Peter S. Winokur, Chairman
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DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

September 3, 2014

The Honorable Ernest J. Moniz
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Moniz:

On September 2, 2014, the Defense Nuclear Facilities Safety Board (Board), in accordance with 42 U.S.C. § 2286d(a)(3), approved Recommendation 2014-1, *Emergency Preparedness and Response*, which is enclosed for your consideration along with all related findings, supporting data, and analysis; the risk assessment; and a copy of the "Disposition of DOE Comments on Draft Recommendation 2014-1." This Recommendation identifies the need to take actions to improve the emergency preparedness and response capability at the Department of Energy's (DOE) defense nuclear facilities.

After you have received this Recommendation, and as required by 42 U.S.C. § 2286d(b), the Board will promptly make the Recommendation and any related Secretarial correspondence available to the public. The Board believes that this Recommendation contains no information that is classified or otherwise restricted. To the extent that this Recommendation does not include information restricted by DOE under the Atomic Energy Act of 1954, as amended, please arrange to have it and any related Secretarial correspondence placed promptly on file in your regional public reading rooms. The Board will also publish this Recommendation in the *Federal Register.*

The Board will evaluate DOE's response to this Recommendation in accordance with the Board's Policy Statement 1, *Criteria for Judging the Adequacy of DOE Responses and Implementation Plans for Board Recommendations.*

Sincerely,

Peter S. Winokur, Ph.D.
Chairman

Enclosures

c: Mr. Joe Olencz

RECOMMENDATION 2014-1 TO THE SECRETARY OF ENERGY
Emergency Preparedness and Response
Pursuant to 42 U.S.C. § 2286d(a)(3)
Atomic Energy Act of 1954, As Amended

Dated: September 2, 2014

The need for a strong emergency preparedness and response program to protect the public and workers at the Department of Energy's (DOE) defense nuclear facilities is self-evident. Design basis accidents resulting from natural phenomena hazards and operational events do occur and must be addressed. Consequently, emergency preparedness and response is a key component of the safety bases for defense nuclear facilities, as evidenced by its inclusion as a safety management program in the technical safety requirements for these facilities and in specific administrative controls that reference individual elements of emergency response. It is the last line of defense to prevent public and worker exposure to hazardous materials. One of the objectives of DOE's order on emergency preparedness and response (Order 151.1C, *Emergency Management System*) is to "ensure that the DOE Emergency Management System is ready to respond promptly, efficiently, and effectively to any emergency involving DOE/[National Nuclear Security Administration (NNSA)] facilities, activities, or operations, or requiring DOE/NNSA assistance." The Defense Nuclear Facilities Safety Board (Board) believes that the requirements in this order that establish the basis for emergency preparedness and response at DOE sites with defense nuclear facilities, as well as the current implementation of these requirements, must be strengthened to ensure the continued protection of workers and the public.

Problems with emergency preparedness and response have been discussed at Board public hearings and meetings over the past three years, as well as in Board site representative weekly reports and other reviews by members of the Board's technical staff. At its hearings, Board members have stressed the need for DOE to conduct meaningful training and exercises to demonstrate site-wide and regional coordination in response to emergencies. Board members have also encouraged DOE to demonstrate its ability to respond to events that involve multiple facilities at a site and the potential for several "connected" events, e.g., an earthquake and a wildland fire at Los Alamos.

On March 21, 2014, and March 28, 2014, the Board communicated to the Secretary of Energy its concerns regarding shortcomings in the responses to a truck fire and radioactive material release event at the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico. The DOE Accident Investigation Board explored and documented these shortcomings in its reports. Many of the site-specific issues noted at WIPP are prevalent at other sites with defense nuclear facilities, as documented in the attached report.

The Board has observed that these problems can be attributed to the inability of sites with defense nuclear facilities to consistently demonstrate fundamental attributes of a sound emergency preparedness and response program, e.g., adequately resourced emergency preparedness and response programs and proper planning and training for emergencies. DOE

has noted these types of problems in reports documenting independent assessments of its sites and in its annual reports on the status of its emergency management system. The annual reports also noted a lack of progress in addressing these problems.

The Board is concerned that these problems stem from DOE's failure to implement existing emergency management requirements and to periodically update these requirements. DOE has not effectively overseen and enforced compliance with these requirements, which establish the baseline for emergency preparedness and response at its sites with defense nuclear facilities. These requirements need to be revised periodically to address lessons learned, needed improvements to site programs, new information from accidents such as those at the Deepwater Horizon drilling rig and the Fukushima Dai-ichi Nuclear Power Plant, and inconsistent interpretation and implementation of the requirements.

Through its participation in DOE nuclear safety workshops in response to the events at the Fukushima Dai-ichi Nuclear Power Plant and its lines of inquiry regarding emergency preparedness and response at recent public hearings and meetings, Board members have been supportive of DOE's efforts to improve its response to both design basis and beyond design basis events. However, the Board believes DOE's efforts to adequately address emergency preparedness and response at its sites with defense nuclear facilities have fallen short as clearly evidenced by the truck fire and radioactive material release events at WIPP.

Background

Technical planning establishes the basis for emergency preparedness and response at DOE sites with defense nuclear facilities. Technical planning includes the development of emergency preparedness hazards assessments, identification of conditions to recognize and categorize an emergency, and identification of needed protective actions. This basis is used to develop emergency response procedures, training, and drills for emergency response personnel. This basis leads to identification of resource requirements for emergency response, including facilities and equipment. Technical planning is also the basis for determining the scope and scenario of exercises and other assessments used to verify and validate readiness and effectiveness of emergency response capabilities at DOE sites with defense nuclear facilities.

Hazards assessments form the foundation of the technical planning basis for emergency preparedness and response and provide the basis for the preparation of the procedures and resources used as personnel respond to emergencies. As cited in the attached report, the Board has observed that hazards assessments at many DOE sites with defense nuclear facilities do not (1) address all the hazards and potential accident scenarios, (2) contain complete consequence analyses, (3) develop the emergency action levels for recognizing indicators and the severity of an emergency, and (4) contain sufficiently descriptive protective actions. One example of incomplete hazards analysis that is endemic to the complex is the lack of consideration of severe events that could impact multiple facilities, overwhelm emergency response capabilities, and/or

have regional impacts.[1] This was a topic of discussion at the Board's public meeting and hearing on the Pantex Plant in Amarillo, Texas, on March 14, 2013, and on the Y-12 National Security Complex in Knoxville, Tennessee, on December 10, 2013.

At many DOE sites with defense nuclear facilities, the Board has observed, as cited in the attached report, that training on the use of emergency response procedures, facilities, and equipment is not adequate to fully prepare facility personnel and members of the emergency response organization. Similarly, drill programs are not adequately developed and implemented to augment this training.

As part of their preparedness for emergencies, DOE sites with defense nuclear facilities have emergency response facilities such as Emergency Operations Centers and firehouses, and associated support equipment. The Board has observed that some emergency response facilities at DOE sites with defense nuclear facilities will not survive all potential accidents and natural phenomena events and, consequently, will be unable to perform their vital function of coordinating emergency response. As discussed in the attached report, many of these facilities will not be habitable during radiological or hazardous material releases. Equipment that is used to support operations of these facilities is frequently poorly maintained and may not be reliable during an emergency.

The Board has also observed problems with DOE efforts to demonstrate the effectiveness of its planning and preparation for emergencies and its response capabilities. Exercises are used to demonstrate a site's capability to respond, and assessments are used to verify adequacy of planning and preparedness. As discussed in the attached report, exercises conducted at many DOE sites with defense nuclear facilities do not adequately encompass the scope of potential scenarios (i.e., various hazards and accidents) that responders may encounter. Some sites do not conduct exercises frequently enough or do not develop challenging scenarios. Many sites are not effective at critiquing their performance, developing corrective actions that address identified problems, and measuring the effectiveness of these corrective actions.

DOE oversight is a mechanism for continuous improvement and is used to verify the adequacy of emergency preparedness and response capabilities at its sites with defense nuclear facilities. As cited in the attached report, the Board has observed that many DOE line oversight assessments are incomplete and ineffective, and do not address the effectiveness of contractor corrective actions. In addition, the Board has noted that the current scope of DOE independent oversight is not adequate to identify needed improvements and to ensure effectiveness of federal and contractor corrective actions.

As observed recently with the emergency responses to the truck fire and radioactive material release events at WIPP, there can be fundamental problems with a site's emergency preparedness and response capability that will only be identified by more comprehensive assessments that address the overall effectiveness of a site's emergency management program.

[1] Severe events include design basis and beyond design basis events. They also include operational and natural phenomena events.

For example, emergencies can occur during off-shift hours, such as the radioactive material release event at WIPP that happened at approximately 11:00 p.m. on Friday, February 14, 2014. Overall effectiveness was the scope of DOE's independent assessments conducted prior to 2010. These assessments consistently identified problems with site emergency preparedness and response, and also sought continuous improvement of these programs. In 2010, DOE independent oversight transitioned to assist visits and did not conduct independent assessments. In 2012, DOE independent oversight returned to conducting independent assessments. However, these assessments are targeted reviews, currently only focused on the ability of the sites to prepare and respond to severe events. As a result, these independent assessments do not encompass all elements of emergency management programs and will not identify many fundamental problems.

Causes of Problems

Based on an evaluation of the problems observed with emergency preparedness and response at DOE sites with defense nuclear facilities, the most important underlying root causes of these problems are ineffective implementation of existing requirements, inadequate revision of requirements to address lessons learned and needed improvements to site programs, and weaknesses in DOE verification and validation of readiness of its sites with defense nuclear facilities.

The Board has observed at various DOE sites with defense nuclear facilities that implementation of DOE's requirements for emergency preparedness and response programs varies widely. Therefore, the Board concluded that some requirements do not have the specificity to ensure effective implementation. For example, existing requirements for hazards assessments lack detail on addressing severe events. Requirements do not address the reliability of emergency response facilities and equipment. Requirements for training and drills do not address expectations for the objectives, scope, frequency, and reviews of effectiveness of these programs. Requirements for exercises do not include expectations for the complexity of scenarios, scope of participation, and corrective actions.

Guidance and direction that address many of the deficiencies in these requirements are included in the Emergency Management Guides that accompany DOE Order 151.1C; however, many sites with defense nuclear facilities do not implement the practices described in these guides. DOE has not updated its directive to address the problem with inconsistent implementation. In addition, DOE has not incorporated the lessons learned from the March 11, 2011, earthquake and tsunami at the Fukushima Dai-ichi Nuclear Power Plant in its directive.[2] These lessons learned need to be more effectively integrated into DOE's directive and guidance on emergency preparedness and response.

[2] Lessons learned from this event that are applicable to DOE sites and facilities were discussed by DOE during its June 2011 Nuclear Safety Workshop and published in its August 16, 2011 report, *A Report to the Secretary of Energy: Review of Requirements and Capabilities for Analyzing and Responding to BDBEs*, and its January 2013 report, *A Report to the Secretary of Energy: Beyond Design Basis Event Pilot Evaluations, Results and Recommendations for Improvements to Enhance Nuclear Safety at DOE Nuclear Facilities*.

The Board also observed that DOE has not effectively conducted oversight and enforcement of its existing requirements. DOE oversight does not consistently identify the needed improvements to site emergency preparedness and response called for in its directive. When problems are identified, their resolution often lacks adequate causal analysis and appropriate corrective actions. When corrective actions are developed and implemented, contractors and federal entities frequently do not measure the effectiveness of these actions.

Conclusions

The Board and DOE oversight entities have identified problems with implementation of emergency preparedness and response requirements at various DOE sites with defense nuclear facilities. The Board has also identified problems with specific emergency preparedness and response requirements. These deficiencies lead to failures to identify and prepare for the suite of plausible emergency scenarios and to demonstrate proficiency in emergency preparedness and response. Such deficiencies can ultimately result in the failure to recognize and respond appropriately to indications of an emergency, as was seen in the recent radioactive material release event at WIPP. Therefore, the Board believes that DOE has not comprehensively and consistently demonstrated its ability to adequately protect workers and the public in the event of an emergency.

