to ensure personnel accountability for TA-55 personnel outside of PF-4.

LANL is located in a remote area of New Mexico where the LAFD and LANL emergency response resources constitute the primary response force for emergency events. A severe event is likely to affect both the site and the surrounding community, exacerbating the need to use scarce assets in the most prudent manner. LANL has completed some planning to determine the offsite response assets that would be needed and, most notably, completed detailed planning for wildland fires with Federal, state, and county agencies. LANL appropriately interacts with offsite response agencies and organizations capable of augmenting site response resources.

A few areas were identified that diminish the strength of the overall LANL program. Testing and inspections of the electrical distribution system are minimal. In addition, LANL does not test some communication systems equipment and does not have a process to ensure that the consequence analyses contained in the geographic information system are accurate. The onsite FMT does not perform periodic inventory checks to ensure that equipment is available when needed. LANL lacks written plans and procedures to guide security operations, emergency response, and short-term recovery after a severe event; has not developed an offsite monitoring capability for HAZMAT releases; has conducted few exercises involving a catastrophic event at a HAZMAT facility; and has not considered how damage and outages after a severe event might affect the offsite responders' abilities to respond to LANL. Also, a few offsite agreements that are important for a response to a catastrophic event have expired or been canceled.

The EPHA analyses for a TA-55 severe seismic event inappropriately considered all of the radioactive material as releasable, identified over-conservative dose consequences, and complicated protective action decision-making. In addition, significant weaknesses were noted in the set of EALs for the CMR and TA-55 facilities, which contain outdated and incorrect information. In addition, LANL did not base the generic EALs for severe natural phenomena events on the potential for or actual uncontrolled release of HAZMAT or link protective actions or protective action recommendations to these EALs. More importantly, the *Protective Action Guides* EPIP does not include predetermined offsite protective action recommendations with well-defined areas for evacuation and sheltering. Further, the review and approval process for the TA-55 EPHA did not identify that the pre-planned protective action of shelter-in-place for a seismic event could potentially expose onsite workers to high radiation levels if personnel sheltered rather than evacuated.

Overall, LANL has identified plausible scenarios for severe natural phenomena events for analysis in EPHAs. Although some OFIs were identified, LANL has appropriately determined offsite response assets needed and has maintained the site's facilities, systems, equipment, and critical emergency response teams in a state of readiness to deal with a severe natural phenomena event. However, weaknesses were noted in the EALs for the CMR and TA-55 facilities: incorrect information, a lack of protective actions or protective action recommendations for generic severe natural phenomena events, and inappropriate protective actions in case of an earthquake.

6.0 FINDINGS

Findings are used to indicate significant deficiencies or safety issues that warrant a high level of attention on the part of management. If left uncorrected, such findings could adversely affect the DOE mission, the environment, the safety or health of workers or the public, or national security. Findings may also identify aspects of a program that do not meet the intent of DOE policy.

DOE Order 227.1, *Independent Oversight Program*, states that timely and appropriate action to address the findings and other deficiencies identified in HSS Independent Oversight appraisal reports must be taken and corrective action plans must be developed and implemented for Independent Oversight appraisal findings. Cognizant DOE managers must use site- and program-specific issues management processes and systems developed in accordance with DOE Order 226.1B, *Implementation of DOE Oversight Policy*, to manage and track these corrective action plans to completion.

LANL does not have an adequate means for determining quickly whether an event occurring at the CMR facility, a criticality event at TA-55 PF-4 facility, or a severe natural phenomena event at either facility involves a significant quantity of HAZMAT and requires implementation of corresponding onsite protective actions or issuance of appropriate offsite protective action recommendations. Consequently,

F-1: EALs are not adequately developed for the identified spectrum of potential operational emergencies and do not provide planned initial onsite protective actions and offsite protective action recommendations, as appropriate, associated with each generic natural disaster event, as required by DOE Order 151.1C, Contractor Requirements Document, Section 11.

