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

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Acronyms

AIP	Agreement in Principle
BNA	Baseline Needs Assessment
CRAD	Criteria, Review, and Approach Document
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U.S. Department of Energy
EAL	Emergency Action Level
ECC	Emergency Command Center
EMG	Emergency Management Guide
EMInS	Emergency Management Information System
EMT	Emergency Management Team
EOC	Emergency Operations Center
EPHA	Emergency Planning Hazards Assessment
ERO	Emergency Response Organization
FBI	Federal Bureau of Investigation
FMT	Field Monitoring Team
HAZMAT	Hazardous Material
HEPA	High Efficiency Particulate Air
HSS	Office of Health, Safety and Security
INL	Idaho National Laboratory
JPA	Joint Powers Agreement
LANL	Los Alamos National Laboratory
NARAC	National Atmospheric Release Advisory Center
NFPA	National Fire Protection Association
NIMS	National Incident Management System
NNSA	National Nuclear Security Administration
NPE	Natural Phenomena Event
NRF	National Response Framework
PAC	Protective Action Criteria
PAR	Protective Action Recommendation
RAP	Radiological Assistance Program
SRS	Savannah River Site
WPS	Wireless Priority Service
Y-12	Y-12 National Security Complex

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1.0 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Enforcement and Oversight (Independent Oversight), which is within the Office of Health, Safety and Security (HSS), occasionally reviews specific areas of interest at DOE nuclear facilities. During calendar year 2012, Independent Oversight, in reference to the tsunami that affected the Fukushima Daiichi nuclear power electrical generating station in Japan, selected DOE preparedness for responding to plausible severe natural phenomena events (NPEs) at DOE, including National Nuclear Security Administration (NNSA) sites as a specific area of interest. Independent Oversight considered several severe NPEs that represent 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 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 2012 reviews performed by Independent Oversight. The reviews performed during the fall of 2011 and throughout 2012 were at DOE/NNSA sites with hazard category 1 and 2 nuclear facilities, some of which also have significant quantities of hazardous chemicals on site. The reviews were performed at six sites and included a review of two nuclear facilities and a minimum of one command center at each site. Independent Oversight has published separate reports to document its activities and conclusions for each site reviewed; the reports are available at: http://www.hss.doe.gov/indepoversight/safety_emergencymgt/semevals.html

The purpose of the Independent Oversight review 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; assessing the sites' abilities to quickly recognize when conditions beyond the site's capabilities occur; and quickly and effectively integrating offsite response assets into the site's response. The scope of the reviews covered the emergency management program elements of technical planning basis; facilities and equipment; and offsite interfaces described in DOE Order 151.1C, *Comprehensive Emergency Management System*. 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, and the plans and procedures for integrating offsite assets into a site response.

Table 1 identifies the sites, primary severe NPEs of concern, the dominant type of HAZMAT involved, and the command centers reviewed by Independent Oversight. For simplicity, the emergency command centers (ECCs) identified in Table 1 represent onsite command centers other than the emergency operations center (EOC), although a particular site may use a different name for an ECC. Independent Oversight also considered floods as a potential for severe NPE consequence; however, concerns regarding large scale flooding at the sites reviewed was eliminated through documented site analysis based on the distance to water sources, site elevations, historical flood data, and dam break studies.

Table 1

Site	Dominant Plausible Natural Phenomena Events	Hazardous Material in Review Scope	Command Centers Reviewed
Y-12 National Security Complex (Y-12)	Earthquake – New Madrid Fault; Tornados	Uranium and Chemicals	EOC; Alternate EOC; Site ECC
Idaho National Laboratory (INL)	Earthquake – Lost River, Lemhi, and Beaverhead Faults; Wildland Fire	Uranium and Fission Products	EOC; Alternate EOC; Central ECC; Advanced Test Reactor Complex ECC; Building 666 Fuel Pool ECC
Los Alamos National Laboratory (LANL)	Earthquake - Pajarito Fault; Tornado; Wildland Fire	Plutonium and Chemicals	EOC; Alternate EOC (mobile)
Paducah Gaseous Diffusion Plant	Earthquake – New Madrid Fault; Tornado	Uranium and Chemicals	EOC; ECC
Savannah River Site (SRS) Tritium Facilities	Earthquake – Helena Banks Fault (Charleston); Tornado; Hurricane	Tritium	Tritium Facilities ECCs
Waste Isolation Pilot Plant	Tornado	Transuranic Waste	EOC; Alternate EOC; ECC

1.2 Requirements and Guidance

This lessons learned report has been compiled to comply with DOE Order 226.1B, *Implementation of DOE Oversight Policy*, which states HSS is responsible to distribute lesson learned resulting from Independent Oversight appraisals as part of the Department'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 has an associated set of emergency management guides (EMGs) to establish expectations and order implementing guidance. The order and guides were used to derive the HSS Criteria, Review, and Approach Document (CRAD) 45-51, *Emergency Management Program Inspection Criteria, Approach, and Lines of Inquiry, Targeted Review of Site Preparedness for Severe Natural Phenomena Events*. Additionally, Independent Oversight referenced DOE-STD-3003-2000, *Backup Power Sources for DOE Facilities*, which was developed to improve the reliability of backup power sources at DOE facilities, as the benchmark for backup power supply inspections, testing, and maintenance activities.