Recommendations

To address the deficiencies summarized above, the Board recommends that DOE take the following actions:

1. In its role as a regulator, by the end of 2016, standardize and improve implementation of its criteria and review approach to confirm that all sites with defense nuclear facilities:

    a. Have a robust emergency response infrastructure that is survivable, habitable, and maintained to function during emergencies, including severe events that can impact multiple facilities and potentially overwhelm emergency response resources.

    b. Have a training and drill program that ensures that emergency response personnel are fully competent in accordance with the expectations delineated in DOE's directive and associated guidance.

    c. Are conducting exercises that fully demonstrate their emergency response is capable of responding to scenarios that challenge existing capability, including their response during severe events.

d. Are identifying deficiencies with emergency preparedness and response, conducting causal analysis, developing and implementing effective corrective actions to address these deficiencies, and evaluating the effectiveness of these actions.

e. Have an effective Readiness Assurance Program consistent with DOE Order 151.1C, *Comprehensive Emergency Management System*, Chapter X.

2. Update its emergency management directive to address:

a. Severe events, including requirements that address hazards assessments and exercises, and "beyond design basis" operational and natural phenomena events.

b. Reliability and habitability of emergency response facilities and support equipment.

c. Criteria for training and drills, including requirements that address facility conduct of operations drill programs and the interface with emergency response organization team drills.

d. Criteria for exercises to ensure that they are an adequate demonstration of proficiency.

e. Vulnerabilities identified during independent assessments.

Peter S. Winokur, Ph.D., Chairman

RECOMMENDATION 2014-1TO THE SECRETARY OF ENERGY
Emergency Preparedness and Response

— Findings, supporting data, and analysis —

Introduction. In recent years, multiple high-visibility, high-consequence accidents have occurred. On April 20, 2010, the Deepwater Horizon oil rig exploded and sank, resulting in a sea floor oil gusher flowing for 87 days and releasing about 210 million gallons of oil in the Gulf of Mexico. On March 11, 2011, an earthquake and tsunami struck the Fukushima Dai-ichi Nuclear Power Plant, resulting in equipment failures, and a subsequent loss of coolant accident, nuclear meltdowns, and releases of radioactive materials. Both accidents are examples of an initial event that cascaded into subsequent events. In both cases the facility operators, institutional managers, and emergency responders were not adequately prepared.

The Defense Nuclear Facilities Safety Board (Board) has been concerned about whether (1) the Department of Energy (DOE) has provided adequate direction and guidance for emergency preparedness and response to severe events[1] that could affect multiple facilities, lead to cascading effects, cause loss of necessary utilities and supporting infrastructure, and require coordination for offsite support; (2) DOE sites and facilities have implemented DOE requirements for emergency preparedness and response; (3) DOE, in its role as a regulator, has provided adequate oversight of site and facility emergency preparedness and response; and (4) DOE and its contractors are adequately trained and qualified, and are using drills and exercises effectively and as required. In general, the Board has been concerned about a culture of complacency with respect to emergency preparedness and response.

These concerns about the emergency preparedness and response capabilities of DOE sites have been topics during recent Board public meetings and hearings at the Savannah River Site [1], Los Alamos National Laboratory [2], Pantex Plant [3], and Y-12 National Security Complex (Y-12) [4]. To address these concerns, members of the Board's staff conducted a review (1) to ensure DOE site emergency preparedness and response capabilities provide adequate protection of the public and workers; and (2) to provide feedback to DOE Headquarters and sites about improvements to complex-wide emergency management programs and site emergency preparedness and response. The objectives for the review included:

- Assessing individual DOE site emergency preparedness and response capabilities.

- Assessing DOE Headquarters efforts to provide comprehensive requirements and guidance, and to provide oversight and enforcement for conducting emergency management; specifically, recent efforts to improve site preparedness for severe events.

As part of an effort to assess the overall "health" of emergency preparedness and response at DOE defense nuclear facilities, members of the Board's staff conducted

[1] Severe events include design basis and beyond design basis events. They also include operational and natural phenomena events.

programmatic reviews at DOE's National Nuclear Security Administration (NNSA) and Environmental Management sites, representing the various elements of the nuclear weapons complex (i.e., weapons design laboratories, production sites, and cleanup sites). These assessments included reviews of emergency management program documents (including policy documents, plans, hazard assessments, and procedures; findings and opportunities for improvement (OFIs) resulting from federal and contractor assessments; corrective actions to address findings and OFIs; exercise and drill packages, with their associated after-action reports; etc.); onsite programmatic reviews; reviews conducted using video conferencing facilities; reviews to follow up on the results of previous reviews; and observation of drills and exercises. In addition to reviewing emergency preparedness and response in general, the staff reviews also addressed the ability to prepare and respond to severe events (e.g., events that can affect multiple facilities, can cascade into additional events, and can overwhelm site resources).

Historical Background. The Board has had a long-standing interest in the state of emergency preparedness and response at DOE sites that predates Deepwater Horizon and Fukushima. In the late 1990s, the Board issued a Technical Report [5] and a Recommendation [6] that led to improvements in emergency preparedness and response. However, the Board observed in the past several years that the momentum for continuous improvement has faded and that some sites have lost ground, failing to institutionalize improvements they had begun. The following section summarizes the Board's earlier engagement in improving emergency preparedness and response at DOE sites, and the fate of the resulting improvements.

DNFSB Technical Report—In March 1999, the Board published Technical Report-21, *Status of Emergency Management at Defense Nuclear Facilities of the Department of Energy*. The reviews documented in that report were based on objective evaluation guidance promulgated by both DOE [7] and the Federal Emergency Management Agency [8]. Although the evaluations were based on observations at several facilities with widely diverse missions and operating characteristics, and the observations were made over an extended time, there were a number of observations that recurred. The following bulleted list is a direct quote of the Board's general conclusions regarding the status of emergency management in a DOE-wide context:

- Top-level requirements and guidance for DOE and contractor organizations involved in emergency management functions are well founded and clearly set forth in appropriate documents.

- Applicable requirements and guidance are applied selectively. In some cases, noncompliance is condoned on the basis of a faulty conclusion—either that a requirement "doesn't apply here," or that a particular guidance element "isn't mandatory."

- A potentially serious problem exists at the DOE level, involving apparent misperceptions and questionable interpretations regarding the division of responsibility for: (1) development and promulgation of emergency management requirements and guidance; (2) establishment, conduct, and supervision of emergency management programs; and (3) oversight and evaluation of performance. Responsibilities are set forth clearly enough in DOE Order 151.1, *Comprehensive*

Emergency Management System (dated September 25, 1995) [9], but implementation could be made more effective with better cooperation among senior and mid-level managers in programmatic and staff offices [at DOE Headquarters] involved with emergency management matters. These conflicts, which also exist between DOE Headquarters and field elements, have been observed in other DOE contexts as well. All the involved organizations bear some degree of responsibility for these problems. This matter merits attention at the highest levels of DOE management.

- Deficiencies exist in emergency hazard analyses in one or more of the following areas:

  - Thoroughness of hazard assessments performed as elements of emergency planning at defense nuclear facilities, particularly in addressing all nuclear and nonnuclear hazards with potential impact on ongoing nuclear operations.

  - Verification and independent review processes used to ensure the completeness and accuracy of the parameters and analytical tools employed in hazard and consequence analyses, and identification of Emergency Classifications, Emergency Planning Zones, and Protective Action Recommendations.

  - Integration of emergency hazard assessments with related authorization basis activities for identification and implementation of the controls necessary for effective accident response.

- In general, consequence assessment is weak all across the DOE complex. Observations have included use of inapplicable computational models and/or software that is limited with regard to the hazards and accident scenarios that can be simulated. There are too few qualified responders assigned to execute sophisticated computer modeling programs for downwind plots of likely radiation levels and/or contamination; at some sites this responsibility is vested in a single individual.

- At some sites and facilities, Emergency Action Levels are insufficiently developed and poorly implemented. Response procedures occasionally fail to address reasonably postulated incidents that could lead to an operational emergency, sometimes because hazard assessments were not sufficiently comprehensive or penetrating. In some cases, initiating conditions have not been recognized in sufficient detail to permit timely initiation of the appropriate emergency action.

- Responders are slow to classify emergencies and to disseminate appropriate Protective Action Recommendations, both in drills and exercises, and in actual events. In some cases, recommended actions have been inconsistent with the prevailing conditions; in others, communication of the recommendations has been confused and unclear, leading either to failure to implement suitable protective measures or to implementation of unnecessary measures.

- Members of emergency response organizations whose emergency response duties are in addition to their routine day-to-day responsibilities are generally provided only minimal training regarding the infrastructure, equipment, and procedures involved in emergency response. Most of the training they do receive is imparted on the job during periodic drills and exercises; little formal classroom training or one-on-one tutoring is conducted for this group of responders.

- Tracking of the resolution of weaknesses disclosed during drills and exercises, as well as those experienced during actual emergencies, is poor. Closure of these issues is, at best, informal, with almost no attention from senior DOE managers. As a result, many weaknesses do not get satisfactorily resolved, and repetition tends to ingrain them groundlessly as inevitable characteristics of emergency response that cannot be corrected.

DNFSB Recommendation 98-1—On September 28, 1998, the Board issued Recommendation 98-1, *Resolution of Issues Identified by Department of Energy (DOE) Internal Oversight* [6]. Under this recommendation, the Board cited the need to establish a clear, comprehensive, and systematic process to address and effectively resolve the environment, safety, and health issues identified by independent oversight during the conduct of assessment activities. As a result, DOE established a disciplined process, clarifying roles and responsibilities for the identification of, and response to, safety issues; established clearer direction on elevating any disputed issues for resolution to the Office of the Secretary, if necessary; and established a tracking and reporting system to effectively manage completion of corrective actions, known as the "Corrective Actions Tracking System."

DOE sent the Implementation Plan [10] for Recommendation 98-1 to the Board, which accepted the Implementation Plan in March 1999. As part of its implementation of this plan, DOE developed corrective actions to address the issues identified in Technical Report-21 and during DOE's assessments of emergency management programs. DOE used these corrective actions as case studies to demonstrate execution of its Implementation Plan. Initially, the Corrective Actions Tracking System addressed only emergency management issues.

Evolution of DOE Oversight—After DOE identified serious problems in its security practices, the Secretary of Energy created the Office of Independent Oversight and Performance Assurance in early 1999 to consolidate security-related Department-wide independent oversight into a single office reporting directly to the Office of the Secretary of Energy. As a result of significant concerns with emergency management programs throughout the DOE complex, DOE created the Office of Emergency Management Oversight within the new organization. DOE incorporated the Office of Independent Oversight (which included the Office of Emergency Management Oversight) into the new Office of Security and Safety Performance Assurance in 2004, and then into the Office of Health, Safety and Security in 2006. The Office of Emergency Management Oversight began conducting oversight inspections in 2000.

The Office of Emergency Management Oversight conducted evaluations of the emergency management programs at DOE's sites about every three years, in accordance with DOE Order 470.2A, *Security and Emergency Management Independent Oversight and*

Performance Assurance Program [11], and DOE Order 470.2B, *Independent Oversight and Performance Assurance Program* [12].

Initially, the evaluations focused on critical planning and preparedness of sites to classify the severity of emergency conditions and to initiate appropriate protective actions. The evaluations addressed the identification and analysis of hazards, consequence analysis, emergency action levels used to determine the classification of an emergency, and protective actions for the workers and public. The evaluations included limited scope performance tests to demonstrate effectiveness of the emergency response organization to execute these essential response actions. As the Office of Emergency Management Oversight observed improvement with the ability to determine and implement protective actions, it iteratively expanded the scope of the evaluations to include other elements of emergency preparedness, such as the adequacy of plans, procedures, emergency response organization, training, drill and exercise programs, and readiness assurance.

