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

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Acronyms

AHJ	Authority Having Jurisdiction
BNA	Baseline Needs Assessment
CRAD	Criteria, Review, and Approach Document
DOE	U.S. Department of Energy
EAL	Emergency Action Level
EMG	Emergency Management Guide
EOC	Emergency Operations Center
EPHA	Emergency Planning Hazards Assessment
EPZ	Emergency Planning Zone
ERO	Emergency Response Organization
FRMAC	Federal Radiological Monitoring and Assessment Center
HAZMAT	Hazardous Material
HEPA	High Efficiency Particulate Air
HSS	Office of Health, Safety and Security
LLNL	Lawrence Livermore National Laboratory
MCI	Mass Casualty Incident
NARAC	National Atmospheric Release Advisory Center
NFPA	National Fire Protection Association
NIMS	National Incident Management System
NNSA	National Nuclear Security Administration
NNSS	Nevada National Security Site
NPE	Natural Phenomena Event
PAC	Protective Action Criteria
PAR	Protective Action Recommendation
PORTS	Portsmouth Gaseous Diffusion Plant
RAP	Radiological Assistance Program
REAC/TS	Radiation Emergency Assistance Center/Training Site
UPS	Uninterruptible Power Supply

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1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Enforcement and Oversight (Independent Oversight), within the Office of Health, Safety and Security (HSS), occasionally reviews specific areas of interest at DOE facilities. During calendar year 2013, as follow-up to the 2011 earthquake and tsunami that affected the Fukushima Daiichi nuclear power electrical generating station in Japan, Independent Oversight selected preparedness for responding to plausible severe natural phenomena events (NPEs) at DOE and National Nuclear Security Administration (NNSA) sites as a specific area of interest. Accordingly, Independent Oversight conducted reviews examining sites' preparedness for severe NPEs, including some NPEs that represented beyond design basis events described in DOE/NNSA site documented safety analyses. Although emergency planners at DOE/NNSA facilities traditionally consider that beyond design basis events result in a hazardous materials (HAZMAT) release from a single facility within their sites, these Independent Oversight reviews evaluated the state of preparedness in case of a severe NPE that is capable of damaging multiple facilities, including HAZMAT facilities, command centers, personnel shelters, electrical power sources, and communication systems.

1.1 Report Scope

This report provides lessons learned from the 2013 reviews performed by Independent Oversight. The reviews performed during 2013 were at DOE/NNSA sites with hazard category 2 nuclear facilities, some of which also have significant quantities of hazardous chemicals on site. The reviews were performed at four sites and included a review of the dominant hazards at the site's facilities and primary and alternate command centers. Independent Oversight has published separate reports to document its activities and conclusions for each site reviewed; the reports are available at: http://energy.gov/hss/office-health-safety-and-security.

The purpose of the reviews was to determine the state of emergency preparedness of selected sites by examining the sites' processes for: evaluating plausible severe NPEs; identifying, acquiring, and maintaining site response assets; quickly recognizing when conditions are beyond the site's response capabilities; and quickly and effectively integrating offsite response assets into the site's response. The scope of the reviews covered the emergency management program elements described in DOE Order 151.1C, *Comprehensive Emergency Management System*: technical planning basis; facilities and equipment; training and drill program; offsite response interfaces; termination and recovery; and emergency medical support. Within these program elements, Independent Oversight evaluated the technical basis for planned responses to documented scenarios, the survivability and habitability of structures used to implement planned responses, the reliability of electrical distribution systems and onsite power capabilities for extended operations, the readiness of onsite emergency response equipment for immediate use, the plans and procedures for implementing the training and drill programs and for integrating offsite assets into a site response, and the site's emergency medical support capabilities.

Table 1 identifies the sites, the primary severe NPEs of concern, the dominant type of HAZMAT involved, and the command centers reviewed by Independent Oversight.

Table 1. Sites Reviewed for NPE Preparedness in 2013

Site	Dominant Plausible Natural Phenomena Events	Dominant HAZMAT in Review Scope	Command Centers Reviewed
Lawrence Livermore National Laboratory (LLNL)	Earthquake	Plutonium and Chemicals	Emergency Operations Center (EOC); Alternate EOC; Alameda County Regional Emergency Communications Center; Department Operations Centers
Hanford Site	Earthquake; Tornado; Wildland Fire	Plutonium and Transuranic Waste	EOC; Alternate EOC; Hanford Fire Station 92; Patrol Operations Center
Portsmouth Gaseous Diffusion Plant (PORTS)	Earthquake; Tornado	Uranium and Chemicals	EOC; Alternate EOC; Fire Station
Nevada National Security Site (NNSS)	Earthquake; Lightning	Plutonium and Chemicals	EOC; Alternate EOC; Emergency Management Center; Alternate Emergency Management Center; Operations Coordination Center; Alternate Operations Coordination Center; Fire Station No. 1

1.2 Requirements and Guidance

This lessons-learned report was compiled to comply with DOE Order 226.1B, *Implementation of DOE Oversight Policy*, which states that HSS is responsible for distributing lessons learned resulting from Independent Oversight appraisals as part of DOE's Operating Experience Program.

Independent Oversight used DOE Order 151.1C as the basis for conducting the reviews. This order identifies functional emergency preparedness and response requirements for a DOE/NNSA site, and provides an associated set of emergency management guides (EMGs) to establish expectations and implementing guidance. The order and guides were used to derive HSS Criteria, Review, and Approach Document (CRAD) 45-56, *Emergency Management Program Inspection Criteria, Approach, and Lines of Inquiry, Review of Preparedness for Severe Natural Phenomena Events*. Additionally, Independent Oversight referred to the following National Fire Protection Association (NFPA) standards in evaluating the reliability of backup power sources at DOE facilities: NFPA-72, *National Fire Alarm and Signaling Code*; NFPA-101, *Life Safety Code*; NFPA-110, *Standard for Emergency and Standby Power Systems*; and NFPA-111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems* (on which DOE-STD-3003-2000, *Backup Power Sources for DOE Facilities*, is based).

2.0 OVERALL ASSESSMENT

The 2013 Independent Oversight reviews reaffirmed similar 2012 findings regarding emergency planning, preparedness, and recovery for severe NPE. Importantly, all sites had at least a basic level of preparedness for severe NPEs, and most of the DOE/NNSA sites/activities that were reviewed do not need significant emergency actions to place facilities in a safe shutdown condition. However, many site plans do not fully consider the ramifications of severe NPE consequences in that they do not address HAZMAT releases from multiple facilities, the degradation of command centers and employee shelters, the proximity of command centers to HAZMAT, the impact on communication systems, the complexity of offsite interfaces after a severe NPE, and the complications in acquiring offsite assets. Additionally, sites have not ensured that engine driven generators and uninterruptible power supply (UPS) systems used as backup power sources for emergency egress lighting and operator-staffed supervisory stations comply with NFPA-110 or NFPA-111, as applicable to the type of power source. Consequently, backup power test and maintenance programs often do not comply with these standards.