The deficiencies contained in the Discussion are based on a general analysis of weaknesses identified during Independent Oversight reviews of multiple DOE sites. The specific underlying deficiencies and weaknesses varied across sites and are not addressed in this report. The Recommended Actions provide insight into potential improvements, and DOE/NNSA organizations and site contractors should evaluate the applicability to site operations of the recommended or equivalent actions and consider their use in accordance with site-specific program objectives.

2.0 OVERALL ASSESSMENT

All sites had at least a minimal level of preparedness for severe NPEs, and most DOE/NNSA process activities reviewed do not require 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 by considering HAZMAT releases from multiple facilities, the degradation of command centers and employee shelters, the proximity of command centers to HAZMAT, and complications in acquiring offsite assets. Also, Independent Oversight identified practices at some sites that were not consistent with DOE policy.

2.1 Technical Planning Basis

DOE Order 151.1C requirements and associated guides provide detailed guidance in 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. Independent Oversight identified the incomplete analysis of NPE scenarios and the improper practice of formulating protective actions based on real-time weather conditions as common weaknesses during its 2012 reviews.

2.1.1 EPHA Scenarios

Lessons Learned Statement: DOE Order 151.1C requires sites to develop a hazards survey to identify significant quantities of HAZMAT for a quantitative assessment and 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 emergency planning hazards assessment (EPHA). Further, the order requires the development of emergency action levels (EALs) for the potential operational emergencies identified in the EPHA. Personnel use EALs to recognize an analyzed event for prompt event categorization, classification, and implementation of predetermined protective actions. Areas required to be placed under protective actions are predetermined using established protective criteria for the type of HAZMAT released in an event.

DOE Guide 151.1-2, *Technical Planning Basis*, 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). The determined exposures are used to develop conservative initial protective actions. Additionally, DOE Guide 151.1-2 recommends that EALs contain event indicators so that personnel can quickly recognize the event and apply the correct EAL.

Discussion: The DOE/NNSA sites reviewed have adequately prepared hazards surveys and have generally considered severe NPEs as HAZMAT release initiators in analyzed scenarios; 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. For example, site EALs generally require that onsite workers (and recommend that the offsite population) shelter in place for an earthquake event without considering the potential damage to the facilities/buildings that could potentially expose workers and the public to high concentrations of HAZMAT for long durations. Consequently, these sites have not developed EALs that fully address protective actions and protective action recommendations (PARs) necessary to protect onsite workers and the public from the consequences of a severe NPE.

Analysis: Most sites consider severe NPEs as event initiators of HAZMAT releases in EPHAs, but do not adequately consider the impacts of the NPEs or severe NPEs on infrastructure; protective actions; or response activities, facilities, and equipment. Consequently, multiple HAZMAT releases and degradation of infrastructure are not considered in the technical planning basis. Therefore, most sites do not have severe NPE-event-specific EALs, or another representative process, that address protective actions and PARs necessary to ensure the health and safety of the onsite and offsite populations during multiple HAZMAT release locations (which could affect primary and alternate rally points) and degradation of assumed shelters.

Recommended Actions: Sites should ensure that their EPHA development and maintenance process includes severe natural phenomena initiating events and that EPHAs identify and include consequence analyses for severe NPEs at each HAZMAT facility. Sites should develop event-specific EALs for the NPE analyses conducted in the EPHAs that indicate the appropriate initial protective actions (sheltering or evacuation) to implement.

2.1.2 Initial Protective Actions

Lessons Learned Statement: DOE Guide 151.1-4, *Response Elements EMG*, recommends that DOE/NNSA sites not use real-time meteorological conditions as a factor in determining initial event classification (and initial protective actions).

Discussion: Contrary to DOE guidance, most DOE/NNSA sites reviewed have developed and implemented EALs that use real-time meteorological conditions in determining initial protective actions. Sites typically differentiate two areas for protective actions: one that represents a circle around and close to a release point (where life-threatening health effects are possible) and one that represents a downwind sector farther away (where irreversible or other serious health effects could impair the ability to take protective actions). Most of the sites reviewed believe that their meteorological systems afford them the ability to be more precise in identifying downwind sectors. However, these sites have not considered the impacts to their meteorological systems or the availability of emergency response personnel during a severe NPE.