Also, the initial protective action for onsite personnel to shelter-in-place does not correlate with the *CMR FERP* and the *TA-55 Emergency Procedures* and does not incorporate the impact of the projected doses to personnel who remain in place or the loss of shelters due to the seismic event. Additionally, the *Protective Action Guides EPIP* does not include predetermined offsite protective action recommendations, coordinated with offsite authorities, with well-defined areas for evacuation and sheltering.

F-2: LANL has not developed procedures to implement or recommend for implementation, as needed, the separate protective actions of evacuation and sheltering of employees and the public to minimize the consequences of emergencies, as required by DOE Order 151.1C, Contractor Requirements Document, Section 14.

Appendix A
Supplemental Information

Dates of Review

Scoping Visit:	February 28 – March 1, 2012
Onsite Data Collection:	March 12-21, 2012
Validation:	March 22, 2012
Closeout (teleconference):	April 23, 2012

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Appendix B
Documents Reviewed and Interviews

Documents Reviewed

- 69-33-BB Battery Bank Maintenance Work Order Record (Annual), 4/19/11
- 69-33-BB Battery Bank Maintenance Work Order Record (Quarterly), 3/12/12
- 71-0028RK, Instruction Manual Eagle Series Portable Multi-Gas Detector, Rev. E, 9/19/11
- AP-341-502, ML Determination, Rev. 2, 2/24/11
- Chapter 12-10B, Intrastate Mutual Aid Act, 9/06
- CMR-AERI-001, Operations Center Alarm/Emergency Response Instruction, Rev. 7, 2/10/12
- CMR-AERI-002, CMR Facility Emergency Response, Rev. 3, 1/19/12
- CMR-AERI-003, CMR Emergency Response Operations, Rev. 4, 2/10/12
- CMR-ASI-017, CMR Facility Emergency Response Equipment Surveillances and Management, Rev. 2, 10/27/11
- CMR-ASI-075, Fire Alarm Control Panel Test and Inspection, Rev. 0.2, 2/7/2012
- CMR-OSA-00,1 2010 CMR Facility DSA, Rev. 0.1, 8/17/10
- CMR-TSR-002, CMR Facility Technical Safety Requirements, Rev. 0.1, 12/20/10
- County of Los Alamos All-Hazard EOP, 3/06
- Criterion 505, Conduct of Maintenance (P950) Operations and Maintenance Manual, Stored Emergency Power Systems, Rev. 2, 9/20/10
- Criterion 506, Conduct of Maintenance (P950) Operations and Maintenance Manual, Emergency and Standby Power Systems, Rev. 2, 10/11/11
- Criterion 511, Conduct of Maintenance (P950) Operations and Maintenance Manual, Stationary Battery Systems, Rev. 2, 1/3/11
- DE-AI32-06NA27356, Annual Operations Plan – Interagency Agreement FY 2011 for Interagency Wildland Fire Management and Aviation Operations Located at TA-49, 9/29/11
- Decontamination Trailer Weekly Checklist, 2/10
- DE-FC52-08NA28090, Statement of Substantial Government Involvement for Financial Assistance to the Incorporated County of Los Alamos, Rev. A001, 12/8/08
- DNFSB Recommendation 2009-2, LANL Plutonium Facility Seismic Safety, 10/26/09
- DNFSB Recommendation 2010-1, Safety Analysis Requirements for Defining Adequate Protection for the Public and the Workers, 10/29/10
- DOE Guide 151.1-2, Technical Planning Basis, 7/11/07
- DOE Guide 151.1-4, Response Elements, 7/11/07
- DOE Lead Federal Manager Memorandum related to an Emergency Situation at or Near a DOE Field Site, 7/24/03
- DOE Order 151.1C, Comprehensive Emergency Management System, 11/2/05
- DOE Order 226.1B, Implementation of DOE Oversight Policy, 4/25/11
- DOE Order 227.1, Independent Oversight Program, 8/30/11
- DOE Order 420.1B, Facility Safety, 4/19/10
- DOE Region 4 RAP Response Plan, 7/05
- DOE/NNSA FY 2012 Performance Evaluation Plan, PBI No. 8 Safeguards and Cyber Security Improvements, 9/28/11
- DOE/NNSA PBI Briefing PBI 8.2.2, 3/20/12
- DOE-STD-1020-2002, DOE Standard, Natural Phenomena Hazards Design and Evaluation Criteria for DOE Facilities, 1/02
- DOE-STD-3003-2000, Backup Power Sources for DOE Facilities, 1/00
- DOE-STD-3020-97, DOE Standard Specification for HEPA Filters Used by DOE Contractors, 1/97