2.1 HAZMAT Release Determination

DOE Order 151.1C requirements and associated guides provide detailed guidance on determining whether a site requires a HAZMAT program and how to establish an appropriate response based on technical considerations. For NPE planning, sites are required to consider scientific and historical data to determine plausible scenarios for analysis and to prepare for these events by establishing technically based protective actions and emergency planning zones (EPZs). During its 2013 reviews, Independent Oversight identified a common weakness in that sites have not fully assessed the impacts of severe NPEs.

2.1.1 Emergency Planning Hazards Assessment (EPHA) Scenarios

DOE Order 151.1C requires sites to develop a hazards survey to identify significant quantities of HAZMAT for a quantitative assessment; generic emergency events and conditions, including NPEs such as wind, tornados, flood, earthquake, wildfire, snowstorms, lightning, and hail; and the potential impacts of such emergencies. The quantitative assessment is documented in an EPHA. DOE Guide 151.1-2, *Technical Planning Basis EMG*, recommends that quantitative analyses determine the exposures at specific receptors of interest (i.e., facility boundary, onsite receptor locations, site boundary, and offsite locations of interest) and determine the maximum distance from release points at which exposures exceed the applicable protective action criteria (PAC).

Lessons Learned Statement: Few DOE/NNSA sites adequately consider the impacts of NPEs or severe NPEs on infrastructure; protective actions; or response activities, facilities, and equipment.

Discussion: Similar to the 2012 reviews, Independent Oversight observed that the sites' analyzed scenarios generally consider severe NPEs as HAZMAT release initiators. Most sites have developed a means for quickly determining whether analyzed events result in the loss of a significant quantity of HAZMAT and are beyond the site's capability to respond. However, most sites have not fully assessed the impacts of severe NPEs by considering damage to multiple HAZMAT facilities, command centers, and facilities used to implement protective actions. Additionally, most site EPHAs do not provide projected dose consequences at critical onsite and offsite facilities to facilitate planning and preparation for an effective emergency response. Further, one site has not developed a site EPZ to facilitate emergency planning with offsite agencies.

Analysis: Because most site EPHAs consider severe NPEs only as event initiators for HAZMAT releases, their technical planning bases do not adequately consider multiple HAZMAT releases and degradation of infrastructure. Additionally, most sites have not effectively planned and prepared for an

emergency response because they have not developed projected dose consequence analyses for critical onsite and offsite locations.

Recommended Actions: Sites should ensure that their EPHAs assess the impacts of severe NPEs by considering damage to multiple HAZMAT facilities, command centers, and facilities used to implement protective actions and provide projected dose consequences at critical onsite and offsite facilities.

2.1.2 Emergency Action Levels (EALs)

DOE Order 151.1C requires the development of EALs linked to planned protective actions for the potential Operational Emergencies identified in the EPHA. Response personnel use EALs to recognize an analyzed event so they can promptly categorize and classify events and implement predetermined protective actions. The EMG recommends that the PAC exposure distances identified in the EPHAs be used to develop conservative initial protective actions. Additionally, the guide recommends that EALs contain event indicators so that personnel can quickly recognize the event and apply the correct EAL.

Lessons Learned Statement: Few DOE/NNSA sites adequately implemented severe NPE-specific EALs that ensure rapid notification and implementation of protective actions and protective action recommendations (PARs).

Discussion: Similar to the 2012 reviews, Independent Oversight observed that most site EALs lack observable entry indicators, making it difficult for users to select the correct EAL; do not provide projected exposures at nearby facilities and at critical onsite and offsite response facilities; and do not identify appropriate protective actions associated with the EALs. Additionally, contrary to DOE guidance, the incident commanders at one site may choose to use the Department of Transportation 2012 *Emergency Response Guidebook* rather than the EALs for making protective action decisions. At another site, protective actions associated with the EALs are based on data obtained from the *Emergency Response Guidebook*, rather than being linked to the analyzed distances established in the EPHA. Further, at another site, some EALs are not linked to the appropriate protective action distances established by the EPHAs but instead are truncated at a maximum EPZ distance of 10 miles, even though the EPHA analyses indicate that the PAC can be exceeded at a much greater distance. Consequently, these sites' EALs do not fully address the protective actions and PARs necessary to protect onsite workers and the public from the consequences of a severe NPE.

Analysis: Most sites have severe NPE-specific EALs or another representative process. However, the EALs generally do not address protective actions and PARs adequately to provide rapid notification to onsite and offsite entities and to ensure the health and safety of the onsite and offsite populations during HAZMAT releases at multiple locations (which could affect primary and alternate rally points) and degradation of assumed shelters.

Recommended Actions: Sites should ensure that their EAL sets include specific instrument set points, such as radiation area monitor readings, where possible to facilitate timely classification of events; provide projected dose consequences at critical onsite and offsite facilities; and include appropriate initial protective actions and PARs for each EPHA analyzed scenario event. Further, sites should develop event-specific EALs for the NPE analyses conducted in the EPHAs to indicate the appropriate initial protective actions (sheltering or evacuation).

2.2 Facilities and Equipment

DOE Order 151.1C establishes functional requirements for responding to a HAZMAT release from a DOE/NNSA facility. Associated guides provide recommendations for meeting the intent of the functional

requirements for sites to consider. Once the site establishes implementing mechanisms, the DOE order requires the facilities and equipment to be available, operable, and maintained. Independent Oversight identified weaknesses in that command centers were too close to HAZMAT and/or alternate EOCs were too close to primary EOCs; command center habitability systems were lacking or inoperable; and testing and maintenance of backup power systems were substandard. Independent Oversight also identified inadequacies in communication system testing programs and in the systems that provide workers with emergency information.

2.2.1 Command Centers

DOE Order 151.1C requires DOE/NNSA sites to have a viable command center for performing required emergency management functions under emergency conditions for the duration of the event. The order does not establish structural or equipment performance criteria but does require provisions for an alternate location in case the primary EOC is unavailable. DOE Guide 151.1-4, *Response Elements EMG*, recommends that sites choose a location for alternate EOCs to minimize the likelihood that a single event could render both the primary and alternate facilities uninhabitable, typically by locating the alternate facility outside the EPZ. The EMG also allows for the possibility that the protective action zone, where PAC may be exceeded, is beyond the EPZ. Independent Oversight used these guiding principles in evaluating EOCs and similar command centers where it is desirable for emergency response personnel to remain for the duration of the event.

2.2.1.1 Habitability Systems

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

Discussion: EOCs are seldom equipped with habitability systems and, where they are, the operating, test, and maintenance protocols are not sufficient to maintain operability and to protect EOC occupants in case of a HAZMAT release. Where habitability systems are installed, site personnel erroneously believe that they are protected from airborne HAZMAT. To maintain EOC functionality during a HAZMAT emergency, DOE Guide 151.1-4 recommends that EOCs be equipped with habitability systems that consist of filtered air intake, positive pressure, monitoring capabilities for airborne contaminants, shielding and protection equipment, and backup power supplies. Furthermore, because of unacceptable failure rates for high efficiency particulate air (HEPA) filters, DOE has made a commitment to the Defense Nuclear Facilities Safety Board to require qualification of all HEPA filters used to protect emergency response organization (ERO) members in EOCs, as well as other similar command centers, before the filters are installed. DOE-STD-3020-2005, *Specification for HEPA Filters Used by DOE Contractors*, and DOE-STD-3025-007, *Quality Assurance Testing and Inspection of HEPA Filters*, include these requirements. DOE-STD-3020-2005 defines a qualified HEPA filter as one that has passed its manufacturer's qualification or requalification tests in accordance with industry standards and is certified by an independent test laboratory through additional testing. Independent Oversight found that sites sometimes operate their air intake filtration systems daily, rather than preserving the filter beds for a HAZMAT release. In addition, site personnel are often not aware of the requirement for HEPA filter certification by an independent laboratory before filter installation. Further, at some sites, preventive maintenance of filter system equipment was suspended or equipment was intentionally disabled. Site personnel were not aware that these conditions might mean that the system will not be able to perform its intended function.