Analysis: Establishing protective action areas based on wind direction requires a sophisticated understanding of the local atmospheric transport/dispersion environment, accurate information on current meteorological conditions, and a high degree of confidence in the forecast. It also complicates, and potentially lengthens, the decision-making processes. The need for reliable real-time weather information and on-call meteorological expertise, together with the added complexity of the decision making process, make such an approach unsuitable for reaching timely, conservative, and anticipatory protective action decisions as required by DOE emergency management policy.

Recommended Actions: Sites should revise their EALs to implement a 360-degree initial protective action distance corresponding with the identified consequence analyses protective action distances in the EPHAs.

2.2 Facilities and Equipment

DOE Order 151.1C establishes functional requirements needed 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 implementing mechanisms are established, the DOE order requires the facility and equipment to be available, operable, and maintained. Independent Oversight identified weaknesses in locating command centers too close to HAZMAT, the lack of operable command center habitability systems, and the lack of test programs for backup power sources and

communication systems.

2.2.1 Command Centers

Lessons Learned Statement: 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*, recommends that the alternate EOC be located to minimize the likelihood of both the primary and alternate facilities being rendered uninhabitable by the same event, which can be accomplished by locating the alternate facility outside the emergency planning zone.

Discussion: Large DOE/NNSA sites often have multiple command centers. The primary command center is the EOC, where the site-level emergency management team (EMT) assembles, and sites identify additional command centers that include area- and/or facility-level ECCs where area-level and facility-level EMTs assemble, respectively. Independent Oversight reviewed the EOCs for compliance with the DOE order and applied its guiding principles to the ECCs. The ECCs are often facility control rooms where important equipment, such as local area public address microphones and controls for backup generators, ventilation systems, and process equipment are located. ECCs are typically staffed with operations personnel who become the facility-level EMTs; EOCs are not staffed full-time, so the site-level EMT and support staff must relocate to the EOC to make it operational. Independent Oversight identified only one EOC that had a stated occupancy duration (14 days) for an event.

Analysis: Many sites have located their EOCs within the PAC distance of one or more analyzed HAZMAT release scenario documented in EPHAs, and, typically, sites consider only one HAZMAT release point when planning an alternate facility location. Problems arising from structural damage, airborne toxins, and security lockdowns could prevent the EMT and support staff from reporting to or remaining at the EOC for the duration of an emergency caused by a severe NPE. In addition, EOCs are typically in buildings that meet the local standard building codes and sometimes have additional seismic upgrades beyond what the standard building codes require. However, EOC buildings typically do not meet the performance criteria specified for HAZMAT buildings, and equipment installed in EOCs is not secured to meet any seismic qualifications. Additionally, ECCs are typically in less robust structures and closer to HAZMAT than EOCs. Therefore, if an NPE is severe enough to cause a HAZMAT release, the command centers are likely to be uninhabitable for some sites due to structural damage or toxic airborne contaminant levels caused by the severe NPE. The designated alternate command center facilities may also be uninhabitable when more than one hazardous release is in progress, because they are not sufficiently distant from the primary facility and sites only considered a single HAZMAT release point when planning alternate locations. Consequently, all or some of the designated command centers may be uninhabitable at the onset of a severe NPE.

Sites typically do not plan for remaining in command centers for an extended duration, and DOE policy does not define an acceptable duration for planning purposes. Severe NPEs will likely result in the need for the EMTs to remain in command centers for much longer durations than sites typically plan or prepare for. Demands placed on command and control with managing wildland fires necessitated extended staffing for those EOCs, which may be representative of the planning needed by other sites when planning for severe NPEs.

Recommended Actions: Sites should evaluate the locations of their primary and alternate EOCs and ECCs, and use the PAC distances determined in EPHAs to identify the habitability concerns of established command centers. Sites should assume the simultaneous HAZMAT release from multiple locations when determining habitable locations. Sites should also determine whether EMT members can

safely relocate to designated primary/alternate EOC/command centers and remain there for extended durations of a severe NPE-induced HAZMAT emergency.

2.2.2 EOC Habitability Systems

Lessons Learned Statement: 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, DOE has committed to the Defense Nuclear Facilities Safety Board (DNFSB) that all high efficiency particulate air (HEPA) filters used in habitability systems will be tested at an approved filter test facility prior to installation. The DNFSB clarified, in a letter dated August 14, 2003, that this includes EOC HEPA filters.