The Office of Emergency Management Oversight documented the results of the evaluations, reviewed corrective action plans, and then followed up with an evaluation of the effectiveness of the corrective actions in the next year. The oversight resulted in progressive improvement in the emergency management programs at the DOE sites. The Board's staff limited its oversight of DOE's emergency management programs as a result of the rigor and effectiveness of the Office of Emergency Management Oversight.

In 2009, in compliance with the new vision for the Office of Health, Safety and Security (HSS) [13], the Office of Emergency Management Oversight focused on assisting DOE line management with solving problems in the area of emergency management, versus independent oversight.[2] In short, this focus included:

- Providing mission support activities only at the request of DOE line managers.
- Defining activities in a collaborative fashion with cognizant site and Headquarters managers and staff, tailoring the activities to best meet identified needs.
- Developing mission support activity reports and similar products that have been specifically designed to provide the information requested by line management, and that do not include ratings or findings.

In addition to moving from an independent oversight mode to an assist mode, the Office of Emergency Management Oversight no longer tracked corrective actions.

[2] HSS was recently reorganized into two new offices, the Office of Independent Enterprise Assessments and the Office of Environment, Health, Safety and Security; however, the rest of this paper will reference HSS since that was its designation when the reviews referenced in this paper were conducted. Also note that the Office of Emergency Management Oversight, which subsequently became part of the Office of Safety and Emergency Evaluations, has become the Office of Emergency Management Assessments and is located in the Office of Independent Enterprise Assessments as part of this reorganization.

DOE began to consider its preparedness for beyond design basis accidents after the 2011 Fukushima accident. As a result, evaluation of emergency preparedness and response at DOE's sites and facilities received attention again. However, DOE limited its reviews to evaluations of severe events.

DOE Response to Fukushima—In response to the March 11, 2011, earthquake and tsunami at the Fukushima Dai-ichi nuclear power plant, the Secretary of Energy issued a safety bulletin, *Events Beyond Design Safety Basis Analysis*, on March 23, 2011 [14]. This safety bulletin identified actions "to evaluate facility vulnerabilities to beyond design basis events at [DOE] nuclear facilities and to ensure appropriate provisions are in place to address them." The safety bulletin directed that these actions were to be completed for Hazard Category 1 nuclear facilities by April 14, 2011, and for Hazard Category 2 nuclear facilities by May 13, 2011.

During June 6–7, 2011, DOE held a two-day workshop addressing preliminary lessons learned from Fukushima. This workshop included presentations from representatives of government agencies and private industry, plus breakout sessions to identify vulnerabilities associated with beyond design basis events, natural phenomena hazards, emergency management, and actions to address these vulnerabilities. Results from this workshop and the responses to the Secretary of Energy's safety bulletin were published by DOE in the August 2011 Nuclear Safety Workshop Report, *Review of Requirements and Capabilities for Analyzing and Responding to BDBEs* [15]. This report identified recommendations for near-term and long-term actions to improve DOE's nuclear safety. A September 16, 2011, memorandum [16] from the Deputy Secretary "directed the Office of Health, Safety and Security (HSS) to work with DOE's Nuclear Safety and Security Coordinating Council, and the Program and Field Offices of both DOE and the National Nuclear Security Administration, to develop a strategy to implement the recommended actions and report back to [the Deputy Secretary] by the end of September 2011." The memorandum also stated that the Deputy Secretary "expect[ed] all short-term actions identified in section 8.1 of the attached report [to] be completed by March 31, 2012, and all recommendations to be completed by December 31, 2012."

HSS issued an implementation strategy, *Strategy for Implementing Beyond Design Basis Event Report Recommendation*, in February 2012 [17]. The implementation strategy addressed all the recommendations in the August 2011 Workshop Report and proposed that guidance and criteria be piloted at several nuclear facilities prior to revising safety basis and emergency management directives. HSS conducted pilot studies at the High Flux Isotope Reactor at the Oak Ridge National Laboratory, the Waste Encapsulation Storage Facility (WESF) at the Hanford Site, the H-Area Tank Farms at the Savannah River Site, and the Tritium Facility at the Savannah River Site [18, 19].

One of the recommendations in the August 2011 Nuclear Safety Workshop Report was to update the emergency management directives by December 2012 with a focus on incorporating requirements and guidance for addressing severe accidents. The DOE Office of Emergency Operations, which is responsible for the development and maintenance of DOE requirements for emergency preparedness and response at its sites, developed draft guidance for planning and preparing for severe events as part of its response to lessons learned from Fukushima; however, it has not been able to incorporate this guidance in the emergency management directives. To

date, none of these directives have been updated to reflect the lessons learned from the earthquake and tsunami at the Fukushima Dai-ichi nuclear power plant. In fact, the Office of Emergency Operations has not been able to update either the emergency management order (last revised in 2005) or the supporting guides (last revised in 2007) as part of its normal update and revision cycle. The Operating Experience Level 1 Document, *Improving Department of Energy Capabilities for Mitigating Beyond Design Basis Events* (OE-1), issued in April 2013 [20] does contain a summary of this guidance, but it does not drive action to implement this guidance.

Review Approach. To address the Board's objectives, members of the Board's staff developed three questions that formed the foundation of its review of the state of emergency preparedness and response at DOE defense nuclear facilities:

1. Does DOE provide facility workers, response personnel, and emergency management decision makers with adequate direction and guidance to make timely, conservative emergency response decisions and take actions that focus on protection of the public and workers?

2. Does DOE provide adequate equipment and hardened facilities that enable emergency response personnel and emergency management decision makers to effectively respond to emergencies and protect the public and workers?

3. Do the contractor assurance systems and DOE oversight provide an effective performance assurance evaluation of emergency preparedness and response?

The staff review was supplemented by reviews of relevant DOE independent oversight assessments. Members of the Board's staff also made observations regarding the ability of various site emergency management programs to address severe events, and included observations of the response to the truck fire and radioactive material release events at the Waste Isolation Pilot Plant (WIPP).

Observations. The following sections discuss observations made by members of the Board's staff as part of their review. Although the staff team made observations in numerous areas of emergency preparedness and response, the following sections address staff team observations that will have the most impact on improvements to emergency preparedness and response at DOE sites. The Technical Planning Documents, Training and Drills, and Exercises sections address the first review question. The Facilities and Equipment section addresses the second question. The Oversight and Assessments section addresses the third question. Some observations reflect problems with emergency management program requirements and guidance, including observations addressing: problems with specific requirements, problems with implementation of guidance, and problems with oversight and enforcement of compliance with these requirements.

Technical Planning Documents—Planning is a key element in developing and maintaining effective emergency preparedness and response. As required by DOE Order 151.1C [21], "emergency planning must include identification and analysis of hazards and threats, hazard mitigation, development and preparation of emergency plans and procedures, and

identification of personnel and resources needed for an effective response." DOE Guide 151.1-2, *Technical Planning Basis* [22], provides further clarification, highlighting in section 2.1 the need to document the technical planning basis used to determine "the necessary plans/procedures, personnel, resources, equipment, and analyses [e.g., determination of an Emergency Planning Zone] that comprise" an emergency management program.

Hazard Assessments: Development of planning documents begins with identification and analysis of hazards and threats, which is then followed by the development of actions to mitigate the effects of these hazards and threats during an emergency. The Board's staff team observed that the quality of these documents varied widely among the DOE sites, also varying among contractors at a site. Specifically, the staff team observed that hazards assessments at many DOE sites do not address all the hazards and potential accident scenarios,[3] contain incomplete consequence analyses, do not develop the emergency actions levels (EALs) for recognizing indications and the severity of an emergency, and contain incorrect emergency planning zones. In addition, a few sites limited their hazards assessments to the bounding analysis in their documented safety analysis; as a result, the hazard assessments do not address less severe events warranting protective actions for the workforce, and do not address beyond design basis accidents.

For example, during its 2013 review of the emergency planning hazard assessments (EPHAs) for facilities at the Sandia National Laboratories (SNL) in New Mexico, the Board's staff team found that the EPHAs were incomplete. The EPHAs for SNL defense nuclear facilities included input parameters for consequence analyses, but did not include documentation of the calculation or the results [23–25]. Further, the SNL EPHAs did not document the derivation of, or basis for, the EALs [23–25]. The EPHA for the Pantex Plant did not address flooding as a potential operational emergency, even though flooding occurred on July 7, 2010 [26–29]. The emergency responders for the radioactive material release at WIPP were unable to classify the event to identify needed protective actions because the hazard assessment did not evaluate a radiological release when the mine was unoccupied or when operations underground were not ongoing [30]. Although some sites have addressed natural phenomena events in their EPHAs, others have not. Overall, the sites do not address "severe" events that would affect multiple facilities or regional areas.

Emergency Action Levels: During its review of EALs for various sites, members of the Board's staff found that EALs and protective actions in the EPHAs for defense nuclear facilities were often based only on the worst case design basis accidents and were too generic to be effective. When decision makers know that the release is less severe than the worst case accident, they may be reluctant to implement conservative protective actions, particularly those that involve the public. Therefore, it is important to analyze less severe accidents so that less extreme responses can be developed for use by decision makers. EALs were often event-based rather than condition-based (i.e., based on observable criteria or triggers). As a result, emergency response personnel would not be able to identify emergency conditions of various degrees of severity and, therefore, would not be able to select appropriate protective actions. In

[3] An EPHA does not have to analyze all the scenarios, but it does have to identify all possible initiating events and their impacts and analyze the results of all potential impacts (such as breaching a confinement barrier or causing an explosion or fire).

addition, many of the EPHAs did not contain specific observable criteria or triggers to determine the severity of a radiological or hazardous material release when a release is occurring.

For example, the EALs for SNL were based on "worst case events"[4] and were event-based only [23, 24, 25, 30]. As a result, emergency response personnel would be unable to classify emergencies at different degrees of severity (Alert, Site Area Emergency, and General Emergency), determine the required response, and determine the needed protective actions for the workers and public. The EALs lacked observable criteria or triggers such as stack monitor readings, the quantity of material involved, the degree that containment or confinement is compromised, and whether ventilation is operating. This failure to include measurable triggers in EALs was also observed by HSS in oversight reviews at other sites such as the Hanford Site [31].

In contrast, the staff observed that the WIPP EALs reference conditions, but only after observing an event (such as a vehicle accident or a fire on a vehicle). Thus, if a condition occurs that is not associated with an observable event that was analyzed in the EPHA (such as occurred during the February 14, 2014, radioactive material release), emergency response personnel would be unable to categorize and classify the event, and then implement appropriate protective actions [29, 32].

Similarly, members of the Board's staff observed a wide variety of problems with EALs at other DOE sites. For example, at the Pantex Plant, EALs were predominantly event-based [33]. At Los Alamos National Laboratory (LANL), some EALs were based on bounding conditions similar to those in the documented safety analysis, and would not lead to the initiation of protective actions for accidents of a lesser degree [34, 35]; while EALs that were condition-based assume that personnel are at work in the facility to observe the indicators [36].[5] Similarly, at Lawrence Livermore National Laboratory (LLNL), EALs were also event-based [37–39]. Some use indicators that were limited to consideration of the initiating event and did not consider the results of the event or the follow-on indicators (e.g., a confinement barrier is defeated, alarms are activated, and monitors indicate a release).

<u>Protective Actions</u>: Some sites default to a protective action of shelter-in-place no matter what the emergency may be. The Pantex Plant [33] and Savannah River Site [40–45] are two sites that use this default protective action extensively.[6] There are some events in which the potential exposures would require an evacuation; however, some sites are sheltering-in-place initially until they recognize that conditions warrant evacuations. Therefore, a necessary

[4] Although the SNL EALs do consider different quantities of material at risk for various activities, they represent the maximum quantities that could be used for those activities and thus do not consider the use of lesser quantities.
[5] For example, in the Weapons Engineering Tritium Facility (WETF) and Chemistry & Metallurgy Research Facility EPHAs [34, 35], the material at risk (MAR) for each scenario is the bounding limit in the technical safety requirements. As a result, none of WETF EALs are less than general emergencies when the ventilation is not intact and none of the Chemistry & Metallurgy Research EALs are less than a site area emergency.
[6] If the hazard from an emergency is an internal exposure hazard, then sheltering-in-place would be appropriate; however, if the release leads to an external exposure hazard, then sheltering-in-place may not be acceptable and it may be important to evacuate personnel as soon as possible. Similarly, if the release is of short duration, sheltering-in-place may be appropriate; whereas, a long duration release with significant consequences might require early evacuation.

evacuation could be delayed and result in unnecessary exposures. For emergencies with the potential for exposures requiring evacuation, sites may need to consider a more timely conservative protective action rather than wait for additional direction from decision makers.