- EM-AAR-165, June 27, 2011 Fire on LANL Property Resulting from the Las Conchas Wildfire, Rev. 0, 9/8/11
- EM-EPIP-205, EOC Operations, Rev. 1.1, 11/23/10
- EM-EPIP-205, EOC Operations, Rev. 2, 2/15/12
- EM-FORM-009, Operational Emergency Notification Form, Rev. 3.2, 11/28/11
- EM-FORM-038, ED Checklist, Rev. 0, 12/8/08
- EM-FORM-039, Secondary Facilitator Checklist, Rev. 0, 3/11/09
- EM-FORM-045b, Inventory for Alternate EOC (Total), Rev. 0, 2/09
- EM-FORM-052, Schedule of Maintenance and Inspection Requirements, Rev. 0
- EM-FORM-059, Primary Facilitator Checklist, Rev. 0
- EM-FORM-060, ETSC Coordinator Checklist, Rev. 0.1, 1/20/10
- EM-FORM-061, ETSC Staff Checklist, Rev. 0.1, 1/20/10
- EM-FORM-063, Radio Room Coordinator Checklist, Rev. 0.1, 9/4/09
- EM-FORM-065, Operations Section Chief Checklist, Rev. 0.1, 8/24/09
- EM-FORM-073, Logistics Section Chief Checklist, Rev. 0, 8/26/09
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Interviews

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- LAFD Fire Chief
- LAFD HAZMAT Team Lead Lieutenant
- LAFD Safety Officer
- LAFD Training Officer
- LANS CMR Electrical System Engineer
- LANS CMR Emergency Preparedness Coordinator
- LANS CMR Facility Operations Director
- LANS DEMs (3)
- LANS Deputy Emergency Management Group Leader
- LANS Emergency Management Tech V
- LANS EOC Maintenance Coordinator
- LANS EOC Operations Manager
- LANS EOD Leader
- LANS EO-EM Group Leader
- LANS EO-EPP Exercise Coordinator
- LANS EO-EPP Group Leader
- LANS EO-EPP LANL GETS/Wireless Priority Service Point of Contact
- LANS EO-EPP Specialists (3)
- LANS EO-ER Acting Group Leader
- LANS EO-ER Emergency Response Specialist II
- LANS EO-ER FMT Lead
- LANS EO-ER Group Leader
- LANS EO-ER Group Training Coordinator
- LANS Fire Protection Division Leader
- LANS Maintenance and Site Services Manager
- LANS Medical Director

- LANS PF-4 Deputy Facility Operations Director
- LANS PF-4 Electrical System Engineer
- LANS Physical Security Division Leader
- LANS Region 4 RAP Coordinator
- LANS TA-55 Emergency Preparedness Coordinator
- LANS Wireless Team Leader
- LASO Emergency Management Program Manager
- LASO Security Specialist
- Los Alamos County CDC Supervisor
- Los Alamos County Dispatch Shift Supervisor
- Los Alamos County Division Chief
- Los Alamos County Emergency Management Coordinator
- New Mexico Department of Homeland Security and Emergency Management Personnel (4)
- SOC General Manager