Discussion: Several DOE/NNSA sites have placed their command centers in locations that could be adversely impacted by a HAZMAT release. Additionally, most sites do not typically have EOCs with operable habitability systems as described in the EMG and instead rely on an alternate location. Further, some sites were unaware of the DOE commitment to the DNFSB, made circa 2001 and promulgated through letters and memoranda, to have HEPA filters installed in EOC air intake ductwork certified at a DOE-approved filter test facility prior to installation.

Analysis: Any decision to relocate a command center during an emergency to an alternate location would disrupt command center functionality. Typically, EOCs and ECCs do not have sufficiently filtered intake air or a means to prevent infiltration by outside air. Although sites are prepared to reduce infiltration of outside air into many existing command facilities, infiltration is not preventable and infiltration rates would likely increase with structural damage caused by some severe NPEs. Additionally, at some command centers, EMT members inappropriately rely on olfactory senses instead of detectors and alarms to determine the habitability of the facility with respect to airborne contaminants.

Recommended Actions: Sites should evaluate whether EOCs/ECCs are adequately equipped to detect the airborne HAZMAT analyzed in EPHAs and install appropriate detectors as appropriate. Sites that have air intake purification capabilities in command centers should verify that testing, maintenance, and operating practices meet the manufacturer's recommendations or appropriate industry standards, as well as test and certify HEPA filters at a DOE-approved facility before installation.

2.2.3 Backup Power Sources

Lessons Learned Statement: DOE developed DOE-STD-3003-2000, *Backup Power Sources for DOE Facilities*, to increase the reliability of backup power supplies after an unacceptable number of generators at DOE sites failed to start and power equipment. The DOE standard applied National Fire Protection Association (NFPA) backup power standards (which are written in generic terms for general industry use) by clarifying their specific use at DOE facilities given the importance and uniqueness of DOE facility equipment, such as radiation detection and alarm systems and security systems. This DOE standard applies a graded approach for testing of, 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 sites to establish the emergency, standby, or optional power designation based on the significance of equipment powered by backup power sources. However, the DOE standard is not required at any DOE/NNSA site unless specifically invoked by contract, authorization basis document, or other commitment. Importantly, there is no requirement that command centers have backup power capability.

Discussion: Only one of the facilities reviewed by Independent Oversight during 2012 invoked the

standard in its contract. Most sites were unaware of the DOE standard and have not used the guidance provided therein for designating the type of backup power sources installed. Some sites attempted to apply NFPA standards separate from the DOE standard, which resulted in inconsistent approaches that primarily focused on life safety code items such as emergency lighting and public address systems. Most sites used the manufacturer's recommendations as the basis for preventive maintenance programs, but Independent Oversight identified significant differences among sites regarding the rigor and frequency of test programs for equipment and diesel fuel.

Analysis: Most sites have designated their backup power sources as either standby or optional power sources using generic industry guidance rather than the DOE-specific guidance contained in the DOE standard. The DOE standard establishes designations of emergency power sources for the most critical equipment, followed by standby power sources for important equipment, and the required rigor of test and maintenance programs reflects that importance. The NFPA standards do not apply to optional power sources, although sites typically use NFPA standards for establishing the optional power source test and maintenance programs in conjunction with the manufacturer's recommendations. If the DOE standard were consistently applied across the complex, backup power source maintenance and test programs at some sites would require significant improvements to ensure that more reliable backup power systems are available. Equipment could also be affected because, at one site, there are no automatic generator start and loading features and only limited remote control capabilities for powering equipment that is needed for an emergency response. In that case, hazardous conditions could delay or prohibit safe operation of needed equipment.

Recommended Actions: To improve the reliability of command centers during an emergency, DOE/NNSA contracting officer representatives should consider the inclusion of DOE-STD-3003-2000, *Backup Power Sources for DOE Facilities*, or an equivalent standard into site contracts to establish the appropriate power source designator and the associated rigor of test and maintenance programs for the assigned designations. Sites should also evaluate their capabilities for powering equipment that is needed during HAZMAT releases and, where remote control capabilities do not exist, perform additional planning to ensure personnel can safely power needed equipment in a timely manner when multiple HAZMAT releases are in progress.

2.2.4 Communication Systems Testing

Lessons Learned Statement: DOE Order 151.1C requires that equipment adequate to support an emergency response be available, operable, and maintained, and that tests of the communication systems used to contact offsite agencies be performed at least annually. NFPA-1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*, recommends testing incoming telephone lines daily in facilities where 911-type calls are answered. DOE Guide 151.1-4 provides additional guidance for communication systems and states that systems relied on to provide notifications and activate the emergency response organization (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.

