DEFENSE NUCLEAR FACILITIES SAFETY BOARD
Washington, DC 20004-2901

May 6, 2025

The Honorable Christopher Wright
Secretary of Energy
U.S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Wright:

The Department of Energy (DOE) must have robust and tested emergency response capabilities to ensure public and worker safety. Accordingly, the Defense Nuclear Facilities Safety Board (Board) routinely observes the conduct of emergency exercises at DOE sites in the defense nuclear complex to assess their ability to respond to potential incidents involving a release of radiological materials. This has been exemplified, in part, by Board Members' observations at several emergency exercises as well as through direct interactions with DOE and National Nuclear Security Administration (NNSA) emergency management personnel, including at the DOE Emergency Management Symposium.

Enclosed for your information is a report summarizing the Board's observations from emergency exercises conducted over the past three years. The report identifies common and recurring safety issues observed in the areas of exercise realism, communications practices, communications and notifications equipment and systems, emergency response by radiological protection personnel, and cross-organizational exercise evaluations. Additionally, the report highlights key, recent DOE complex-wide improvement efforts, including severe incident exercises, new operations emergency centers, and the use of best practices and benchmarking. These findings can help inform DOE's future oversight efforts as sites begin to implement the recently issued DOE Order 151.1E, *Comprehensive Emergency Management System*.

Sincerely,

Thomas A. Summers
Acting Chairman

Enclosure

c: Ms. Teresa Robbins, Acting Administrator, National Nuclear Security Administration
Mr. Roger Jarrell, Principal Deputy Assistant Secretary, DOE Office of Environmental Management
Mr. John Juskie, Associate Administrator for Emergency Management, NNSA
Mr. Joe Olencz, Director, Office of the Departmental Representative to the Board

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Report

February 13, 2025

Observations from Department of Energy Emergency Exercises

Summary. This report documents a Defense Nuclear Facilities Safety Board (DNFSB) staff review of emergency exercises conducted by Department of Energy (DOE) laboratories, plants, and sites (sites) within the defense nuclear complex. This assessment is based on observations and document reviews over the past three years following the general resumption of field drill and exercise activities after the COVID-19 pandemic.

This report identifies common and recurring safety weaknesses observed in the areas of exercise realism, emergency communications practices, communications and notifications equipment and systems, emergency response by radiological protection personnel, and cross-organizational exercise evaluations. Additionally, this report highlights results from some key, recent DOE complex-wide efforts, including severe incident exercises, new operations emergency centers, and the use of best practices and benchmarking.

Background. At DOE defense nuclear facilities, emergency preparedness and response programs are important safety management programs, responsible for ensuring appropriate mitigative efforts are taken to protect life safety following incidents, including those involving an unplanned release of radiological material. Emergency response is the last line of defense to protect workers and the public.

The DNFSB has historically focused on emergency preparedness and response activities across the defense nuclear complex, most notably in Recommendation 2014-1, *Emergency Preparedness and Response*, which resulted in changes to requirements reflected in the recent issuance of DOE Order 151.1E, *Comprehensive Emergency Management System*. To provide assurance of emergency readiness and proficiency, DOE sites with defense nuclear facilities must conduct one or more evaluated emergency exercises annually. DNFSB staff, including resident inspectors, routinely observe the conduct and evaluation of these emergency exercises. Common observation venues include event scenes, incident command posts, control rooms, emergency operations centers, technical support rooms, and plant shift superintendent offices.

The exercises described in this report were functional or full-scale exercises conducted across the Savannah River Site, the Hanford Site, Pacific Northwest National Laboratory, the Pantex Plant, Los Alamos National Laboratory, Y-12 National Security Complex, the Waste Isolation Pilot Plant, Idaho National Laboratory, Sandia National Laboratories, Lawrence Livermore National Laboratory, and the Nevada National Security Site from 2022 to 2024. Appendix A contains a list of exercises observed by DNFSB staff. In addition to observing these exercises, DNFSB staff observed associated briefings, hotwashes, critiques, and reviewed available documentation, such as exercise plans, relevant procedures, and after-action reports.