Analysis: Qualification of HEPA filters used to protect EOC occupants is not required by Order 151.1C or recommended by the EMGs. Agreements and expectations to qualify HEPA filters were initially promulgated through other means, such as letters and memoranda, over ten years ago. Later, HEPA filter qualification was added to DOE-STD-3020-2005, *Specification for HEPA Filters Used by DOE Contractors*. Over that period, the turnover of personnel in emergency management programs has further reduced awareness of the need for intake HEPA filter qualification because these requirements are not contained in the documents that are normally used to implement emergency management programs. As a result, site personnel, including maintenance personnel who may not be aware of the HEPA filter functions at command centers, are usually more familiar with the less-rigorous requirements for HEPA filters used to protect the environment from operational process effluent releases than for those that protect personnel by filtering intake air at command facilities. Additionally, operating the intake filtration system daily reduces the effectiveness of charcoal and other types of filter beds as normal airborne contaminants build up in the systems. Finally, whenever sites discontinue preventive maintenance on filters, fans, and system instrumentation and controls, there is no technical basis for concluding that the system remains operable. These conditions put command center occupants at risk because they believe they are protected while inside the command centers, and no air monitoring capability is installed to alert them otherwise. If the filtration system is not functioning properly, contaminants can build up in the command centers faster than through normal infiltration because the system pulls in outside air to pressurize the interior atmosphere, and the outside air could contain HAZMAT.

Recommended Actions: Sites should evaluate whether command facilities are adequately equipped to detect airborne HAZMAT that could be released on site and install appropriate detectors where needed. Sites that have air intake filtering capabilities at command centers should verify that testing, maintenance, and operating practices meet the manufacturer's recommendations, appropriate industry standards, and DOE requirements. Written operability surveillance requirements should be established. DOE cognizant field elements should also ensure that the sites have contractual mechanisms to test HEPA filters at a DOE-approved filter test facility for sites using this type of system.

2.2.1.2 Alternate Command Centers

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

Discussion: DOE Guide 151.1-4 recommends minimizing the likelihood that the same event would render both the primary and alternate facilities uninhabitable by locating the alternate facility outside the EPZ. The guide also states that this principle should be applied to other command facilities. However, the EPZ could be smaller than the area where PAC is projected to be exceeded, so locating command centers outside the EPZ but within the PAC area may still render them uninhabitable. Additionally, primary and alternate command centers are seldom equipped to detect or protect occupants from airborne HAZMAT. Instead, sites rely on the protective actions linked to EALs for the emergency to determine whether command centers must be evacuated. When implementing protective actions, the EMG states that because of daily weather variability and the possibility of frequently changing meteorological conditions, the initial protective action decisions should be independent of the wind direction and that protective actions should be implemented for 360 degrees around the event scene. The EMG also recommends that the site calculate the one-hour exposures and the plume arrival times at receptors of interest to support planning. Further, although DOE identifies acceptable dispersion modeling programs for use in developing EAL protective actions, DOE policy and guidance do not establish requirements regarding the appropriateness of specific dispersion modeling programs that can be used to determine initial protective actions and could result in larger than necessary protective action zones.

Independent Oversight found that many alternate EOCs are located close enough to primary EOCs that PAC would be exceeded at both facilities from the same HAZMAT release, based on the EPHA consequence analysis. Some alternate EOCs are located upwind from site HAZMAT, based on the site's predominant wind direction, but within the 360-degree protective action zone. Other alternate EOC locations are closer to HAZMAT release points than the primary EOC locations, and the same plume would affect both facilities. At some sites, the one-hour exposures at command centers, such as EOCs, alternate EOCs, site emergency command centers, operator supervisory stations, security stations, and fire stations, are not available in the EPHAs, nor are plume arrival times provided. In the absence of site exposure estimates at these receptors of interest, Independent Oversight used site data to extrapolate projected exposures at these facilities and concluded that personnel could receive exposures well above DOE guidelines in less than an hour. Personnel at these command centers were not aware of the potential exposure, and the facilities are not equipped with HAZMAT detectors or systems to alert or protect facility occupants. The high projected exposures result partly from the use of very conservative EPHA dispersion modeling techniques. Nevertheless, site emergency response planning is required to be based on the EPHA results, and the EPHAs should include exposures at receptors of interest and plume arrival times to support response planning.

Analysis: Where command centers lack habitability systems, sites rely on protective actions linked to an EAL. These protective actions are intended to be conservative and are to be implemented at the onset of an event to ensure that personnel are adequately protected even when not all event conditions are known. However, overly conservative dispersion modeling programs sometimes lead to protective actions well beyond what is needed and adversely affect the planned response; for example, they may be in error in indicating that the primary and alternate facilities are uninhabitable. During an event, the EOC cadre must decide whether to disregard the planned protective actions (based on the likelihood that they are overly conservative) or to evacuate to the alternate EOC or an ad hoc facility. If the EOC cadre chooses to disregard the planned protective actions and remain at the EOC or alternate EOC while awaiting confirmation that the planned protective actions are overly conservative, they will typically have to wait for over an hour after EOC activation for the results of a more accurate dispersion modeling program and real-time input data by an EOC consequence assessment team. During this time, the EOC cadre will be at risk, and the consequence assessment results may confirm that HAZMAT concentrations did exceed one-hour exposure criteria and that the cadre should have relocated. Actual airborne concentrations at these facilities would not be readily known, either because there is no detection equipment or, in some cases, because the installed detection systems are disabled or not maintained. Furthermore, decision-makers would benefit from knowing the estimated plume arrival time at command facilities so they would know how much time they would have to get real-time consequence assessment results before the plume arrived; however, this information is not commonly available. Also, even though the alternate facilities at some sites are appropriately located upwind of the site's prevailing wind direction, they may still be subject to 360-degree protective actions if they are not located far enough from the event scene. These concerns should also be examined at other command centers, such as security tactical operations centers, fire and security central alarm stations, call/dispatch centers, and other supporting emergency command centers described in site emergency plans.

Recommended Actions: Sites should install monitoring equipment at command facilities to detect HAZMAT and alert personnel to hazardous airborne concentrations, as well as habitability equipment, such as intake filtration systems, to protect personnel from HAZMAT. Additionally, sites should establish and implement technically based operability requirements. Sites should locate their alternate EOCs outside of the protective action zone, which may be well beyond the EPZ. To facilitate decisions about command center habitability, sites should calculate plume arrival times via the EPHA process to determine in advance whether there is sufficient time to perform real-time consequence assessments using known event data and sophisticated modeling programs, such as National Atmospheric Release Advisory Center (NARAC), to ensure that ERO members are not put at risk. Finally, sites should use NARAC for

analyzing HAZMAT release scenarios in the EPHAs whenever the conservative dispersion modeling programs predict that the primary and alternate EOCs will have HAZMAT concentrations above PAC so that they can more conclusively determine whether facilities should or should not be staffed at the onset of an Operational Emergency.