Discussion: DOE/NNSA sites have multiple communication systems available for use during emergencies to facilitate information flow. Although the sites periodically test most of the communication systems to ensure their operability, several weaknesses were noted. Procedures and checklists did not contain testing requirements (methodology and frequency) for all of the communication systems. Further, testing methodologies did not always confirm that the equipment would function as needed. For example, some sites test a handheld radio by merely turning it on although that does not verify that the radio can transmit and receive messages. In addition, the sites did not consistently document the completion of required testing. Most significantly, sites did not test one or more of their

communication systems, which included equipment such as:

- 911 telephone lines
- Pagers (ERO and field workers)
- Radios (EOC and Alternate EOC)
- Telephones (Alternate EOC)
- Desktop computers (EOC and Alternate EOC)
- Laptop computers (field locations)
- Facsimile machines (EOC and Alternate EOC)

Analysis: DOE/NNSA 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, none of the sites test all of the systems to ensure they are functioning as intended. Past events at DOE/NNSA sites, such as wildland fires and ice storms, caused some primary communication systems to fail and validated the need for multiple communication systems. During and after severe NPEs, the disruptions to communication systems would be even greater, further necessitating the need for reliable primary and backup systems. Failing to 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 all systems are included. The testing procedure and/or checklist should include the frequency (e.g., weekly or monthly) and functional testing methodology for each system (e.g., ability to receive and transmit a message, or create and display an event log). The sites should also document the completion of testing requirements and any corrective actions needed to restore system operability.

2.3 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 determined the level of planning and preparedness activities between sites and offsite agencies, which allowed a comparative analysis of planning among DOE/NNSA sites. During the 2012 reviews, Independent Oversight identified significant differences among the sites relative to the level of planning for performing offsite monitoring activities, the extent of offsite response planning, the identification of offsite response capabilities for use at a DOE/NNSA site, and recovery planning.

2.3.1 Offsite Monitoring and Integration with NNSA Assets

Lessons Learned Statement: 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. Consequence assessments must:

- Be timely throughout the emergency
- Be integrated with the emergency classification and protective action process
- Incorporate monitoring of specific indicators and field measurements

- Be coordinated with Federal, state, local, and tribal organizations

Discussion: Independent Oversight observed significant differences in planning for chemical and radiological offsite emergency response field monitoring across the DOE/NNSA complex.
At some sites, DOE has signed an agreement in principle (AIP) with the state and included specific requirements for offsite field monitoring and consequence assessment. Typically, the AIP process has resulted in the implementation of an offsite monitoring capability that integrates DOE monitoring resources with state government resources. One NNSA site further integrated their offsite field monitoring team (FMT) and the regional radiological assistance program (RAP) team to provide a large pool of monitoring personnel. State and site plans, procedures, and instructions exist to implement the offsite field monitoring process and provide information to state and DOE decision-makers. Routinely, these sites validated this capability during exercises with the state, including full participation exercises involving RAP and the National Atmospheric Release Advisory Center (NARAC).
At several other sites, there is no AIP or equivalent formality in planning between DOE and the state government relative to offsite monitoring. Consequently, the site and the state do not have offsite FMTs. Additionally, these sites usually have no written plan or procedure that defines how offsite monitoring of actual or perceived offsite radiological and chemical hazards and risks to the public and the environment is accomplished. Furthermore, most surrounding county governments stated to Independent Oversight that the county expects the site to facilitate offsite radiological monitoring for a DOE-owned HAZMAT release. Nonetheless, there was no protocol or procedure to integrate site field monitoring concepts of operation with other potential monitoring teams, the state's National Guard Civil Support Team, the regional RAP, Environmental Protection Agency, or other Federal agencies. In addition, none of these sites had validated, in the site exercise program, effective 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, Federal 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 NNSA national assets (RAP, FRMAC, NARAC, and Radiation Emergency Assistance Center/Training Site (REAC/TS)) capabilities and protocols. 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 the response function will likely default to the RAP or FRMAC.

Analysis: Few DOE/NNSA 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 in identifying the radiological plume, areas requiring protective actions, and food control boundaries potentially resulting from a DOE general emergency. Independent Oversight observed significant differences in offsite planning and emergency response field monitoring capabilities at recently reviewed DOE/NNSA sites. Also, some sites are not appropriately participating with NNSA assets to ensure an effective integration with local, state, and Federal government agencies, when needed. The National Response Framework Nuclear Radiological Incident Annex provides a framework to integrate radiological monitoring response across all levels of government; this has not been factored into 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 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). Furthermore, sites should ensure that monitoring capabilities include planning for airborne sampling, direct measurement of the radiation dose rate or contamination levels, and sampling with 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. Lastly, 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 the site exercise plan to ensure validation of all emergency management program elements over a five-year period and to optimize the usefulness of annual exercises.