Emergency exercises are intended to challenge responders with realistic scenarios and to identify vulnerabilities or weaknesses prior to real-world incidents, and so the existence of identified safety issues is not directly correlated with the strength of a program. Additionally, while emergency exercises serve as a valuable indicator of readiness and proficiency, they are complemented by a suite of processes such as assessments, issues management, and line management oversight, which are largely outside the scope of this report. In many cases, the observations in this report are from recurring observations at one or more of the DOE sites.

Weaknesses. The DNFSB staff review team identified the following weaknesses.

Exercise Realism—Not all emergency exercises have been effectively planned and conducted as realistic demonstrations of readiness. Exercises have often featured scenario conditions, simulations, and injects that needlessly simplify response actions, such as pre-planned (or "canned") wind that does not vary in speed or direction over the exercise duration. Frequently, exercise controllers provide players with observational or field data that is technically inconsistent with the scenario, such as radiological survey data that is inconsistent with the scenario hazards. DOE Guide 151.1-1B, *Comprehensive Emergency Management System Guide*, states that "Message injects should contain accurate, unambiguous, and non-prompting information and technical data… and provide proper direction for the exercise." Site personnel frequently attribute these issues to late changes to planned exercise scenarios, changes that are not disseminated clearly to exercise controllers, and inadequate involvement of technical groups in earlier stages of exercise planning.

At some DOE sites, emergency exercises, which are designed to be formally evaluated, are treated by site personnel more as emergency drills designed for training and practice. DNFSB staff have observed infrequent but recurring examples of exercise controllers coaching or asking leading questions of players during response, which degrades the validity of the exercise evaluation.

Some sites conduct emergency exercises shortly after one or more emergency drills that are highly resemblant to the subsequent exercise, either in scenario or in necessary response actions. These drills can effectively precondition players for the exercise by providing them an opportunity to practice specific response plans and actions. While this practice can be acceptable in specific contexts such as readiness reviews, DOE should be vigilant to this practice, as it can reduce confidence that a given emergency exercise is a valid indicator of a site's actual readiness to respond to emergency incidents, which can occur at any time.

Common Operating Picture and Communications Practices—Site emergency communications are a vital piece of an effective emergency response system. For a site's emergency response to be effective, continuous and accurate communications among response organizations must be reliably maintained during an operational emergency. DOE Order 151.1E requires DOE sites to "Ensure communication among response facilities, field response elements, and off-site command centers by providing a [common operating picture] of the emergency response and shared situational awareness among all teams. This must be accomplished by enabling access to unclassified emergency response information, such as notification forms, emergency status updates, hazardous material plume estimates, significant

activities data, and field monitoring data." DOE Order 151.1E also defines a common operating picture as "a standard overview of an incident, thereby providing incident information that enables… agencies and organizations to make effective, consistent, and timely decisions."

Examples of common issues between emergency responders that affect the ability to maintain a common operating picture include:

- Delayed or no periodic briefings between key response groups, such as between the incident command post and the emergency operations center;
- Failure to brief responders soon after they arrive at a given venue;
- Failure to clearly identify and communicate response priorities and objectives;
- Failure to provide or update common operating picture displays and whiteboards;
- Failure to correctly track and share information regarding patients being transported offsite; and
- Inadvertent mixing of radiological terminology and units (e.g., rem vs. rads, counts per minute [cpm] vs. disintegrations per minute [dpm], dose rates vs. total dose).

In general, issues with site communications are the most common type of issue observed by DNFSB staff during exercises. To an extent, communication issues are inevitable due to inherent uncertainties, assumptions, and human error. However, a disciplined use of communication practices and tools, such as repeat-backs, conducting frequent briefings (both internally and across response groups), and using status boards, can significantly reduce these problems. Busy decision makers should be encouraged to delegate communication tasks, as failing to do so can quickly overwhelm them. Processes for providing and sharing unclassified and classified information with off-site response agencies should be tested frequently.