2.2.2 Backup Power Sources

2.2.2.1 Reliability Evaluation

Lessons Learned Statement: Backup power sources are often not evaluated by an authority having jurisdiction (AHJ) to establish the required system capabilities and the appropriate test and maintenance program.

Discussion: DOE developed DOE-STD-3003-2000 to increase the reliability of backup power supplies after an unacceptable number of generators at DOE sites did not start and power equipment. The standard clarifies NFPA backup power standards (which are written in generic terms for general industry use) for use at DOE facilities, given the importance and uniqueness of DOE facility equipment, such as radiation detection and alarm systems and security systems. This standard applies a graded approach to testing and maintenance programs for equipment designated as emergency and standby systems, and does not apply to power sources designated as optional backup power sources. The standard directs the establishment of emergency, standby, or optional power designation based on the significance of equipment powered by backup power sources. However, the standard is not required at any DOE/NNSA site unless specifically invoked by contract, authorization basis document, or other commitment. Independent Oversight found that the sites that were reviewed were not required to comply with the DOE standard, but were required to comply with the NFPA codes and standards that serve as the basis for the DOE standard.

An important component of the NFPA standards is the assignment of an AHJ and establishment of the AHJ's responsibilities to evaluate backup power systems and the equipment they power, apply the appropriate NFPA test and maintenance program, and perform periodic assessments to verify program compliance. The intent of these codes and standards is to ensure that backup power systems are operable and reliable and will power important equipment in case of a loss of normal power. Most sites have not assigned an AHJ to perform these duties (or there are no records of these activities). The lack of an AHJ evaluation has led to undersized backup power systems and to test and maintenance activities that do not comply with NFPA codes and standards.

Analysis: A requirement for DOE/NNSA backup power systems to comply with NFPA standards may come from different sources. One source is contracts or authorization basis documents that require an evaluation of backup power systems and a judgment of equipment importance; for example, critical equipment used to save lives would be in the most rigorous test and maintenance program. Under the NFPA, an AHJ is responsible for performing these evaluations. Another source of required compliance with NFPA test and maintenance standards is a requirement to meet other NFPA codes, such as NFPA-72 or NFPA-101, that invoke the test and maintenance standards by reference. In either case, the AHJ should periodically ensure program compliance. At most sites, an AHJ has not performed system evaluations and assigned the appropriate test and maintenance program or has not conducted compliance reviews for systems that were evaluated. In these cases, Independent Oversight found that the systems were not fully tested, or were not tested as often as required by NFPA standards. At some of the facilities Independent Oversight reviewed, the lack of comprehensive test and maintenance programs led to failure of UPS systems and automatic transfer switches during loss of normal power.

Recommended Actions: To ensure the reliability of the backup power systems that sites rely on to power important equipment sitewide, sites should designate an AHJ to review all fixed backup power

systems and establish the appropriate NFPA-110 or NFPA-111 test and maintenance program or optional standby system requirements. Once this program is established, the site should consider performing periodic assessments to ensure compliance with the applicable test and maintenance program level. AHJs should evaluate the system capabilities for powering equipment needed during HAZMAT releases, and the site should perform additional planning, if necessary, to ensure that personnel can safely power the equipment in a timely manner when multiple HAZMAT releases are in progress. DOE-STD-3003-2000 provides guidance on identifying critical equipment unique to DOE facilities that should have robust test and maintenance programs for their backup power sources. Sites should consider developing a master list of backup power sources with their assigned NFPA type, class, and level, which would be helpful in clearly establishing backup power source requirements.

2.2.2.2 NFPA Compliance for Backup Power Sources

Lessons Learned Statement: Sites have not complied with applicable NFPA codes and standards for ensuring the capabilities and reliability of backup power sources used at operator-staffed supervisory stations.

Discussion: The facilities that Independent Oversight reviewed during 2013 are required to comply with NFPA-72 because of requirements in their contracts, design documents, or authorization basis documents. All sites have operator-staffed supervisory stations on site to monitor central fire alarm panels and perform call/dispatch tasks. For operator-staffed supervisory stations, NFPA-72 establishes system capability, testing, and maintenance requirements. The NFPA code states that for such stations, the backup power source must be capable of powering connected emergency equipment for a 24-hour period before it is necessary to refuel or recharge the power source and that the system must be in an NFPA-110 or NFPA-111 level 2 test and maintenance program, as applicable to the system type. However, Independent Oversight found that some of the facility backup power systems do not meet these requirements. Although all sites perform some test and maintenance activities on backup power systems, the programs do not comprehensively test active system components, such as generator automatic start features and automatic transfer switch alignments, and other design features at the required frequency. In addition, often the diesel generator fuel supply tanks are not periodically sampled and analyzed to ensure that the fuel is free of contaminants. Independent Oversight also found that at most facilities, backup power systems for operator-staffed supervisory stations had not been evaluated by an AHJ for NFPA compliance.

Analysis: NFPA-72 establishes standards to provide reliable power to operator-staffed supervisory stations for at least 24 hours so that operators can remain on station to monitor site fire alarm panels, receive emergency calls, and dispatch emergency response vehicles. These life-saving actions are most important during the initial phase of an Operational Emergency and need to be continuously available. DOE sites are committed to comply with NFPA-72 requirements through contracts and authorization basis documents, but program implementation lacks the necessary AHJ system evaluations and compliance reviews. The lack of AHJ evaluations has led to minimal test and maintenance programs and undersized backup power systems that do not meet NFPA standards at some sites.

Recommended Actions: Sites should identify all command centers where it is desirable for staff to remain and perform emergency response functions. The backup power sources at these command centers should be evaluated to determine their capabilities and the appropriate NFPA test and maintenance program. Once the program is established, sites should consider performing periodic assessments to verify compliance with test and maintenance program requirements.

2.2.2.3 NFPA Compliance for Egress Lighting

Lesson Learned Statement: Sites have not consistently complied with applicable NFPA codes and standards for powering emergency egress lighting. Where known deficiencies existed, some facilities have not provided compensatory measures to ensure adequate illumination for a safe facility evacuation during loss of power.

Discussion: Some facilities rely on generators or UPS systems as a backup power source for emergency egress lights, rather than dedicated batteries. In such cases, NFPA-101 requires that the backup power source be in an NFPA-110 or NFPA-111 level 1 test and maintenance program, as appropriate for the type of power system. However, Independent Oversight found that these generators and UPS systems do not generally meet these requirements. At one site, many facilities did not have emergency egress lighting capabilities, and the ten-year plan to correct this condition did not include any compensatory measures to ensure that some type of lighting is available during the ten-year implementation phase.