Other sites do not provide sufficient description in their protective actions. Some sites implement shelter-in-place when the need is to take shelter in a structurally sound facility for a natural phenomenon hazard (such as an earthquake or tornado). Sites should have separate protective actions in response to a radioactive or hazardous material release versus protection from physical harm (e.g., falling debris, collapsing buildings, and missiles). Some sites have identified shelter (or take cover) and shelter-in-place (or remain indoors) to address these two categories of protective needs. This problem has been corrected in protective actions at the Savannah River and Hanford sites [46], but is still evident in protective actions at WIPP [32, 47] and LANL [48].[7]

Severe Events: During Board public hearings and meetings at the Savannah River Site [1], LANL [2], Pantex Plant [3], and Y-12 [4], the Board discussed weaknesses in the ability of DOE sites to respond to severe events. In addition, as part of its reviews of the overall state of emergency preparedness and response at DOE sites, members of the Board's staff reviewed the preparedness for, and the ability to respond to, severe events. During these reviews, the staff team identified weaknesses in existing programs, as well as elicited input from the sites on gaps in the existing requirements and guidance. Many sites have not completed a hazard assessment for severe events; particularly events that can affect multiple facilities and events that can affect a regional area [15, 20]. As a result, they have not developed EALs and protective actions commensurate with the unique hazards and complexity of these events. Technical planning requirements are focused on individual facilities without consideration of the impact of collective facilities with additional and varied hazards.

Specific gaps in requirements and guidance that were identified by the sites during the reviews by members of the Board's staff or through the staff's review of their existing programs include:

- The need for clarification of the definition of a severe event, and the actions that sites are expected to take to prepare for such events, particularly addressing the question of "how much preparation is enough for severe events."

- The focus of existing requirements on individual facilities with no current direction on evaluating multi-facility events.

- The need to develop a methodology for prioritizing response to multi-facility events, including the development of prioritization strategies for response, mitigation, and reentry.

[7] For example, the LANL protective action guide only addresses sheltering as a "strategy to reduce exposure to airborne materials."

- The need to incorporate self-help and basic preparedness training into workforce refresher training.

- The need to develop a logistical process for providing food, water, and other essentials to responders if they are required to stay on site for an extended period of time.

Although DOE's OE-1 highlights the need to incorporate some of these considerations in site emergency management programs, it does not provide explicit guidance on how to do so.

Members of the Board's staff also had the opportunity to observe pilot studies at WESF at the Hanford Site, and at the tank farms and Tritium Facility at the Savannah River Site. The studies were conducted by HSS in tandem with the Office of Emergency Operations to develop guidance on how to address beyond design basis events in documented safety analyses and how to address severe events in emergency management programs [18, 19]. One major gap identified by the staff team during its reviews, as well as by the pilot study group at both the Hanford and Savannah River sites, is related to the actions to be taken by facility personnel in the immediate aftermath of a severe event (i.e., actions taken by facility personnel that will put the facility into a safe and stable condition). Although the pilot study report, *BDBE Pilot Evaluations, Results and Recommendations for Improvements to Enhance Nuclear Safety at DOE Nuclear Facilities* [18], highlights this gap, it does not identify who will develop guidance to address the gap. DOE's OE-1 does not mention this issue.

In general, members of the Board's staff observed problems associated with requirements (or lack of requirements) addressing severe events, specifically those addressing the scope of hazards assessments, EALs, and protective actions that address the complexity of events that could cascade or affect multiple facilities. The staff team also observed problems with identification and development of actions to be taken by workers in the immediate aftermath of an event and in situations where outside response is delayed.

Training and Drills—With respect to preparation for emergencies, DOE Order 151.1C, Chapter IV, 4.a requires that:

> A coordinated program of training and drills for developing and/or maintaining specific emergency response capabilities 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.

The associated emergency management guide [7] contains detail on meeting this requirement. Members of the Board's staff submitted comments pertaining to training requirements in the order and guides during the last order revision cycle in 2005. At the conclusion of the RevCom process, DOE personnel responded to these comments with a commitment to address them during the next revision cycle [49]. These comments focused on the need to include requirements for the effectiveness of training and drills, and for responsibilities to ensure the adequacy and consistency of training and drills. These comments

were based on the staff team's observation that implementation of training and drill programs was inconsistent among the DOE sites, and that more specificity was needed in the requirements.

During its recent reviews, members of the Board's staff continued to observe that the implementation of training and drill programs at DOE sites is variable; these programs were also addressed during Board public meetings and hearings [1, 3]. At some sites such as Y-12, Savannah River Site, and Hanford Site, the training of emergency response personnel is well developed and executed. At some sites, a task analysis of individual positions was completed, and training was developed and executed to address these tasks. Drills were scheduled to practice these tasks, and the basis for qualification was determined and confirmed. As part of the training program, some sites identified continuing training and the need for retraining based on feedback from performance on drills and exercises.

However, at other sites, the quality of training varied significantly, sometimes to the point of being perfunctory and limited to only participation of the emergency response organization. Some sites schedule drills, but rarely perform them, while other sites do not have a drill program that meets the expectations of the guidance. In general, the training and drills conducted at some sites frequently do not reflect lessons learned and feedback from performance of exercises. For example, the Pantex Plant has a drill program, but conducts few of the scheduled drills. SNL conducts drills; however, the drills involving facility personnel are only evacuation drills and are essentially the equivalent of fire drills.

The staff also observed issues with the training and qualification of emergency management program staff at various sites. Some sites, such as the contractors at Y-12, Savannah River Site, and Hanford Site, have established qualification programs for these personnel and hire experienced personnel or train personnel to fill these positions. Other sites, such as the Pantex Plant, have not established training qualification requirements for their emergency management program staff.

Exercises—As part of a site's preparedness for responding to emergencies, DOE Order 151.1C requires that "[a] formal exercise program must be established to validate all elements of the emergency management program over a five-year period." The Order also stipulates that "[e]ach exercise must have specific objectives and must be fully documented (e.g., by scenario packages that include objectives, scope, timelines, injects, controller instructions, and evaluation criteria)." In addition, Chapter 4, 4.b(1) of the Order requires that:

(a) Each DOE/NNSA facility subject to this chapter must exercise its emergency response capability annually and include at least facility-level evaluation and critique.

(b) Site-level emergency response organization elements and resources must participate in a minimum of one exercise annually. This site exercise must be designed to test and demonstrate the site's integrated emergency response capability. For multiple facility sites, the basis for the exercise must be rotated among facilities.

This requirement to conduct exercises is further clarified in section 3.1 of the DOE Emergency Management Guide 151.1-3, *Programmatic Elements*, which provides guidance for DOE sites to:

> …establish a formal exercise program that validates all elements of a facility/site or activity emergency management program over a 5-year period. The exercise program should validate both facility- and site-level emergency management program elements by initiating a response to simulated, realistic emergency events or conditions in a manner that, as nearly as possible, replicates an integrated emergency response to an actual event.

Members of the Board's staff reviewed exercise programs at various DOE sites as part of its programmatic reviews of emergency management programs, as well as through observations of exercises conducted at DOE sites. The staff team observed a wide variability in the quality of the scenarios. Some sites had challenging scenarios and a few recent site exercises involved severe events, including multiple facilities and cascading events. However, other sites had scenarios that were not challenging and did not fully test the capabilities of the site. Some sites do not have a 5-year plan for exercises that involves all of the hazards and accidents at their facilities with EPHAs. In addition, some sites do not exercise all of their facilities with EPHAs and all of their response elements on an annual basis.

Exercises are intended to be a demonstration of performance and, therefore, addressing all the elements of emergency response on an annual basis is important. The staff team observed specific problems with planning and scheduling of exercises at various sites. Some sites, such as the Pantex Plant, did not conduct an annual site-wide exercise in 2013 [50]; while other sites, such as SNL, are not conducting annual exercises (or appropriately tailored drills to test emergency preparedness and response) for each facility that has an EPHA [51–53]. In addition, some of these sites, such as the Pantex Plant [23, 54, 55], do not conduct exercises to "validate all elements of an emergency management program over a 5-year period." At SNL, the staff team was particularly concerned that emergency management personnel are not scheduling drills and exercises that address the different types of hazards and accident scenarios possible at its nuclear facilities. The drills and exercises should train and test the various elements of their capability for responding to radiological hazards and scenarios. In addition, the staff team observed that few if any of the sites have scheduled exercises to be conducted during swing and night shifts.

As part of its observations of exercises and review of exercise packages, members of the Board's staff observed several examples of exercise scenarios that were not challenging enough to demonstrate proficiency. For example, the 2013 annual exercise at the Savannah River Site [56] involved the drop of a 55-gallon drum of radioactive waste during a repackaging operation at the Solid Waste Management Facility. The exercise assumed that the dropped drum injured an employee and resulted in contamination in the immediate area of the drum. Similarly, the 2013 exercise at the Pantex Plant [50], which was conducted in January 2014, also involved a simplistic scenario involving a liquid nitrogen truck in a vehicular accident. The hazardous release was limited and required little protective action to be taken by the plant population. In contrast to these simplistic scenarios, the 2013 site-wide exercise at the Hanford Site [57]

involved an earthquake that led to problems at multiple facilities, including a tunnel collapse at PUREX and a release of contamination and a fire at WESF, that were compounded initially by problems with communications.

In addition to the use of simplistic scenarios, another problem observed by the staff team was the failure of most sites to adequately incorporate recovery actions into the exercise. Due to the hazardous nature of operations at DOE sites, planning and implementing recovery and reentry actions will be extremely complex, as evidenced by the current recovery activities at WIPP. Recovery at other DOE sites could be more difficult due to the more hazardous and complex nature of operations at those sites. Planning and implementing recovery actions are typically not demonstrated in detail during the normal scope of annual emergency exercises at DOE sites, or in follow-on exercises [3, 4, 58]. For example, the 2013 Savannah River Site annual site-wide exercise demonstrated the importance of more fully exercising recovery planning. The exercise team did not appear to understand the level of detail required for developing a recovery plan outline and had a difficult time completing the outline for recovery planning that is included in the Savannah River Site emergency procedures [59].

Members of the Board's staff also observed problems with the preparation and conduct of exercises. Problems associated with preparation for exercises have involved both the content and timing. Specifically, the staff team observed that some sites use identical scenarios in the drills preparing for exercises, and some sites often schedule the majority of their drills immediately prior (i.e., within days) to the exercise [60, 61]. Although it is appropriate to use drills to train and practice, these strategies can lead to a false impression of a site's preparedness and response capability (i.e., "cramming for the exam"). The graded exercise becomes a snapshot of proficiency rather than being a true representation of long-term proficiency. For example, at the Savannah River Site, the staff team observed that the scenarios used in preparation for the 2013 evaluated exercise for Building 235-F addressing concerns raised in Board Recommendation 2012-1 were identical to the scenario planned for the actual exercise. Based on feedback from the Board's Savannah River site representatives, the scenario was changed [61]. The Board's site representatives raised similar concerns with scenarios used to prepare for other exercises at the Savannah River Site, and this practice appears to have been changed. The staff team observed that at some sites, such as the Hanford Site, these preparatory drills are conducted immediately prior to the actual performance of the exercise, ensuring that the participants can perform adequately during the actual exercise, but not addressing the need for making sustained improvements in emergency preparedness and response capabilities by conducting preparation activities throughout the course of the year.