Communications and Notifications Equipment and Systems—DOE Order 151.1E states, "Equipment must be maintained and tested, as applicable, to ensure equipment functions as designed for emergency response and implementation of protective actions…". This includes communication and notification equipment. DNFSB staff observed other communications issues rooted in technological equipment, systems, and their associated limitations. Examples include:

- Poor radio reception due to hardened facilities and/or inadequate repeaters;
- Inadequate number of available radio channels;
- Communication systems that are incompatible with offsite response agencies;
- Ineffective briefings conducted over multiple simultaneous communications channels (e.g., radios, speakerphones, web conferences) rather than unified bridge lines, resulting in participants not being able to clearly hear all speakers;

- Weak ability or inability to provide timely consequence assessment results to field responders; and

- Strong dependence on the use of personal cellular phones rather than government-issued devices.

DOE Order 151.1E also requires DOE sites to establish provisions to notify and provide updates to workers during an emergency. Many DOE sites use emergency public address systems to provide emergency information, such as protective actions. However, several sites that rely on public address systems have areas where these systems are inaudible, which hinders the site's ability to safely shelter, evacuate, and achieve accountability for workers. Additionally, these gaps in coverage have impaired situational awareness, potentially increasing risk during emergencies. A real-world example of this situation was identified at Y-12 following the February 22, 2023, operational emergency due to a fire in Building 9212.[1]

While locations lacking adequate public address system coverage can be identified and managed through compensatory measures, sites have found it challenging to perform corrective maintenance work due to aging and obsolescence issues and a need for funding. Proper maintenance and testing of public address systems is important so that the emergency response organization can reliably alert and provide clear instruction to workers during emergencies. Degradation or failure of these safety systems can result in delayed or missed emergency response actions.

Through its interactions, the DNFSB staff is also aware that not all sites have routinely field-tested backup communications capabilities, such as the Government Emergency Telecommunications Service, satellite phones, and the use of alternate facilities, during evaluated drills and exercises. Sites should ensure they provide responders with routine opportunities to test alternative and backup communication systems under realistic conditions during drills and exercises, rather than only in isolated functional checks.

Radiological Protection Emergency Response—DOE Order 151.1E requires establishing methods for "controlling, monitoring, and maintaining records of personnel exposure to hazardous materials" and "controlling access to contaminated areas and for decontaminating personnel or equipment exiting the area." For emergencies involving radiological materials, these functions are performed in part or in whole by radiological protection responders.

The emergency response performance of radiological protection personnel varies considerably across the defense nuclear complex. In many exercises, radiological protection personnel arrive promptly with supplies and equipment, establish timely contamination control, conduct surveys, and integrate effectively with facility operators, fire departments, and emergency medical service providers. However, during other exercises, radiation protection personnel are slow to arrive or fail to respond entirely, do not bring appropriate supplies or equipment, do not provide timely support to the fire department or emergency medical service provider, fail to conduct background surveys, or select inappropriate equipment. In some

[1] EMPO-1203, *Building 9212 Site Area Emergency After-Action Report*, March 2023

exercises, responders failed to prioritize life-threatening injuries over contamination control. DNFSB staff observed radiological protection response issues in multiple exercises at the Waste Isolation Pilot Plant and Sandia National Laboratories in New Mexico and in other exercises across the complex.

DOE sites would benefit from conducting additional training and drills to ensure that radiological protection personnel demonstrate emergency response proficiency and fully integrate with the broader emergency response organization.

Cross-Organizational Exercise Evaluation—DOE Order 151.1E requires sites to establish a readiness assurance framework to validate that emergency plans, procedures, and resources adequately address threats and hazards and identify improvements. DOE conducts evaluated exercises as part of this framework.