Analysis: The lack of rigorous test and maintenance programs has led to complete loss of emergency egress lighting at some DOE facilities after a loss of normal power. Typically, sites do not test generator automatic start circuitry or the automatic transfer switch alignment between normal and emergency power sources, and do not sample the generator fuel to ensure that it is free of particulate, biological, and water contaminants. Lack of emergency egress lighting has impacted some sites' ability to respond to an emergency and implement protective actions during a loss of power. For example, at one site, personnel had to evacuate the facility in total darkness. At another site, where no preventive maintenance had been performed, the automatic transfer switches failed at two facilities. Furthermore, sites do not have qualified operators continuously on site to manually start generators that fail to start automatically upon loss of normal power.

Recommended Actions: Sites should identify backup power sources for emergency egress lighting at all facilities that are required to comply with NFPA-101. Once identified, sites should ensure that those backup power sources are capable of providing emergency egress lighting for the required duration, and that they are in a test and maintenance program that complies with NFPA-110 or NFPA-111 level 1 requirements, as applicable to the type of power source. Additionally, sites should consider implementing an annual diesel fuel sampling and analysis program for all their generator supply tanks. Finally, sites should perform periodic assessments to verify the compliance of test and maintenance programs with program requirements.

2.2.3 Communication Systems Testing

DOE Order 151.1C requires that equipment adequate for an emergency response be available, operable, and maintained and that the communication systems used to contact offsite agencies be tested at least annually. DOE Guide 151.1-4 provides additional guidance for communication systems and states that systems relied on to provide notifications and activate the ERO should be tested and maintained regularly. The guide also states that backup communications, such as cellular and/or satellite telephones and radios, should be available and periodically tested.

Lessons Learned Statement: Limitations in the formality and thoroughness of some testing practices diminish the robustness of the communication systems.

Discussion: Similar to the 2012 reviews, the sites reviewed have multiple communication systems available for use during emergencies to facilitate information flow. The sites have procedures and checklists in place to ensure that systems are periodically tested and to ensure operability. However, the sites omitted some equipment from these procedures and checklists, such as command center telephones,

Government Emergency Telecommunications Service cards, and external telephone lines. In addition, testing was not always completed at the required frequencies (sporadically, rather than monthly as required) or the frequency for testing was not specified (e.g., the ability to transfer 911 calls to another telephone line tested only once). Furthermore, testing methodologies were not always defined or did not confirm that the equipment was functional. For example, tests were performed on public address systems before buildings were occupied for the day, ERO activation tests were not performed outside of normal working hours, and radio interoperability tests did not include any mutual aid organizations. In addition, the sites did not consistently document the completion of required testing.

Analysis: Sites maintain multiple communication systems to increase the likelihood that one or more of the systems will continue to function during and after an emergency. However, most of the sites do not perform comprehensive tests on all systems to ensure that they will function when needed. Past events at DOE/NNSA sites, such as wildland fires and construction accidents, caused some primary communication systems to fail and validated the need for multiple systems. During and after severe NPEs, the disruptions to communication systems would be even greater, further emphasizing the need for reliable primary and backup systems. Failing to adequately test all of the communication systems decreases the probability that they will be available when needed.

Recommended Actions: Sites should review the testing procedure and/or checklist for their emergency communication systems to ensure that all systems are included. The testing procedure and/or checklist should include the frequency (e.g., weekly or monthly) and testing methodology for each system (e.g., ability to receive and transmit a message or transfer 911 calls). Additionally, sites should ensure that testing confirms the desired functionality (e.g., ability to hear public address announcements or ability to reach mutual aid organizations via interoperable radios). The sites should also document the completion of testing requirements to ensure that all systems and components are tested appropriately.

2.2.4 Communication Systems Reliability and Coverage

DOE Order 151.1C requires that sites have the capability to provide prompt initial notifications to workers during an emergency and facilitate their safe evacuation or sheltering.

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

Discussion: The sites that were reviewed have communication systems that provide workers with emergency information, including the need to take immediate protective actions (e.g., shelter or evacuate) or a change in protective actions (e.g., area evacuation to sitewide evacuation). However, the primary systems that some sites rely on to provide this information are past their useful life and are experiencing age-related failures. At one site, the public address system frequently transmits garbled messages and often fails in some buildings. At another site, the radio system needs spare parts that are no longer manufactured, requires a master controller that is experiencing failures, and is not interoperable with offsite emergency responders. In addition, the systems used at some sites do not ensure that all workers will receive emergency information. At one site, the public address system has too few outdoor speakers to ensure that workers hear the messages. At another site, additional protective action instructions may not be heard after workers enter designated shelter locations. Some sites also lack a system or process to ensure that hearing-impaired workers receive emergency information. For example, one site provides information to hearing-impaired workers through an alphanumeric pager group, but does not ensure that all such workers are included in the group. At another site, all emergency information messages rely on workers hearing a message, and no provisions are in place for hearing-impaired workers.

Analysis: Sites use multiple communication systems to ensure that emergency information is provided to all workers; however, some sites rely on unreliable or inadequate means for these notifications. These reliability and coverage issues substantially diminish the sites' ability to provide prompt initial emergency notifications to all workers. The sites have self-identified the reliability issues but have been unable to obtain sufficient funding to replace their aged systems.

Recommended Actions: Sites should consider the reliability and adequacy of communication systems when prioritizing funding decisions, particularly for communication systems that provide workers with emergency information. Additionally, sites should ensure that personnel in shelter locations can receive additional emergency information. Sites should also establish additional methods for providing emergency notifications that include at least one non-verbal method (such as an alphanumeric pager group for hearing-impaired workers or a desktop computer alerting system).

2.3 Training and Drill Program

DOE Order 151.1C requires each site to establish a coordinated program of training and drills for developing and/or maintaining specific emergency response capabilities that must be an integral part of the emergency management program. The program must apply to emergency response personnel and organizations that the site/facility expects to respond to onsite emergencies, and emergency-related information must be available to offsite response organizations. The program must also consist of self-study/homework, training, and drills. Further, the order requires that both initial training and annual refresher training be provided for the instruction of and demonstration of proficiency by all ERO personnel, and drills must provide supervised, hands-on training for all ERO personnel.

DOE Order 151.1C and associated guides provide specific requirements for the development of the training and drill programs at NNSA/DOE sites. Independent Oversight identified that sites have established coordinated training programs consisting of formal training and hands-on drills for preparing ERO members in their assigned tasks during its 2013 reviews. However, not all site training programs address NPEs affecting multiple facilities. Additionally, one site has contracted with offsite fire departments to provide onsite response without these personnel being required to comply with DOE requirements.

Lessons Learned Statement: Most of the sites' training and drill programs do not address NPEs affecting multiple facilities, and some sites have not provided adequate EAL training to all ERO personnel.

Discussion: The training and drill programs at most sites do not include severe NPEs affecting multiple facilities. Therefore, emergency response personnel are not adequately trained to respond to severe NPEs. Additionally, at one site the offsite fire department personnel are designated as the onsite incident commander and are tasked with determining and implementing DOE required initial protective actions. However, these offsite incident commanders are not required to receive training on the use of the site EALs. Further, at another site, the ERO personnel tasked as incident commanders are trained to use the *Emergency Response Guidebook* rather than the EALs to make initial protective actions. Consequently, appropriate initial protective actions and PARs may not be implemented, thus limiting the ability to provide rapid event categorization and notifications to onsite and offsite populations as required by DOE Order 151.1C.