As part of its observation of exercises at various sites, members of the Board's staff had the opportunity to observe after-exercise critiques, as well as to review the after action reports for the exercises. During many exercises, the staff team observed that evaluators failed to document needed improvements identified during the course of the exercise. The staff team also observed that the critiques were often not adequate to identify the underlying causes of problems during the exercise and that subsequent assessments and evaluations did not ensure the effectiveness of corrective actions to address these problems. One example of a flawed critique system was observed at the Pantex Plant, where the 2011 exercise was originally graded as "satisfactory" and the 2012 exercise was originally graded as "successful." After Board Member questions during

the public meeting and hearing on the Pantex Plant and subsequent staff questions, Babcock & Wilcox Technical Services Pantex, LLC (B&W Pantex) regraded the 2011 exercise as "unsatisfactory" and the 2012 exercise as "marginal" [3, 62].

Members of the Board's staff also observed that some sites incorporated severe event scenarios into their drill and exercise programs. Some sites have conducted exercises that include severe event scenarios that encompass multiple facilities; however, some sites such as the Pantex Plant and Y-12 have yet to do so [3, 4]. It is important to practice and demonstrate proficiency in responding to severe event scenarios due to the complexity of response, the need to prioritize limited resources, the need to make decisions about protective actions when multiple facilities are involved, the potential need to respond without the assistance of mutual aid, and the potential loss of infrastructure (e.g., power, communications, mobility). The current DOE directives do not contain requirements or expectations to conduct these types of challenging exercises. While DOE's OE-1 contains guidance on the scope of severe event scenarios that should be conducted by the sites, it does not explicitly require that the sites conduct these types of exercises.

Facilities and Equipment—DOE Order 151.1C requires a site's emergency program to address the "provision of facilities and equipment adequate to support emergency response, including the capability to notify employees of an emergency to facilitate the safe evacuation of employees from the work place, immediate work area, or both." Facilities include an emergency operations center (EOC) and an alternate, and the Order stipulates that these facilities must be "available, operable, and maintained." Maintenance and appropriate upgrading of emergency response facilities and equipment are an important part of ensuring that the emergency preparedness and response capabilities of a site are sustainable. Communications and notification systems are necessary to initiate protective actions and enable safe evacuation of employees. Chapter 4 of the Order requires "[p]rompt initial notification of workers, emergency response personnel, and response organizations, including DOE/NNSA elements and State, Tribal, and local organizations, and continuing effective communication among response organizations throughout an emergency."

The staff team observed some problems with the survivability, habitability, and maintenance of emergency response facilities and equipment, as well as communications and notification systems [63, 64] that the staff believes are due to the lack of explicit requirements or expectations in the DOE Order and Guides. Specifically, members of the Board's staff observed that many of the emergency response facilities may not be habitable in the aftermath of a hazardous or radiological material release event, or survivable in the aftermath of a severe natural phenomena event. These facilities were not designed to survive an earthquake, and many do not have ventilation systems that will filter radiological and toxicological materials. Examples of such facilities include the Emergency Control Center (ECC), the Technical Support Center (TSC), and the fire house at Y-12 [4, 66]; the EOC at the Hanford Site [67]; the EOC and alternate EOC, the Department Operations Centers, and the Emergency Communications Center at LLNL [68]; and the EOC and Central Monitoring Room at WIPP [69].

Some facilities were designed with filtered air systems that would enable them to remain habitable in the event of a hazardous release in proximity to the facility. However, members of

the Board's staff observed that some of these systems were not being properly maintained [63, 64, 68–71]. Habitability of these facilities could also be compromised by failures of their emergency backup systems. Many of the facilities have backup systems that are general service and do not have a pedigree for an expectation of reliability. In general, the staff team observed problems with the lack of established maintenance programs for these facilities and support equipment, such as backup generators and fuel tanks [63, 64, 67–69, 71]. It should be noted that some of these facilities are scheduled to be replaced. For example, Babcock and Wilcox Technical Services Y-12, LLC (B&W Y-12) has a new project planned to replace the ECC and the TSC, with funding beginning in fiscal year 2015 and project completion scheduled in fiscal year 2017, and B&W Y-12 is preparing for Critical Decision–0 for a new fire house [4]. Similarly, there are plans to replace the LLNL EOC.

Members of the Board's staff also observed problems with systems used to support emergency communications and notifications. For example, the staff observed problems with the systems used to notify workers and visitors about an emergency and protective actions that are to be taken, such as was observed recently at WIPP during the underground truck fire [72]. Some systems have experienced failures to broadcast due to failures of sirens, overriding signals, and incomplete coverage, or have provided workers with garbled messages [73–78]. The staff team also observed potential problems with the method by which remote workers, such as those at the Hanford Site, are notified of emergencies via portable alerting systems, and the process by which they are refreshed on hazards and responses (e.g., pre-job briefings).

In addition to the vulnerabilities of some of these facilities during an emergency, the Board's staff team also observed, based on its review of site exercise schedules across DOE sites, that alternate emergency response facilities were not being exercised on a periodic basis. In general, many of the alternate response facilities have limited, older, less-effective communications systems and support equipment, which could dramatically hamper on-site emergency response. Their locations are sometimes so close to the primary facilities that they will suffer the same habitability problems. Conversely, sometimes they are so distant that it will be difficult for personnel to travel to the alternate facilities. Therefore, it is important for emergency response personnel to practice using the less-effective equipment and understand the challenges of using alternate facilities.

Oversight and Assessment—As part of its readiness assurance requirements, DOE Order 151.1C stipulates the need for assessments of emergency management programs and capabilities by the contractor and oversight of these programs and capabilities by DOE program and field (site) offices. Additionally, in the general requirements sections of the Order, the HSS Office of Security and Safety Performance is tasked with responsibility for independent oversight of emergency management programs at DOE sites.[8] Members of the Board's staff have observed problems with oversight of emergency management programs overseen by DOE Headquarters and site office personnel, and with assessments and self-assessments conducted by the contractors. These failures are contributing to the problems with the emergency management programs at the various sites that have been observed by the staff team, particularly problems that are long-standing or recurrent.

[8] The Office of Independent Enterprise Assessments now has this responsibility. See Footnote 2.

Federal Independent Oversight: The Office of Safety and Emergency Management Evaluations in HSS was responsible for oversight of emergency management programs at DOE sites.[9] The Office of Emergency Operations is responsible for the development and maintenance of emergency management requirements for programs at all DOE sites, and is also responsible for providing interpretations of these requirements. The Office of Emergency Operations also has responsibility for NNSA emergency management programmatic support to NNSA sites. The Office of Emergency Operations does not conduct assessments of emergency management programs at DOE (or NNSA) sites. However, when requested, it provides assistance to sites and subject matter experts to support reviews, such as readiness reviews and biennial reviews by the NNSA Chief of Defense Nuclear Safety (CDNS).

After operating in an assistance mode since 2010, HSS returned in 2012 to conducting independent assessments. These assessments are targeted reviews, currently focused on the ability of the sites to prepare and respond to severe events, and do not encompass all elements of emergency management programs. In 2012, HSS focused on five elements (Emergency Response Organization, Equipment and Facilities, Technical Planning Basis, EPHAs, and Off-site Interfaces) for severe event preparedness in its reviews at five sites and one facility (Y-12 [70], LANL [71], Idaho National Laboratory [79], WIPP [69], Paducah Gaseous Diffusion Plant [80], and the Tritium Facilities at the Savannah River Site [81]). In 2013, HSS focused on three new elements, while retaining three elements from its 2012 reviews (Off-site Interfaces, Equipment and Facilities, EPHAs, Medical Response, Training and Drills, and Termination and Recovery) at four sites (LLNL [68], Portsmouth Gaseous Diffusion Plant [82], Hanford Site [67], and the Nevada National Security Site (NNSS) [83]). After each of its reviews, HSS produced a document summarizing the results of the review and identifying findings and OFIs. HSS also issues a year-end report that highlights common issues, lessons learned, and recommended actions [63, 64]. Unlike the independent assessments conducted previously in the 2000–2009 timeframe, adjudication of findings is left to site offices. HSS does not review corrective actions or their effectiveness, although it may review the resolution of findings from previous assessments as part of its follow-up review.

As part of its review of the efficacy of federal oversight, members of the Board's staff reviewed the reports issued by HSS in 2012 and 2013, and observed its targeted assessments at LLNL, Hanford Site, and NNSS conducted in 2013. The staff team observed that these assessments were effective in identifying issues associated with a site's preparedness to respond to severe events. The HSS assessment team does not assess the site's capability to respond to less severe events that are more likely to occur. Although the assessment team does identify fundamental program weaknesses as part of its assessment, it does not document these weaknesses. As a result, the assessments do not evaluate the overall effectiveness of a site's emergency preparedness and response capability. As observed recently with the emergency responses to the truck fire and radioactive release events at WIPP, there can be fundamental problems with a site's emergency preparedness and response capability that will only be identified by more comprehensive assessments designed to evaluate the overall effectiveness of a site's emergency management program. Independent assessments conducted prior to 2010 focused on overall effectiveness. These assessments consistently identified problems with site

[9] The Office of Emergency Management Assessments now has this responsibility. See Footnote 2.

emergency preparedness and response, and HSS sought to ensure continuous improvement of these programs by conducting follow up assessments.

The HSS targeted assessments did not include an observation of drills or exercises. Drills and exercises are representative of a site's broader response capability. While the HSS team observed a drill during its assessment at LLNL, this exercise was outside the scope of the assessment and was not incorporated into the potential findings and OFIs of their report. During 2014, HSS is observing severe event exercises as part of its assessments.

Members of the Board's staff found that many of the HSS findings from its independent assessments conducted prior to 2010, as well as findings from the HSS targeted assessments, were not effectively addressed. Specifically, based on its review of numerous federal and contractor assessments and associated corrective action plans, the staff team found that many of the corrective actions did not adequately address the specifics of the findings or did not result in long-term resolution of the issue. In many cases, there was not adequate causal analysis and there was no review of the effectiveness of the corrective actions. As a result, findings have gone uncorrected, sometimes for many years, and are found again in subsequent assessments.

For example, members of the Board's staff reviewed the 2009 HSS report [30] as part of the staff's 2013 assessment at SNL. Several of the findings in the report addressed the inability of emergency response personnel to effectively use emergency plans and procedures to implement protective actions. In addition, as part of their discussions of program weaknesses and items requiring attention, the HSS assessors identified problems with using EALs due to their complexity and the overly conservative nature of the protective actions. The staff team reviewed the EALs [23–25] and protective actions [84–97], as well as other technical planning documents such as EPHAs [23–25]. The staff team found them to be of poor quality and difficult to implement. When the staff team discussed the HSS findings with Sandia Field Office and SNL emergency management personnel, the SNL personnel indicated that they developed corrective actions to address the findings in the HSS report and all corrective actions had been completed. However, based on its 2013 assessment, the staff team found that the original problems identified by HSS still existed. SNL did not address the implications of the systemic program weaknesses identified by HSS regarding the entire suite of SNL technical planning documents, not just EALs. Thus, the original findings identified by HSS were not effectively addressed by SNL.

Similarly, during the HSS targeted assessment conducted at the Hanford Site in 2013 that was observed by members of the Board's staff, HSS team members noted that the same issues had been identified during the team's assist visit to the Hanford Site in 2010 [67]. HSS team members also noted that recommendations from the 2010 visit had been entered and closed in the site's corrective active tracking system but were observed again during the 2013 assessment.

<u>Federal Line Oversight</u>: In addition to oversight conducted by DOE Headquarters personnel, members of the Board's staff also reviewed oversight by site office personnel of contractor emergency management programs. The scope of this review included numerous federal assessment reports and associated contractor corrective action plans. The level and type of oversight conducted by site office personnel varied widely across DOE sites. At some sites,

the federal employee responsible for emergency management did not have any other responsibilities; at other sites, such as Y-12, emergency management was a collateral duty. At some sites, this position rotated frequently and there was a long period of time before the individual responsible for oversight of the contractor's emergency management program was qualified as an emergency management specialist per the DOE qualification standard [98, 99].