2.3.2 Severe Event Planning with State and Local Governments

Lessons Learned Statement: 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.

Discussion: Numerous examples of severe NPEs and other 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. 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. Importantly, a severe NPE is likely to affect both the site and the surrounding counties, exacerbating the need to use scarce assets in the most prudent manner to accomplish national response priorities. Independent Oversight observed noticeable differences in emergency planning with state and local governments across the DOE/NNSA complex.

Only a few sites had adequate planning for obtaining and integrating offsite response assets needed to respond to a severe NPE. These locations had jointly developed with state and local government and other Federal agencies emergency response plans that included response to severe and catastrophic events. Additionally, at these locations, the state had specific emergency planning for a site event. Furthermore, these sites routinely interact with offsite response agencies and organizations to review response planning and preparedness for augmenting site response resources. These emergency response plans serve as the primary planning documents for offsite response organizations and describe general concepts that guide the offsite response. In addition, support agreements are in place to identify the mechanisms to request supplemental resources from offsite organizations, and the sites' emergency plans contain provisions to communicate with offsite response assets and to coordinate decision-making.

At other DOE/NNSA sites, planning and provisions for interfacing and coordinating with Federal, state, and local agencies responsible for offsite emergency response were minimal. Importantly, an overarching

factor in response planning is the location of the site, with many DOE sites in remote areas of the state where the most significant developments are the site facilities and the associated residential communities and commercial areas. At these locations, mutual aid responders from the contiguous counties would likely require significant time to respond to an onsite event. Additionally, a severe regional event is likely to affect both the site and the surrounding communities, exacerbating the need to use scarce assets in the most prudent manner to accomplish national response priorities.

Independent Oversight also found that some state and local governments do not consider the DOE nuclear hazard category 3 sites as fixed nuclear facilities under Federal criteria. Therefore, the state and county governments are not required to have site-specific response planning. Based on this determination, these sites coordinate an emergency response in accordance with their respective state and county emergency operations plans, all of which use the National Response Framework (NRF) as a basis.

Analysis: Insufficient offsite response planning at some DOE sites may result in an unclear understanding of the actions anticipated by each interface agency and the information needed to respond effectively. During a severe NPE, a DOE/NNSA site will likely be one of numerous entities competing for scarce resources. The National Incident Management System (NIMS) emphasizes resource management with the utilization of standardized resource management concepts such as typing, inventorying, organizing, and tracking that will facilitate the dispatch, deployment, and recovery of resources before, during, and after an incident.

Recommended Actions: To improve site-specific planning for severe NPEs, sites should plan for response to severe NPEs that could have a significant and widespread impact on the site and surrounding community emergency response infrastructure. 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. Furthermore, sites should include the planning assumptions 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, for improved emergency planning with state and local governments, sites should consider adopting and/or integrating NIMS resource management tools, such as resource typing, which is categorizing, by capability, resources requested, deployed, and used in an incident. Another recommended resource management tool is the NIMS Incident Resource Inventory System (IRIS), which is free software developed for NIMS, used to enter typed and non-typed resources into a database and allows the user to search/identify specific resources for incident operations and mutual aid purposes.

Additionally, sites should continue reinforcing the site ERO and offsite responder skills and capabilities related to severe NPEs by including severe NPE scenarios in the site drill and exercise program. 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. Furthermore, sites should update response plans and procedures to reflect information extrapolated from severe NPE planning workshops, drills and exercises, and lessons learned from past disasters.

2.3.3 Response Planning for Events Beyond the Site's Capabilities

Lessons Learned Statement: 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 420.1B, *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.

Discussion: Independent Oversight observed 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, and trench and excavation work
- 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
- Some site BNAs do not identify and establish the levels of capabilities needed for conducting technical rescue operations

Most sites fittingly plan for wildland fires and have support agreements in place with Federal, state, local, and tribal agencies for wildland firefighting. However, one site did not adequately plan for wildland fires. Specifically:

- The site identified in their documented safety analysis and hazards survey that wildland fires are a potential threat on the site.
- The site fire response capability does not include wildland fire fighters trained in accordance with NFPA-1051, *Wildland Fire Fighter Professional Qualifications.*
- The site has no response plan or agreements with Federal, state, or county agencies to respond to a wildland fire.
- The site BNAs do not identify and establish response capabilities needed for conducting wildland fire operations.

The remote location of several DOE/NNSA sites limits the availability of emergency response resources to the site. Many sites plan that offsite mutual aid responders require an hour or more for ground responders to arrive on site. Unfortunately, this means an increased risk of death for some severely injured persons due to a lengthy transport time of the patient to a level 1 trauma center. In fact, the nearest level 1 trauma center to several DOE/NNSA sites is only accessible by air ambulance, and some sites do not have planning for an air ambulance service to transport or a level 1 trauma center to receive and treat contaminated injured personnel.