Analysis: Most sites' lack of a training and drill program that implements training and/or drills for multiple-facility NPEs could impact emergency response capabilities during an emergency event. In addition, some sites have not provided adequate EAL training to personnel who may be tasked as the

incident commander. This training must include EAL training to onsite and offsite personnel who may be tasked as the onsite incident commander.

Recommended Actions: Sites should consider developing a training course and conducting drills and/or tabletop exercises to ensure effective emergency response capabilities during severe NPEs affecting multiple facilities. Sites should ensure that all personnel responsible for determining and implementing event categorization and initial protective actions are adequately trained to perform these duties. Additionally, sites should continue to reinforce the site ERO's and offsite responders' skills and capabilities related to severe NPEs by including severe NPE scenarios in the site drill and exercise program. When offsite fire department services are used for onsite emergency response, procedures should be reviewed to minimize conflict between DOE and local/state requirements, such as the use of EALs verses the *Emergency Response Guidebook* for implementing protective actions and providing PARs.

2.4 Offsite Interfaces

DOE Order 151.1C does not provide specific requirements for site planning with offsite agencies, and the level of planning is often a function of interest by the site, state, and local governments. Independent Oversight examined the level of planning and preparedness activities between sites and offsite agencies, allowing a comparative analysis of planning among DOE/NNSA sites. During the 2013 reviews, Independent Oversight identified significant differences among the sites' level of planning for offsite monitoring activities, the extent of offsite response planning, and identification of offsite response capabilities for use at a DOE/NNSA site.

2.4.1 Offsite Monitoring and Integration with NNSA Assets

DOE Order 151.1C requires that effective interfaces be established and maintained to ensure integration and coordination of emergency response activities with Federal, state, and local agencies, and with organizations responsible for emergency response and protection of workers, the public, and the environment. Further, a formal exercise program must validate all elements of the emergency management program over a five-year period, including provisions to assess the potential or actual offsite consequences of an emergency. Additionally, consequence assessments must incorporate monitoring of specific indicators and field measurements, and must be coordinated with Federal, state, and local organizations.

Lessons Learned Statement: Few sites have adequately addressed the requirements that consequence assessments must be coordinated with Federal, state, local, and tribal organizations, and that effective planning for offsite field monitoring capabilities must be implemented to assist state and local governments.

Discussion: Similar to the 2012 reviews, Independent Oversight continued to observe significant differences in planning for chemical and radiological offsite emergency response field monitoring across the DOE/NNSA complex.

At only one of the sites reviewed in 2013, DOE has signed agreements with the state and included specific requirements for offsite field monitoring and consequence assessment. This agreement led to the implementation of an offsite monitoring capability that integrates DOE monitoring resources with state government resources. However, none of the remaining sites interacted with their respective state and local governments for this common purpose.

At most sites, the planning between DOE and the state for offsite monitoring is informal, and the sites and their respective states lack a written plan or procedure defining how to accomplish offsite monitoring of actual or perceived radiological and chemical hazards and risks to the public and the environment. Furthermore, most surrounding local governments stated to Independent Oversight that the local government expects the site to facilitate offsite radiological monitoring for a DOE-owned HAZMAT release. Nonetheless, there were no protocols or procedures to integrate site field monitoring concepts of operation with other potential monitoring teams, such as the state's National Guard Civil Support Team, the regional NNSA radiological assistance program (RAP) team, the Environmental Protection Agency, or other Federal agencies. In addition, none of these sites' exercise programs had validated the effectiveness of planning for a significant offsite HAZMAT release that requires a large offsite monitoring and consequence assessment response.

Additionally, most states expect a RAP response for any General Emergency declaration involving the potential for offsite radiological contamination, in recognition of the states' limited offsite monitoring capabilities. However, some sites have not established the appropriate planning, coordination, and response capabilities with RAP, the Federal Radiological Monitoring and Assessment Center (FRMAC), and NARAC to assist state and local governments in identifying the radiological plume, areas requiring protective actions, and food control boundaries after a DOE radiological emergency. Furthermore, some local and state governments are not familiar with the capabilities and protocols of NNSA national assets: RAP, FRMAC, NARAC, and Radiation Emergency Assistance Center/Training Site (REAC/TS). In the absence of a written plan or procedure that defines how offsite monitoring of actual or perceived DOE radiological hazards will occur, performance of this response function will likely default to the RAP or FRMAC.

Analysis: Many sites have not adequately addressed the requirements that consequence assessments be coordinated with Federal, state, local, and tribal organizations, and that effective planning for offsite field monitoring capabilities be implemented to assist state and local governments in identifying the radiological plume, areas requiring protective actions, and food control boundaries that may result from a DOE General Emergency. Independent Oversight noted significant differences in offsite planning and emergency response field monitoring capabilities at recently reviewed DOE/NNSA sites. In addition, some sites do not appropriately interact with NNSA assets to ensure effective integration with local, state, and Federal government agencies when needed. Further, the *National Response Framework Nuclear Radiological Incident Annex* provides a framework for integrating radiological monitoring response across all levels of government, but sites and offsite authorities have not factored this framework into their planning. Consequently, ascertaining actual offsite contaminated areas and levels of contamination caused by a DOE/NNSA radioactive materials release will default to an ad hoc response and will likely cause unnecessary delays in gathering empirical data.

Recommended Actions: To improve planning for offsite radiological support to local and state governments, sites should consider developing a comprehensive plan for offsite field monitoring that defines an overall monitoring and sampling strategy, including minimum resources (personnel and equipment), command and control, data acquisition protocols, communications, and safety-related guidelines. Additionally, sites should emphasize that the primary objective for offsite monitoring is to verify the absence of an airborne plume and identify the boundaries of the area contaminated with a HAZMAT deposition (i.e., bound the plume). Sites should also ensure that monitoring capabilities include planning for airborne sampling, direct measurement of the radiation dose rate or contamination levels, and sampling for appropriate radiological analysis of air, water, soil, and vegetation. As necessary, sites should develop standard operating procedures for offsite monitoring that include staffing, assignment of responsibilities, control of field teams, and specific sampling and monitoring protocols. These procedures should be based on the FRMAC monitoring and sampling protocols to promote interoperability with DOE and state capabilities. Finally, sites should coordinate, via the appropriate

DOE/NNSA program office, the participation of NNSA radiological emergency response assets (e.g., NARAC, FRMAC, REAC/TS, and RAP) in site exercises to ensure validation of all emergency management program elements over a five-year period and to optimize the usefulness of annual exercises.

2.4.2 Severe Event Planning with State and Local Governments

DOE Order 151.1C requires that contractors at all DOE/NNSA facilities coordinate with state and local agencies and organizations responsible for offsite emergency response and for protection of the health and safety of the public. The site emergency management program can incorporate or invoke by reference existing plans, such as catastrophic earthquake plans or mass-casualty plans detailing compliance with Federal or state standards. Additionally, contractors must develop a methodology for informing the public of emergency plans and planned protective actions before and during emergencies.

Lessons Learned Statement: Several sites have insufficient offsite response planning that may result in an unclear understanding of the actions expected of each interface agency and the information needed to respond effectively.