The type of oversight conducted by site office personnel varied widely, ranging from independent assessments to shadow assessments of contractor reviews to reviews of data provided by contractor assurance systems. Sole reliance on data provided by the contractor assurance system without confirmatory independent reviews can be problematic. For example, the Y-12 emergency management program manager relied heavily on the results of B&W Y-12 management self-assessments of its emergency management program against the 15 assessment criteria suggested by the DOE Emergency Management guides, with the exception of direct observation of Y-12 exercises by the program manager, assisted by other personnel. Although the general health of the Y-12 emergency management program appeared to be consistent with DOE requirements and guidance, the oversight strategy employed by the NNSA Production Office may not be able to identify a reduction in effectiveness of the program. While this has not been a problem at Y-12, the programs at SNL and WIPP demonstrate that this is a problem at sites that do not have a strong contractor emergency management program.

Contractor Assessments: Most of the sites reviewed by members of the Board's staff were conducting annual assessments of their emergency management programs using the 15 criteria suggested by the DOE Emergency Management Guides. However, based on its review of numerous contractor assessment reports, the staff team observed that many of the assessments were not effective at identifying problems and weaknesses with their programs. For example, many of the observations identified by HSS were not identified by the contractor assessments. As already discussed, SNL did not identify problems with its technical planning documents or its failure to conduct required exercises, and B&W Pantex did not identify problems with its training and drill and exercise programs. Similarly, LANL did not identify problems with the membership of its emergency response organization [100].

Members of the Board's staff also observed that while most sites developed corrective actions to address issues identified in their assessments, as well as independent assessments, and tracked actions to closure, few sites were evaluating the effectiveness of these corrective actions. As already discussed, many of the sites, such as the Hanford Site and SNL, were not effectively addressing the findings and OFIs identified by external reviewers such as HSS and CDNS. Specifically, they were performing poor root cause analyses and were not performing reviews of the effectiveness of these corrective actions to address the issues and prevent their recurrence.

Another area of weakness noted by members of the Board's staff during its review of assessments and corrective actions, and observation of exercises was exercise assessment and critique. The staff team reviewed numerous exercise packages, after action reports, and corrective action plans, and observed many annual site exercises. The staff team observed that the critiques were often superficial, were not self-critical, and downplayed the significance of findings while conveying an aura of success. Most critiques failed to identify the root causes of problems, thus these problems recurred. For example, several significant findings of critical

response capabilities, such as delayed notifications and lack of communication within the response organization, were identified during exercises at the Pantex Plant, yet the results of the exercises were graded as satisfactory [3]. The need for critical review of exercises has now been recognized by the NNSA Production Office and B&W Pantex, and corrective actions are now being implemented.

Summary of Observations. The following table summarizes the Board's staff team's observations of the three questions that formed the foundation of its review of the state of emergency preparedness and response at DOE sites with defense nuclear facilities:

Review Question 1: Does DOE provide facility workers, response personnel, and emergency management decision makers with adequate direction and guidance to make timely, conservative emergency response decisions and take actions that focus on protection of the public and workers?	**Review Question 2**: Does DOE provide adequate equipment and hardened facilities that enable emergency response personnel and emergency management decision makers to effectively respond to emergencies and protect the public and workers?	**Review Question 3**: Do the contractor assurance systems and DOE oversight provide an effective performance assurance evaluation of emergency preparedness and response?
Many EPHAs did not adequately cover plausible emergency scenarios, including severe events. Many EALs did not provide a clear method to identify the severity of events in order to categorize and classify an emergency and select protective actions. Many emergency protective actions did not have the clarity to ensure the protection of workers and the public during an emergency. Many facility worker, initial responder, and EOC personnel training and drills were not adequate to prepare and qualify personnel to ensure timely, effective response during an emergency. Many site emergency exercise programs did not demonstrate proficiency and did not identify weaknesses that will allow management to effectively drive improvements in emergency preparedness and response.	Many emergency facilities will not be survivable or habitable during an emergency. Many emergency facilities and their alternates did not have reliable support systems, including an adequate maintenance program. Many communications and notification systems were not adequate to ensure notification of workers and the public.	Many contractor assurance systems were not effective at sustainably correcting identified emergency preparedness and response issues. DOE Headquarters and local site personnel were not providing effective oversight to ensure emergency preparedness and response issues are identified and corrected.

In general, the staff team observed that implementation of DOE's requirements for emergency preparedness and response programs varies widely at various DOE sites with defense nuclear facilities. DOE has noted these types of problems in the HSS reports documenting

independent assessments of its sites and in its annual reports on the status of its emergency management system. The annual reports also noted a lack of progress in addressing these problems [101–103].

Based on an evaluation of these observations, the staff team determined that the most important underlying root causes of these problems were inadequate implementation and revision of requirements, and ineffective contractor and federal verification and validation of readiness for responding to emergencies.

Conclusions. In the aftermath of DOE's implementation of corrective actions addressing Board Recommendation 98-1, members of the Board's staff observed considerable improvement in emergency preparedness and response at many DOE sites across the complex. However, during this review of emergency preparedness and response, the staff team found that many sites had not continued to improve their programs, and in some cases, there had been degradation in these programs. One of the contributing factors in this lack of sustained continuous improvement was the failure of DOE as a regulator of emergency management programs at its sites. Although the problems observed by the Board's staff team were largely associated with a failure to implement existing requirements and guidance, the Office of Emergency Operations has failed to maintain and improve the requirements and guidance in its directives, particularly in response to addressing lessons learned, needed improvements to site programs, and inconsistent interpretation and implementation of the requirements. The Office of Emergency Operations has also failed to revise its requirements to address lessons learned from Fukushima and use feedback from its sites on the type of guidance needed to effectively prepare and respond to severe events.

Many problems result from inconsistent implementation of existing requirements by the various DOE sites; therefore, the staff team concluded that some requirements do not have the level of specificity to ensure effective implementation. Requirements for hazards assessments lack detail on addressing severe events. Requirements do not address reliability of emergency response facilities and equipment. Requirements for training and drills do not address expectations for the objectives, scope, frequency, and reviews of effectiveness. Requirements for exercises do not include expectations for the complexity of scenarios, scope of participation, grading of proficiency, and corrective actions. Some of the additional detail that addresses the deficiencies in these requirements is already included in the Emergency Guides that accompany DOE Order 151.1C. However, many sites have not implemented the practices described in the guides.

Contractor assessment and federal oversight often did not identify needed improvements to site emergency preparedness and response, which compounded the observed problems with the implementation of requirements. When problems were identified, they often lacked adequate causal analysis and appropriate corrective actions. When corrective actions were developed and implemented, sites (contractors and federal entities) frequently did not measure the effectiveness of these actions.

During its period of focus on conducting assist visits rather than independent assessments, HSS failed to conduct effective oversight of emergency management programs and

enforcement of existing requirements at DOE sites, and did not ensure that the sites adequately responded to its findings and OFIs. HSS has made progress on reengaging in its role of independent oversight of emergency management programs at DOE sites with its recent transition back to independent oversight. The effectiveness of this oversight has been constrained by both the limited scope of the assessments currently being conducted by HSS and by the lack enforcement to ensure that its findings and OFIs are effectively addressed by the sites. The HSS focus on targeted assessments of a site's ability to respond to severe events can lead to a failure to identify fundamental weaknesses in a site's emergency management program. The HSS failure to engage in the resolution of its findings and OFIs is similar to the problem that was the genesis of Board Recommendation 98-1.

These deficiencies in implementation and oversight have led to failures to identify and prepare for the suite of potential emergency scenarios and to demonstrate proficiency, and ultimately to the failure to recognize and respond appropriately to indications of an emergency, as was seen in the recent radioactive material release event at WIPP. Therefore, the Board's staff review team believes that DOE has not comprehensively and consistently demonstrated its ability to protect the worker and the public in the event of an emergency.

DOE Headquarters can address many of these problems by conducting more rigorous and comprehensive independent oversight and by revising its directives to address lessons learned, needed improvements to site programs, and inconsistent interpretation and implementation of the requirements.

Technical and Economic Feasibility of Recommendation. The results of this review by members of the Board's staff were used to support the development of Recommendation 2014-1, *Emergency Preparedness and Response*. The deficiencies identified in this review relate to problems with DOE's safety management framework. The recommendation is technically feasible because it can be addressed using known scientific and engineering principles. The recommendation is economically feasible because it has been structured to allow DOE to identify short-term and long-term enhancements to its emergency management programs.

Several of these enhancements may involve improvements in infrastructure, while other improvements require the revision and strengthening of directives and guidance, as well as strengthening DOE oversight. Revising its directives is part of its normal process for maintaining the currency of its directives as codified in DOE Order 251.1C, *Departmental Directives Program* [104]. Much of the detail needed to resolve problems of variability of implementation of requirements is already addressed in existing Emergency Management Guides. In addition, improvements to oversight would simply return the type of Headquarters oversight to the levels in which it was previously engaged and is an expectation in its directives on oversight (DOE Order 226.1B, *Implementation of Department of Energy Policy* [105] and DOE Order 227.1, *Independent Oversight Program* [106]). Members of the Board's staff are confident that DOE can identify solutions to address these deficiencies that are technically and economically feasible.

References.

[1] Defense Nuclear Facilities Safety Board, *Public Meeting and Hearing for Public Health and Safety, Including that of the Workers, Savannah River Site*, Augusta, GA, June 16, 2011.

[2] Defense Nuclear Facilities Safety Board, *Public Meeting and Hearing for Seismic Safety of the Plutonium Facility, Los Alamos National Laboratory*, Santa Fe, NM, November 17, 2011.

[3] Defense Nuclear Facilities Safety Board, *Public Meeting and Hearing for Safety Culture, Emergency Preparedness, and Nuclear Explosive Operations at Pantex*, Amarillo, TX, March 14, 2013.

[4] Defense Nuclear Facilities Safety Board, *Public Meeting and Hearing for Safety in Design, Operations, and Emergency Preparedness at the Y-12 National Security Complex*, Knoxville, TN, December 10, 2013.

[5] Defense Nuclear Facilities Safety Board, *Status of Emergency Management at Defense Nuclear Facilities of the Department of Energy*, Technical Report-21, March 1999.

[6] Defense Nuclear Facilities Safety Board, *Recommendation 98-1: Resolution of Issues Identified by Department of Energy (DOE) Internal Oversight*, September 28, 1998.

[7] Department of Energy, *Programmatic Elements: Emergency Management Guide*, DOE G 151.1-3, July 11, 2007.

[8] Federal Emergency Management Agency, *Radiological Emergency Preparedness Exercise Evaluation Methodology*, FEMA-REP15, January 1991.

[9] Department of Energy, *Emergency Management System*, DOE O 151.1, September 25, 1995.

[10] Department of Energy, *Department of Energy Plan to Address and Resolve Safety Issues Identified by Internal Independent Oversight*, DOE Implementation Plan for Recommendation 98-1, March 10, 1999.

[11] Department of Energy, *Security and Emergency Management Independent Oversight and Performance Assurance Program*, DOE O 470.2A, March 1, 2000.

[12] Department of Energy, *Independent Oversight and Performance Assurance Program*, DOE O 470.2B, October 31, 2002.

[13] Simonson, S, *Future HS-63 Activities*, email to Department of Energy distribution list, October 27, 2009.

[14] Secretary of Energy, *Events Beyond Design Safety Basis Analysis*, Safety Bulletin No. 2011-01, March 23, 2011.

[15] Department of Energy, Office of Nuclear Safety, *A Report to the Secretary of Energy: Review of Requirements and Capabilities for Analyzing and Responding to BDBEs*, August 16, 2011.