Analysis: The response to some potential emergency response scenarios, such as technical rescue (collapsed structure, confined space, trench, and excavation), wildland fire, and severe NPEs, would likely be ad hoc by some DOE/NNSA sites, since little or no onsite capability is available and the site has not completed adequate planning to acquire resources from outside resources. Additionally, some sites may need to evaluate the need for additional planning with a level 1 trauma center to receive and treat contaminated injured personnel, such as burn victims.

Recommended Actions: To improve site-specific planning for technical rescue operations, sites should establish and document, in the BNA, 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 document any specific functional rescue capabilities provided by offsite assistance and reference applicable mutual aid agreements. If these services are provided by site personnel, job performance requirements should be

established. Also, the site emergency plan should include all technical rescue capabilities, how they are provided, and applicable agreements.

Sites should ensure site-specific planning for wildland fire management by verifying that a documented strategy for initial response to a wildland fire exists. Additionally, sites should determine if there is a strategy for management of wildland fires beyond initial response capability. Sites should also verify that the site BNA appropriately documents wildland firefighting capabilities relied on through mutual aid agreements. In addition, the site emergency plan should summarize all response strategies and capabilities for a wildland fire response.

To improve emergency medical services and mass casualty incident response planning, sites should ensure the closest level 1 trauma center hospital agrees to receive and medically treat chemically and radiologically contaminated injured site personnel at their trauma center. Additionally, sites should verify that available air ambulance services agree to transport chemically and radiologically contaminated injured site personnel to designated trauma centers. Sites should consider incorporating the Centers for Disease Control and Prevention Guidelines for Field Triage of Injured Patients, which serves as the basis for triage protocols to guide initial emergency medical service providers through the decision steps to determine the most appropriate destination facility within the local trauma care system.

2.3.4 Recovery and Reconstitution Planning Following a Severe or Catastrophic Event

Lessons Learned Statement: DOE Order 151.1C requires that recovery from a terminated operational emergency must include communicating and coordinating with state and local governments and other Federal agencies; planning, management, and organization of the associated recovery activities; and ensuring the health and safety of the workers and public.

Discussion: Independent Oversight observed that all DOE/NNSA sites describe basic emergency event recovery operations in their respective procedures. However, Independent Oversight noted several limitations in response and short-term recovery planning for severe NPEs. For example:

- 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, but the plans typically document only nominal reconstitution planning
- 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 following a severe NPE or catastrophic event
- Few sites conduct an adequate number of exercises that focus on severe NPEs or catastrophic events, but very few of these exercises postulate consequences that result in significant structural damage or building collapse and generate resource requirements that the site cannot meet

Notably, some sites have initiated reconstitution planning following a catastrophic event, both for a severe NPE and a catastrophic security event. For example:

- Some sites have developed response plans with the Federal Bureau of Investigation (FBI), which define roles, responsibilities, logistical requirements, and procedures used during a catastrophic event at the site that require intervention by the FBI
- One NNSA site has planned for reconstituting the site after a severe NPE or catastrophic security event. The site also interacts annually with dozens of law enforcement agencies within a 50-mile

radius of the site and provides training related to response and interface with the protective force, and the site has recently conducted numerous tabletop exercises with the Federal, state, and local jurisdictions that may be involved in reconstitution following a catastrophic event

Analysis: Independent Oversight determined that most DOE/NNSA 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 on the NRF 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 before receiving any significant Federal response. Planning should also 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. Furthermore, sites should 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. In addition, 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).

3.0 NOTEWORTHY PRACTICES

Independent Oversight observed that some sites had significant strengths in planning for severe NPEs that could benefit others within the DOE/NNSA complex. Independent Oversight identified the following areas and sites that have particularly innovative or mature aspects of their emergency management program. Sites interested in learning more about specific attributes of these strengths should contact site representatives directly.

3.1 EOC Occupancy Planning

LANL has established a14-day EOC occupancy duration for planning purposes to allow undisrupted management of a long-term event. The LANL EOC is equipped with ready-to-eat meals, beds, showers, a kitchen, and a dedicated standby generator and water supply.

3.2 Structure Integrity

SRS implements a periodic inspection program to ensure maintenance of structures' seismic and tornado shelter qualifications.

3.3 Standby Power Generator Testing

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

3.4 Diesel Fuel Analysis Program

SRS implements a comprehensive diesel fuel-sampling program to meet industry standards and includes fuel analysis upon receipt from the supplier, bulk storage tanks, site distribution trucks, and generator fuel supply tanks.