Discussion: Independent Oversight observed noticeable differences between sites' levels of emergency planning with state and local governments. At one site, offsite organizations were unaware of the distance to PAC and plume arrival times at specific offsite receptors for the bounding event scenarios. Consequently, offsite officials were unaware that they may need to expand protective actions for bounding events significantly beyond the facility EPZs. Furthermore, some General Emergency declarations may require the implementation of an integrated offsite field monitoring concept to determine offsite protective measures that may be necessary, which have not been pre-planned and validated. Consequently, the state and potentially impacted counties lack specific emergency planning, largely because of the extremely low population densities surrounding the site, the determination that no communities exist within the sites' facility EPZs, and the incorrect perception that there is no need to extend protective measures beyond the EPZs.

At one site, emergency planning related to PAC distances was inconsistent with the DOE policy to protect public health and safety, and PARs did not reflect a bounding estimate of event consequences relative to PAC, as derived from the EPHA analyses. For example, two facility EPHAs documented that the release of HAZMAT had a distance to PAC of 5 miles, more than doubling the current 2-mile offsite PAR and offsite planning. Additionally, the site lacks an EPZ that, when implemented, will necessitate additional offsite emergency planning with state and county agencies to reflect the EPHA consequence assessments and bounding event scenarios for the site.

Yet another site has implemented a practice of truncating PAC distances at a maximum EPZ distance of 10 miles, even though the PAC can be exceeded at a much greater distance. Consequently, the PARs did not reflect a bounding estimate of event consequences relative to PAC, as derived from the EPHA analyses. As a result, offsite organizations were not given bounding event information that included distance to PAC and plume arrival times at specific offsite receptors to enable emergency planning and response outside the 10-mile EPZ.

Sites have established at least minimal planning and provisions for interfacing and coordinating with Federal, state, and local agencies responsible for offsite emergency response. Since a severe regional event is likely to affect both the site and the surrounding communities, it will be especially important to use scarce assets in the most prudent manner to accomplish national response priorities. The National Incident Management System (NIMS) recognizes this situation and emphasizes resource management by using standardized resource management concepts, such as resource typing (i.e., categorizing, by capability, the resources requested, deployed, and used in an incident), inventorying, organizing, and

tracking, to facilitate the dispatch, deployment, and recovery of resources before, during, and after an incident. None of the sites have implemented these resource management concepts.

Analysis: Insufficient offsite response planning at some sites may result in an unclear understanding of the actions expected of each interface agency and the information needed to respond effectively. For some sites, the impacted areas are populated by day-care centers, schools, and prisons, so significant planning may be necessary to adequately protect the affected population. Additionally, the DOE site will likely be only one of many entities competing for scarce resources during a severe NPE. Emergency planning with state and local governments has not integrated NIMS resource management tools, such as resource typing.

Recommended Actions: To improve offsite emergency planning and preparedness, sites should provide information to appropriate state and county agencies on the distance to PAC and plume arrival times at specific offsite receptors for the bounding event scenarios. Additionally, sites should coordinate offsite PARs with appropriate offsite agencies, based on the analysis of scenario results documented in the EPHAs. Furthermore, sites should confirm that initial PARs provided to offsite authorities include the distance to PAC and reflect a bounding estimate of consequences, and ensure that the PAR provides the time available for carrying out the protective action before the plume arrives.

In addition, sites should plan for response to severe NPEs that could have a significant and widespread impact on the emergency response infrastructure of the site and surrounding community. Therefore, the site should define a timeframe to be self-sufficient and plan accordingly. Additionally, sites should integrate severe NPE response planning with applicable state and Federal catastrophic event plans. Site planning should assume that severe NPEs 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.

Additionally, to improve emergency planning with state and local governments, sites should consider adopting and/or integrating NIMS resource management tools, such as resource typing. Another recommended resource management tool is the NIMS Incident Resource Inventory System, which is free software developed for NIMS. With this software, sites enter typed and non-typed resources into a database that allows the user to search/identify specific resources for incident operations and mutual aid purposes.

Finally, sites should conduct tabletop exercises with appropriate Federal, state, and local response agencies and organizations that would respond to an event caused by a severe NPE, a manmade disaster, or terrorism. Sites' response plans and procedures should then be updated to reflect information extrapolated from severe NPE planning workshops, drills and exercises, and lessons learned from past disasters.

2.4.3 Response Planning for Events Beyond the Site's Capabilities

DOE Order 151.1C requires appropriate application of resources to mitigate an emergency event. Additionally, baseline needs assessment (BNA) processes, performed in accordance with DOE Order 420.1C, *Facility Safety*, require a determination of the necessary onsite fire, emergency medical services, and HAZMAT response resources based on conclusions contained in the site emergency plan.

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

Discussion: Independent Oversight noted some significant inconsistencies in emergency response planning for events that exceed onsite response capabilities. Several sites have not documented provisions for important technical rescue capabilities in accordance with NFPA-1670, *Standard on Operations and Training for Technical Search and Rescue Incidents*. A variety of hazards, including earthquakes, manmade accidents, and terrorist activities, may result in the need for urban search and rescue and could involve the location, extraction, and initial medical stabilization of victims trapped in confined spaces due to a structural collapse. Notably, some sites do not possess NFPA-1670 technical rescue capability for structural collapse, confined space, trench and excavation work, and swift water. Also, most assistance agreements with offsite organizations do not identify technical rescue capabilities or the intent for offsite organizations to provide these services at the site. Furthermore, some site BNAs do not identify and establish the level of capabilities needed for conducting technical rescue operations.

Analysis: Some DOE/NNSA sites would likely need to implement an ad hoc response to some potential emergency response scenarios, such as technical rescue (collapsed structure, confined space, trench, and excavation), wildland fire, and severe NPEs, because they have little or no onsite capability available and have not completed adequate planning to acquire outside resources.

Recommended Actions: The site emergency plan should summarize all technical rescue capabilities and agreements. To improve site-specific planning for technical rescue operations, site BNAs should establish and document the levels of functional capability (in accordance with NFPA-1670) for technical rescue operations (structural collapse, rope rescue, vehicle and machinery rescue, confined space rescue, and trench excavation search and rescue). The BNA should also document any specific functional rescue capabilities to be obtained through offsite assistance and mutual aid agreements. Finally, the minimum job performance requirements for personnel who provide a specific functional capability should be established in the BNA.

2.5 Termination and Recovery

DOE Order 151.1C requires that recovery from a terminated Operational Emergency include communicating and coordinating with state and local governments and other Federal agencies; planning, managing, and organizing the associated recovery activities; and ensuring the health and safety of the workers and the public.

Lessons Learned Statement: Most DOE/NNSA contractors have incomplete planning for response and short-term recovery activities related to a severe NPE.

Discussion: Independent Oversight observed that all sites describe basic emergency event termination and recovery operations in their procedures. However, Independent Oversight noted several limitations in response and short-term recovery planning for severe NPEs. For example, although all sites have continuity of operations plans that identify mission-essential functions that may be helpful in determining priorities for restoration and mitigation efforts during a severe NPE scenario, these plans typically document only nominal reconstitution planning. Additionally, the potential severe NPEs postulated for most sites lack specific event response planning or procedures that include short-term recovery actions, such as considering infrastructure damage and outages that may impede the normal response of onsite or offsite responders. Most sites lack a written response plan that defines operations after a severe NPE or catastrophic event. Finally, few sites conduct an adequate number of exercises that focus on severe NPEs or catastrophic events, and very few of these exercises postulate consequences that result in significant structural damage or building collapse and that generate resource requirements the site cannot meet.