[16] Deputy Secretary of Energy, *Report on Review of Requirements and Capabilities for Analyzing and Responding to Beyond Design Basis Events*, Memorandum, September 16, 2011.

[17] Department of Energy, Office of Nuclear Safety, *Strategy for Implementing Beyond Design Basis Event Report Recommendation*, February 2012.

[18] Department of Energy, Office of Nuclear Safety, *A Report to the Secretary of Energy: Beyond Design Basis Event Pilot Evaluations, Results and Recommendations for Improvements to Enhance Nuclear Safety at DOE Nuclear Facilities*, January 2013.

[19] Department of Energy, Office of Nuclear Safety, *Technical Details on Beyond Design Basis Events Pilot Evaluations*, July 2013.
[20] Department of Energy, Office of Health, Safety and Security, *Improving Department of Energy Capabilities for Mitigating Beyond Design Basis Events*, OE-1: 2013-01, April 2013.
[21] Department of Energy, *Comprehensive Emergency Management System*, DOE O 151.1C, November 2, 2005.
[22] Department of Energy, *Technical Planning Basis: Emergency Management Guide*, DOE Guide 151.1-2, July 11, 2007.
[23] Sandia National Laboratories, *Emergency Planning Hazards Assessment, Building 6588: Annular Core Research Reactor Facility*, Volume 1, 2 and 3, April 2011.
[24] Sandia National Laboratories, *Emergency Planning Hazards Assessment, Building 6597: Auxiliary Hot Cell Facility*, Volume 1, 2 and 3, October 2012.
[25] Sandia National Laboratories, *Emergency Planning Hazards Assessment, Building 6590: Sandia Pulsed Reactor Facility*, Volume 1, 2 and 3, October 2010.
[26] B&W Pantex, *Pantex Plant Response to HSS Safety Bulletin 2011-01, March 25, 2011, "Events Beyond Safety Basis Analysis,"* May 2, 2011.
[27] B&W Pantex, *Pantex Plant Emergency Planning Hazards Assessment*, MNL-190881, Issue No. 8, (undated).
[28] B&W Pantex, *Pantex Plant Emergency Planning Hazards Assessment*, MNL-190881, Issue No. 9, (undated).
[29] Department of Energy, *Waste Isolation Pilot Plant Emergency Planning Hazards Assessment*, DOE/WIPP-08-3378, Rev. 3, June 2013.
[30] HSS Independent Oversight Inspection of Emergency Management at the Sandia Site Office and Sandia National Laboratories, May 2009.
[31] HS-63 Independent Oversight Review of Emergency Management at the Hanford Site, February 2010.
[32] Waste Isolation Pilot Plant, *Categorization and Classification of Operational Emergencies*, WP 12-ER3906, rev 7, February 27, 2014.
[33] B&W Pantex, *Emergency Action Levels*, MNL-190884, Issue No. 6, (undated).
[34] Los Alamos National Laboratory, *EPHA for the TA-16 Weapons Engineering Tritium Facility (WETF)*, EPP-EPHA-406, R0, November 13, 2013.
[35] Los Alamos National Laboratory, *EPHA for the TA-03 Chemistry & Metallurgy Research (CMR) Facility*, EPP-EPHA-405, R0, October 31, 2013.
[36] Los Alamos National Laboratory, *EPHA for the TA-55 Complex*, EPP-EPHA-404, R0, (undated).
[37] Lawrence Livermore National Laboratory, *Emergency Planning Hazards Assessment, Rev. 3: Building 332, Plutonium Facility*, LLNL-TM-439100, June 2010.
[38] Lawrence Livermore National Laboratory, *Emergency Planning Hazards Assessment, Rev. 3: Building 331, Tritium Facility*, LLNL-TM-433672, May 2010.
[39] Lawrence Livermore National Laboratory, *Emergency Planning Hazards Assessment, Decontamination and Waste Treatment Facility (Including Buildings 693, 695, 696S and 696R)*, LLNL- TR-410870, February 2009.
[40] Savannah River Nuclear Solutions, *Emergency Planning Hazards Assessment for HB-Line (U)*, S-EHA-H-00004, Rev. 12, June 2011.

[41] Savannah River Site, *Emergency Classification*, EPIP-HSEP-001, Rev. 29, August 27, 2012.
[42] Savannah River Nuclear Solutions, *Emergency Planning Hazards Assessment for the Tritium Extraction Facility (TEF)*, S-EHA-H-00009, Rev. 1, September 2012.
[43] Savannah River Site, *Emergency Classification (EALs) (U)*, EPIP-TRIT-001, Rev. 27, April 4, 2013.
[44] Savannah River Nuclear Solutions, *Emergency Planning Hazards Assessment for the Concentration, Storage and Transfer Facilities*, S-EHA-G-00002, Rev. 11, December 2011.
[45] Savannah River Site, *Emergency Classification*, EPIP-CST-001, Rev. 11, March 9, 2012
[46] Richland Operations Office, *Emergency Procedures, RLEP 3.8, Protective Actions*, Rev. 15, November 5, 2012.
[47] Waste Isolation Pilot Plant, *Evacuation/Sheltering in Place*, WP 12-ER4907, rev 14, February 27, 2014.
[48] Los Alamos National Laboratory, *Protective Action Guides*, ERO-EPIP-215, rev 6.1a, March 27, 2012.
[49] Krol, J, *Board Staff Comment Resolutions for Draft DOE O 151.1C, "Comprehensive Emergency Management System,"* memorandum to M. Whitaker, September 13, 2005.
[50] Erhart, S, *Pantex Emergency Management Exercise (EMEX 13-1) January 2014*, memorandum to J. Maisonet, December 19, 2013.
[51] Sandia National Laboratories, *Table listing recent and planned emergency management drills and exercises for SNL nuclear facilities, and recent and planned facility-level drills for SNL nuclear facilities*, received February 11, 2013, (undated).
[52] Sandia National Laboratories, *NNSA Emergency Readiness Assurance Plans-FY 2012 Submission Completed Activities For FY 2012 and Projected Activities For FY 2013*, (undated).
[53] National Nuclear Security Administration, Headquarters Biennial Review of Site Nuclear Safety Performance: Final Report for the Sandia Site Office (SSO), February 2012.
[54] B&W Pantex, *Emergency Management Exercise Program Plan*, EM-PLN-22, Issue No. 9, (undated).
[55] B&W Pantex, *NNSA Emergency Readiness Assurance Plans-FY 2012 Submission Completed Activities For FY 2012 and Projected Activities For FY 2013*, Pantex ERAP, (undated).
[56] Savannah River Nuclear Solutions, *SRS 2013 Site Emergency Response Organization Emergency Preparedness Evaluated Exercise*, F9210053.DRSC000100, Rev. 00, (undated).
[57] Hanford Site Emergency Management Program, *Hanford FY 2013 Annual Field Exercise, August 15, 2013*, (undated).
[58] Defense Nuclear Facilities Safety Board, *Savannah River Site Activity Report for the Week Ending September 13, 2013*, September 13, 2013.
[59] Savannah River Nuclear Solutions, *Savannah River Site FY 2013 Site Evaluated Exercise Report, Conducted September 11, 2013*, F9210053.DRSC000100, October 23, 2013.
[60] Defense Nuclear Facilities Safety Board, *Hanford Activity Report for the Week Ending June 17, 2011*, June 17, 2011.
[61] Defense Nuclear Facilities Safety Board, *Savannah River Site Activity Report for the Week Ending June 21, 2013*, June 21, 2013.

[62] Erhart, S. C., *Public Hearing and Meeting Regarding Safety Culture, Emergency Preparedness, and Nuclear Explosive Operations at* Pantex, communication to Peter S. Winokur, June 12, 2013.

[63] Department of Energy, Office of Health, Safety and Security's Office of Safety and Emergency Management Evaluations, *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*, April 2013.

[64] Department of Energy, Office of Safety and Emergency Management Evaluations, *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*, February 2014.

[65] Babcock & Wilcox Technical Services Y-12, LLC, *Y-12 Contractor Response, HSS Safety Bulletin 2011-01, Events Beyond Design Safety Basis Analysis*, SBS-YAREA-F-0001-000-00, May 4, 2011.

[66] Department of Energy, Office of Health, Safety and Security's Office of Safety and Emergency Management Evaluations, *Independent Oversight Evaluation of Emergency Response Facilities at the Y-12 National Security Complex*, July 2011.

[67] Department of Energy, Office of Health, Safety and Security's Office of Safety and Emergency Management Evaluations, *Independent Oversight Review of Preparedness for Severe Natural Phenomena Events at the Hanford Site*, September 2013.

[68] Department of Energy, Office of Health, Safety and Security's Office of Safety and Emergency Management Evaluations, *Independent Oversight Review of Preparedness for Severe Natural Phenomena Events at the Lawrence Livermore National Laboratory*, July 2013.

[69] Department of Energy, Office of Health, Safety and Security's Office of Safety and Emergency Management Evaluations, *Independent Oversight Review of Site Preparedness for Severe Natural Phenomena Events at the Waste Isolation Pilot Plant*, November 2012.

[70] Department of Energy, Office of Health, Safety and Security's Office of Safety and Emergency Management Evaluations, *Independent Oversight Targeted Review of Site Preparedness for Severe Natural Phenomena Events at the Y-12 National Security Complex*, February 2012.

[71] Department of Energy, Office of Health, Safety and Security's Office of Safety and Emergency Management Evaluations, *Independent Oversight Review of Preparedness for Severe Natural Phenomena Events at the Los Alamos National Laboratory*, May 2012.

[72] Department of Energy, Office of Environmental Management, *Accident Investigation Report: Underground Salt Haul Truck Fire at the Waste Isolation Pilot Plant February 5,* 2014, March 2014.

[73] Defense Nuclear Facilities Safety Board, *Savannah River Site Activity Report for the Week Ending November 25, 2011*, November 25, 2011.

[74] Defense Nuclear Facilities Safety Board, *LLNL Activity Report for the Week Ending October 21, 2011*, October 21, 2011.

[75] Defense Nuclear Facilities Safety Board, *Hanford Activity Report for the Week Ending March 21, 2014*, March 21, 2014.

[76] Defense Nuclear Facilities Safety Board, *Savannah River Site Activity Report for the Week Ending May 17, 2013*, May 17, 2013.
[77] Defense Nuclear Facilities Safety Board, *Savannah River Site Activity Report for the Week Ending July 19, 2013*, July 19, 2013.
[78] Defense Nuclear Facilities Safety Board, *Savannah River Site Activity Report for the Week Ending August 9, 2013*, August 9, 2013.
[79] Department of Energy, Office of Health, Safety and Security's Office of Safety and Emergency Management Evaluations, *Independent Oversight Review of Site Preparedness for Severe Natural Phenomena Events at the Idaho National Laboratory*, July 2012.
[80] Department of Energy, Office of Health, Safety and Security's Office of Safety and Emergency Management Evaluations, *Independent Oversight Review of Preparedness for Severe Natural Phenomena Events at the Paducah Site*, April 2013.
[81] Department of Energy, Office of Health, Safety and Security's Office of Safety and Emergency Management Evaluations, *Independent Oversight Review of Site Preparedness for Severe Natural Phenomena Events at the Savannah River Site Tritium Facilities*, December 2012.
[82] Department of Energy, Office of Health, Safety and Security's Office of Safety and Emergency Management Evaluations, *Independent Oversight Review of Preparedness for Severe Natural Phenomena Events at the Portsmouth Gaseous Diffusion Plant*, November 2013.
[83] Department of Energy, Office of Health, Safety and Security's Office of Safety and Emergency Management Evaluations, *Independent Oversight Review of Preparedness for Severe Natural Phenomena Events at the Nevada National Security Site*, February 2014.
[84] Sandia National Laboratories, *Emergency Response Protective Action Plan – 6588 PA Plan 400*, March 22, 2011.
[85] Sandia National Laboratories, *Emergency Response Protective Action Plan – 6588 PA Plan 1590*, March 22, 2011.
[86] Sandia National Laboratories, *Emergency Response Protective Action Plan – 6588 PA Plan 3650*, March 22, 2011.
[87] Sandia National Laboratories, *Emergency Response Protective Action Plan – 6588 PA Plan 7710*, March 22, 2011.
[88] Sandia National Laboratories, *Emergency Response Protective Action Plan – 6588 PA Plan 17480*, March 22, 2011.
[89] Sandia National Laboratories, *Emergency Response Protective Action Plan – 6597 PA Plan 330 Alert*, December 16, 2009.
[90] Sandia National Laboratories, *Emergency Response Protective Action Plan – 6597 PA Plan 500*, December 16, 2009.
[91] Sandia National Laboratories, *Emergency Response Protective Action Plan – 6597 PA Plan 4429 SAE*, December 16, 2009.
[92] Sandia National Laboratories, *Emergency Response Protective Action Plan – 6597 PA Plan 15000 GE*, December 17, 2009.
[93] Sandia National Laboratories, *Emergency Response Protective Action Plan – 6590 PA Plan 330 Alert*, November 5, 2009.
[94] Sandia National Laboratories, *Emergency Response Protective Action Plan – 6590 PA Plan 500*, November 5, 2009.