3.5 Site Evacuations

INL has extensively prepared for implementing site evacuations. Commuter and site buses, operator cross training as bus drivers, communications, personnel accountability protocols, and staged prophylactics are covered in INL plans.

3.6 Communication Systems

LANL and the Paducah Gaseous Diffusion Plant provide their EOC cadre with Government Emergency Telecommunications Service cards that provide priority telephone access and Wireless Priority Service (WPS) accounts that provide priority cellular telephone access during periods of severe network congestion or disruption. WPS proved to be particularly useful at LANL during a wildland fire by allowing users to place cellular telephone calls when the system was overloaded.

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

3.7 Personal Protective Equipment

Although sites do not intend for their FMTs to enter a plume or receive an exposure, Y-12 provides their teams with respiratory protection in case the teams unexpectedly encounter HAZMAT.

3.8 Decontamination Equipment

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

3.9 Offsite Monitoring and Integration with NNSA Assets

The most mature DOE site relative to planning for offsite monitoring and integration with NNSA assets is Y-12. The site has signed an AIP with the State of Tennessee and included specific requirements for offsite field monitoring and consequence assessment. As a result, the site has implemented a rigorous offsite monitoring capability that integrates their offsite FMT and the Region 2 RAP team to provide a large pool of monitoring personnel. The state has also established a large pool of counterparts from departments within the state government. Initially, the site EOC directs their offsite FMT; however, as

state resources become operational, the state EOC director will request the transfer of command and control of the site FMT to the state. Furthermore, the state EOC director develops a consolidated field monitoring strategy that incorporates all offsite monitoring assets. Should the state EOC director determine the need for additional monitoring assets, he/she may request further support from DOE RAP, the state Civil Support Team, and the Environmental Protection Agency. In accordance with state and site procedures, the state will request RAP assistance through the site EOC. Detailed state and site plans, procedures, and instructions exist to implement the offsite field monitoring process and provide information to state and NNSA decision-makers. The site has validated this capability during numerous exercises with the state, including full participation exercises involving RAP and NARAC.

3.10 Response Planning for Wildland Fire Events Beyond the Site's Capabilities

LANL has the most robust planning and preparedness for wildland fires. These events are an expected occurrence at LANL 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. As a result, LANL has completed significant planning for wildland fires with Federal, state, and county agencies. Most importantly, Los Alamos Site Office entered into a joint powers agreement (JPA) with the State of New Mexico Forestry Division, the U.S. Forest Service, the U.S. Department of Interior, Bureau of Indian Affairs, Bureau of Land Management, National Park Service, and the U.S. Fish and Wildlife Service for interagency fire protection. In addition, a separate agreement between the State of New Mexico and Los Alamos County further documents the commitment to wildland fire suppression and interagency cooperation. Important aspects of the 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 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

4.0 FUTURE REVIEWS

During 2013, Independent Oversight will continue to evaluate the capabilities and preparedness of select site and facility emergency response programs to respond to severe NPEs. The emphasis of the reviews will be on the plans and procedures of program elements related to response and recovery to severe NPEs, combined with programmatic weaknesses and deficiencies identified during previous reviews. HS-45 will utilize a small team to review the emergency management program of nuclear hazards category I or II sites (including command centers and select nuclear facilities). A CRAD has been developed for 2013 that focuses on the technical basis, plans, equipment and facilities, training and drills, emergency medical support, and exercise elements contained in DOE Order 151.1C. This CRAD and other guidance documents and reports can be viewed on the Independent Oversight website at http://www.hss.doe.gov/indepoversight/safety_emergencymgt/index.html

HS-45 will also sample corrective actions from prior reviews for follow-up and respond to emergent requirements, as appropriate. During 2014, review emphasis will evolve from reviewing planning documents and procedures to evaluating site/facility ERO performance. Limited-scope performance tests

will be conducted with an emphasis on the ERO's ability to perform short- and long-term recovery in response to severe NPEs.

Appendix A
Supplemental Information

A.1 Office of Health, Safety and Security Management

Glenn S. Podonsky, Chief Health, Safety and Security Officer
William A. Eckroade, Principal Deputy Chief for Mission Support Operations
John S. Boulden III, Director, Office of Enforcement and Oversight
Thomas R. Staker, Deputy Director for Oversight
William E. Miller, Deputy Director, Office of Safety and Emergency Management Evaluations

A.2 Quality Review Board

William Eckroade
John Boulden
Thomas Staker
William Miller
Michael Kilpatrick
George Armstrong
Robert Nelson

A.3 Independent Oversight Reviewers

Randy Griffin – Lead
John Bolling
Deborah Johnson
Teri Lachman
Tom Rogers