Depending on the nature and severity of an emergency, recovery may involve a variety of activities directed at restoring the facility and area affected by the emergency to a safe, stable pre-incident

condition. During the 2013 reviews, Independent Oversight identified significant differences among the sites relative to recovery planning.

Analysis: Independent Oversight determined that most site contractors have incomplete planning for response and short-term recovery activities related to a severe NPE and have not identified how infrastructure damage and outages might affect the recall of onsite responders and assistance from offsite responders, who may be prevented from responding due to the rural locations of many sites. Several sites and state and local governments rely solely on the *National Response Framework* for Federal assistance as the primary response to a severe NPE or catastrophic event.

Recommended Actions: To continue to improve site-specific planning for severe NPEs and catastrophic events, sites should adopt a benchmark for self-sufficient response and short-term recovery operations to be implemented before a significant Federal response can be mounted. Planning should incorporate self-help response, including the identification of roles and responsibilities, life-saving skills among workers, and locations of medical and life-sustaining supplies currently on site. Additionally, sites should pre-determine the most likely types of additional resources needed by the site, the availability of those resources, and logistical requirements once the resources arrive at the site. Sites should also consider developing functional (e.g., protective force operations, power and utilities, fire protection, telecommunications, shift operations, and critical facilities/operations) emergency response procedures, matrices, or checklists needed to respond to a severe NPE. Finally, sites should develop an incident action plan template for a multiagency response at the site 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).

2.6 Emergency Medical Support

DOE Order 151.1C requirements and associated guides direct sites to have sufficient medical support to care for contaminated or injured personnel, including documented arrangements with offsite medical facilities to transport, accept, and treat personnel, and plans for responding to mass casualty incidents (MCIs). Independent Oversight identified weaknesses in that sites lack a requirement for periodic MCI exercises, and most sites lack documented agreements with air ambulance providers.

2.6.1 Mass Casualty Incident Exercises

DOE Order 151.1C requires that sites plan for MCIs. DOE Guide 151.1-4 provides additional guidance for emergency medical support in the areas of HAZMAT event planning, training, resources, and exercises.

Lessons Learned Statement: Sites do not require periodic exercises designed to ensure that the ERO can adequately respond to an MCI.

Discussion: The sites that were reviewed have developed plans for responding to an MCI and have conducted an exercise in the last three years; however, their exercise plans do not contain a requirement to conduct periodic MCI exercises to ensure continued proficiency.

Analysis: Sites include a variety of scenarios (e.g., security incidents, transportation accidents, or offsite HAZMAT releases) in their exercise plans to ensure that they can adequately respond to the array of postulated events. Sites recognize that they could experience an MCI and have included an MCI scenario in previous exercises. However, the sites do not include an MCI in the list of exercise scenarios that are required to be conducted periodically, thus reducing the confidence that the site has the necessary plans, procedures, offsite agreements, training, and resources in place to adequately respond to an MCI.

Recommended Actions: Sites should add a requirement for a periodic MCI exercise to their exercise plans and procedures.

2.6.2 Air Ambulance Support

DOE Order 151.1C requires that sites arrange and document agreements with offsite medical organizations to accept contaminated injured personnel.

Lessons Learned Statement: Most sites lack documented agreements with air ambulance providers on whether they will transport contaminated injured patients.

Discussion: The sites that were reviewed have determined the methods (e.g., onsite, offsite, and air ambulances) that will be used to transport injured personnel to offsite medical facilities. Several sites believe that an air ambulance will transport a contaminated patient, but they lack documented agreements with the air ambulance providers to support that belief.

Analysis: Air ambulances are generally reserved for trauma patients who must be transported to a trauma center promptly. However, most sites either do not know whether their air ambulance providers will transport a contaminated trauma patient or have only a verbal agreement with the provider. In an emergency, transport may be significantly delayed, and the patient's chances of survival substantially diminished, while the option of air ambulance transport is explored.

Recommended Actions: Sites should discuss the transport of contaminated trauma patients with their air ambulance providers and establish documented agreements with providers willing to supply this service.

3.0 NOTABLE PRACTICES

During the course of the 2013 reviews, the Independent Oversight team identified a number of notably effective practices that can provide useful information to DOE line management and other DOE/NNSA sites. The following areas and sites have particularly innovative or mature aspects of their emergency management program. Other DOE/NNSA sites should consider gathering additional information about these notable practices (e.g., by contacting the applicable sites) and determining whether the notable practice should be further evaluated and, if determined to be beneficial, applied or adapted in planning for severe NPEs.

3.1 Disaster/Self-Help Program

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

3.2 Employee Notification Systems

Hanford uses a wide variety of methods to notify employees of an emergency. The Hanford Site Emergency Alerting System uses six methods to communicate information and protective action instructions to workers (located at the site and in town): 1) Outdoor warning sirens, which cover personnel working outdoors in the more densely populated areas of the site; 2) AM radio station, which

covers all major site roadways; 3) Message boards, which instruct commuters at the site entrances to tune to the AM radio station; 4) Pop-up computer messages, which display on all computers connected to the Hanford local area network; 5) Telephone notifications, which include all office telephones; and 6) Tone alert radios, which cover remote work locations.

Most of these systems can be activated from two locations, at the site and in town. Additionally, duty officers can broadcast emergency information over the two-way commercial radio system used by operations personnel, and building emergency directors can activate facility sirens at their respective locations, if so equipped.

3.3 ERO Activation System Accessibility

To activate their EROs, several sites use communication systems that can be accessed through multiple routes. The systems used at LLNL, PORTS, and NNSS can be accessed from any telephone. The NNSS system can also be accessed via the Internet, and the LLNL system can be operated using the remote backup system located in Tennessee.

3.4 Amateur Radio Operators

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

3.5 Enhanced Paramedic Capabilities

NNSS paramedics can directly administer chelation therapy to workers using protocols reviewed by DOE's REAC/TS and approved by the State of Nevada. This capability allows administration of the chelation drugs as soon as possible after a suspected or known internal contamination, thereby increasing the potential effectiveness of the treatment. NNSS paramedics can also collect forensic samples (blood, hair) after criticality events using approved protocols to aid in reconstructing the dose received by workers.

4.0 FUTURE REVIEWS

Independent Oversight will continue to evaluate the capabilities and preparedness of selected site and facility emergency response programs to respond to severe NPEs. The emphasis of the reviews will include performance and programmatic evaluations focused on response to severe events, consistent with the *Office of Health, Safety and Security Operating Experience Level 1* notice of April 2013. During 2014, Independent Oversight will evaluate the effectiveness of selected site exercise programs via participation in the planning, development, and administration of their scheduled exercises. Independent Oversight will also continue to conduct programmatic reviews of sites' technical planning basis, plans, and procedures related to severe NPEs. Review plans, CRADs, and other guidance documents, as well as review reports, can be viewed on the Independent Oversight website at: http://energy.gov/hss/office-health-safety-and-security.

Appendix A
Supplemental Information

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