[95] Sandia National Laboratories, *Emergency Response Protective Action Plan – 6590 PA Plan 4429 SAE*, November 5, 2009.
[96] Sandia National Laboratories, *Emergency Response Protective Action Plan – 6590 PA Plan 15840 GE*, November 6, 2009.
[97] Sandia National Laboratories, *Emergency Response Protective Action Plan – 6590 PA Plan 65050 GE*, November 6, 2009.
[98] Department of Energy, *Emergency Management Functional Area Qualification Standard*, DOE–STD–1177-2004, January 2004.
[99] Department of Energy, *FTCP Site Specific Information*, http://energy.gov/hss/services/assistance/federal-technical-capability-program-ftcp/ftcp-site-specific-information, accessed on May 27, 2014.
[100] Department of Energy, Office of Safety and Emergency Management Evaluations, *Independent Oversight Review of the Emergency Response Organization at the Los Alamos National Laboratory*, April 2012.
[101] Krol, J, *Annual Report for Fiscal 2009 on the Status of the Department's Emergency Management System*, Memorandum with attached report, June 23, 2010.
[102] Krol, J, *Annual Report for Fiscal 2010 on the Status of the Department's Emergency Management System*, Memorandum with attached report, October 25, 2011.
[103] Krol, J, *Annual Report for Fiscal 2011 on the Status of the Department's Emergency Management System*, Memorandum with attached report, April 2, 2013.
[104] Department of Energy, *Departmental Directives Program*, DOE O 251.1C, January 15, 2009.
[105] Department of Energy, *Implementation of Department of Energy Policy*, DOE O 226.1B, April 25, 2011.
[106] Department of Energy, *Independent Oversight Program*, DOE O 227.1, August 30, 2011.

Risk Assessment for Recommendation 2014-01
Emergency Preparedness & Response

The recommendation addresses vulnerabilities in the Department of Energy's (DOE) safety framework for defense nuclear facilities resulting from deficiencies in the content and implementation of DOE's requirements for emergency preparedness and response. In accordance with the Defense Nuclear Facilities Safety Board's (Board) Policy Statement 5 (PS-5), *Policy Statement on Assessing Risk*, this risk assessment was conducted to support the Board's recommendation on *Emergency Preparedness and Response*. As stated in PS-5,

> The Board's assessment of risk may involve quantitative information showing that the order of magnitude of the risk is inconsistent with adequate protection of the health and safety of the workers and the public … the Board will explicitly document its assessment of risk when drafting recommendations to the Secretary of Energy in those cases where sufficient data exists to perform a quantitative risk assessment.

DOE's hazards assessments address initiating events, preventive and mitigative controls, and consequences. Initiating events in these assessments include operational and natural phenomena events. Preventive and mitigative controls are design basis controls identified in safety analysis documents. Consequences cover a wide spectrum, ranging from insignificant to catastrophic effects.

Emergency preparedness and response programs exist at DOE sites with defense nuclear facilities because the risk associated with those facilities is acknowledged by DOE and is required by law. Therefore, emergency preparedness and response programs need to function effectively to protect the workers and the public.

This recommendation is focused on improving the effectiveness of DOE's emergency preparedness and response programs. A quantitative risk assessment on the effectiveness of these programs requires data on probability and consequences. However, data do not exist on the probability of failure of elements of the emergency preparedness and response programs. Therefore, it is not possible to do a quantitative assessment of the risk of these elements to provide adequate protection of the workers and the public.

The Secretary of Energy
Washington, DC 20585

August 5, 2014

The Honorable Peter S. Winokur
Chairman
Defense Nuclear Facilities Safety Board
625 Indiana Avenue, NW, Suite 700
Washington, DC 20004

Dear Mr. Chairman:

Thank you for the opportunity to review the Defense Nuclear Facilities Safety Board (DNFSB) Draft Recommendation 2014-01, *Emergency Preparedness and Response.* DOE agrees that actions are needed to improve emergency preparedness and response capabilities at its defense nuclear facilities. The Department's emergency preparedness and response infrastructure, capabilities, and resources are of great importance to me and DOE's senior leadership. Recommendation 2014-01 will complement actions that the Department has already initiated to improve emergency management.

Following my review of the Draft Recommendation with my leadership team, it appears the document establishes a timeline for accomplishing the recommended actions. I recommend the DNFSB remove the specific time for completing responsive actions. It is the Department's responsibility to determine the necessary resources, including the requisite timeline to accomplish the actions in our implementation plan to address DNSFB recommendations. I share your intent to improve emergency management in the Department and I assure you that the Department takes this situation seriously. We will prioritize efforts and plan to consult with you. I have already directed my staff to expeditiously proceed with improvements which we identified separately, accomplishing the highest priorities within a one year period.

In addition to the wording change identified above, I offer suggested language that may help clarify the DNFSB's intent in the Draft Recommendation. These changes are included as an enclosure for your consideration.

We appreciate the DNFSB's perspective and look forward to continued positive interactions. If you have any questions, please contact me or Mr. Joseph J. Krol, Associate Administrator for Emergency Operations, at 202-586-9892.

Sincerely,

Ernest J. Moniz

Enclosure

Received - Office of the Chairman - 08.07.14

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Specific DOE Comments on

Draft DNFSB Recommendation 2014-01,

Emergency Preparedness and Response

1. The formal process for developing an implementation plan for an accepted recommendation will establish a schedule commensurate with careful consideration of scope, capabilities, and resources, subject to the expectations for timeliness found in the DNFSB enabling legislation. The Department recommends changing the phrase at the beginning of the Draft Recommendation, striking the words, "...during each site's 2015 annual emergency response exercise", which would change the statement to read, "To address the deficiencies summarized above, the Board recommends that DOE take the following actions:"

2. Regarding Action 1, the Departmental management model currently uses criteria and review approaches. The current wording, "develop and initiate", could lead the public to believe that the Department does not have a criteria and review approach, whereas your staff recognizes that such approaches exist and are in use. The use of this terminology "criteria and review approach" also seems to focus narrowly on a particular solution when other parts of the DNFSB's Draft Recommendation appear to imply that systemic changes are needed in the overall DOE oversight and continuous improvement processes. DOE recommends changing Action 1 to read, "In its role as a regulator, standardize and improve implementation of its criteria and review approach to confirm...."

3. Regarding Action 2c, as written, it is not clear that you may have intended for "facility-specific drill programs" to mean drill programs for facility operators, who, as part of conduct of operations, take actions under abnormal and emergency operating procedures to mitigate conditions or that bring facilities into safe shut-down, separate from actions taken by the emergency response organization. DOE recommends changing this action to read, "...including requirements that address facility conduct of operations drill programs and the interface with emergency response organization team drills."

4. Regarding Action 2e, the intent of this element is unclear since the Department already has continuous improvement processes in place and processes for including lessons learned during implementation of DOE directives into future directive revisions. In addition, Action 2e appears to imply that improvements should be made to the emergency management directive on a one-time basis and that the directive should not be changed until after program reviews called for in Action 1 are completed. The Department recommends a clarification of the intent of this action.

Received - Office of the Chairman - 08.07.14

Disposition of DOE Comments on Draft Recommendation 2014-1

DOE comment	Board response	Revised wording
The formal process for developing an implementation plan for an accepted recommendation will establish a schedule commensurate with careful consideration of scope, capabilities, and resources, subject to the expectations for timeliness found in the DNFSB enabling legislation. The Department recommends changing the phrase at the beginning of the Draft Recommendation, striking the words, "…during each site's 2015 annual emergency response exercise", which would change the statement to read, "To address the deficiencies summarized above, the Board recommends that DOE take the following actions:"	The Board understands the DOE rationale for removing the time constraint from the Recommendation. However, the Board's enabling legislation states that "not later than one year after the date on which the Secretary of Energy transmits an implementation plan with respect to a Recommendation (or part thereof) under subsection (f), the Secretary shall carry out and complete the implementation plan." The Board believes that the actions in the first sub- Recommendation can be accomplished by the end of 2016 and has revised the wording of the Recommendation accordingly.	To address the deficiencies summarized above, the Board recommends that DOE take the following actions: 1. In its role as a regulator, by the end of 2016, standardize and improve implementation of its criteria and review approach to confirm that all sites with defense nuclear facilities:
Regarding Action 1, the Departmental management model currently uses criteria and review approaches. The current wording, "develop and initiate", could lead the public to believe that the Department does not have a criteria and review approach, whereas your staff recognizes that such approaches exist and are in use. The use of this terminology "criteria and review approach" also seems to focus narrowly on a particular solution when other parts of the DNFSB's Draft Recommendation appear to imply that systemic changes are needed in the overall DOE oversight and continuous improvement processes. DOE recommends changing Action 1 to read, "In its role as a regulator, standardize and improve implementation of its criteria and review approach to confirm …"	The Board acknowledges that DOE uses criteria and review approaches in its current oversight of the emergency preparedness and response capabilities of its sites. However, as discussed in the Recommendation, "… the current scope of DOE independent oversight is not adequate to identify needed improvements and to ensure effectiveness of federal and contractor corrective actions." In addition, the Recommendation notes "that DOE has not effectively conducted oversight and enforcement of its existing requirements." Therefore, the scope and implementation of the existing criteria and review approaches should be standardized and improved. The Board believes that DOE's suggested rewording addresses this issue and is appropriate.	1. In its role as a regulator, by the end of 2016, standardize and improve implementation of its criteria and review approach to confirm that all sites with defense nuclear facilities:
Regarding Action 2c, as written, it is not clear that you may have intended for "facility-specific drill programs" to mean drill programs for facility operators, who, as part of conduct of operations, take actions under abnormal and emergency operating procedures to mitigate conditions or that bring facilities into safe shut-down, separate from actions taken by the emergency response organization. DOE recommends changing this action to read, "… including requirements that address facility conduct of operations drill programs and the interface with emergency response organization team drills."	The Board acknowledges that the meaning of "facility-specific drill programs" needs to be clarified. The use of this term was intended to address the response of facility operators during emergency events and their interactions with emergency response personnel. The Board believes that DOE's suggested rewording addresses this need for clarification and is appropriate.	2.c Criteria for training and drills, including requirements that address facility conduct of operations drill programs and the interface with emergency response organization team drills.

Regarding Action 2e, the intent of this element is unclear since the Department already has continuous improvement processes in place and processes for including lessons learned during implementation of DOE directives into future directive revisions. In addition, Action 2e appears to imply that improvement should be made to the emergency management directive on a one-time basis and that the directive should not be changed until after program reviews called for in Action 1 are completed. The Department recommends a clarification of the intent of this action.	Based on DOE's comment, the Board acknowledges that clarification of the intent of this element is necessary. The clarification that DOE requested can be accomplished by phrasing the required element more simply as "Vulnerabilities identified during independent assessments."	2.e Vulnerabilities identified during independent assessments.