At several DOE sites with defense nuclear facilities, emergency response functions are spread across multiple primary management and operating contractors, emergency management integration contractors, or depend on offsite response agencies such as local fire departments for primary response capabilities. Exercise after-action reports often do not cover all applicable organizations with the same level of rigor or criticism when those organizations are spread across multiple emergency management contractors and/or primary offsite response agencies. In some cases, contractors conducted separate evaluations for their respective roles in the same exercise. In discussions with DNFSB staff, contractor personnel have expressed reservations about criticizing other contractors or offsite response agencies. At these sites, DOE and NNSA field offices should take additional steps to ensure that contractor readiness assurance processes accurately reflect a comprehensive picture of capabilities across different organizations and that interface issues between primary response organizations are identified and managed.

Other Observations. The DNFSB staff review team identified the following observations that have narrower applicability but may warrant additional consideration by DOE.

Severe Incident Exercises—In 2016, with the issuance of DOE Order 151.1D, DOE created a requirement to exercise severe incident scenarios involving a release of hazardous materials at more than one facility as well as disruption of site infrastructure, such as power or telecommunications, or the significant delay of mutual aid. This requirement was driven by DNFSB Recommendation 2014-1, *Emergency Preparedness and Response*, and informed by DOE Operating Experience 2013-1, *Improving Department of Energy Capabilities for Mitigating Beyond Design Basis Events*, issued following the 2011 events at Fukushima Daiichi. Numerous real-world events, most recently exemplified by Hurricane Helene's impacts to the South Carolina region surrounding the Savannah River Site in 2024 as well as multiple wildfires that have damaged local communities while encroaching toward DOE facilities, have continued to demonstrate the need for robust consideration of and planning for severe incidents.

In general, severe incident exercises have presented suitable challenges for responders. These emergency exercises have featured: concurrent evacuations of multiple nuclear facilities; losses of on-site power or communications; and responses to active physical and digital hostile actors. While challenging to plan and coordinate, sites have consistently conducted their severe

incident exercises with off-site response agencies, which provided useful perspectives to site personnel on mitigating such incidents and generally identified opportunities for improvement on how to better engage them going forward.

New Emergency Operations Centers—Recently completed emergency operations centers at Lawrence Livermore National Laboratory, Y-12 National Security Complex, Nevada National Security Site, and Sandia National Laboratories in New Mexico, meet modern survivability requirements and have been demonstrated in exercises to be considerable improvements for their respective emergency response programs.

A planned replacement emergency operations center at the Savannah River Site remains a high priority based on deteriorating conditions at the site's existing emergency operations facility. While it remains available for emergency response operations, the existing facility was deemed unsuitable for continuous occupation in 2024 due to the unhealthy presence of water, mold, and sewage. Consequently, the Savannah River Site Operations Center is operating from its alternate location, in a building not considered storm safe. The planned replacement facility is also poised to introduce or allow new technological capabilities not present in the existing facility while meeting improved standards for survivability.

Best Practices and Benchmarking—DOE promotes collaboration and benchmarking across the defense nuclear complex through its sponsorship of the Emergency Management Issues Special Interest Group (EMI-SIG) and Emergency Management Symposium. Through EMI-SIG, DOE contractors, vendors, and federal employees share best practices, lessons learned, and work on joint efforts to improve the quality of emergency management programs. This is exemplified by numerous examples of federal and contractor personnel observing and supporting emergency exercises at other sites. DOE should continue to seek and encourage opportunities for federal and contractor employees to perform cross-site benchmarking.

Similarly, the Office of Enterprise Assessments produces periodic lessons learned reports based on the results of emergency management assessments. Their most recent report, *Lessons Learned from Assessments of Emergency Management Programs at U.S. Department of Energy Sites During Fiscal Years 2022-2024*, contains best practices and recommendations complementary to the observations in this report.

Conclusion. The observations in this report provide DNFSB staff's perspectives on common and recurring safety issues seen in emergency exercises conducted by DOE at defense nuclear facilities. This report is based on observations and document reviews made by DNFSB staff between calendar years 2022 and 2024 and does not represent a comprehensive assessment of DOE emergency preparedness and response programs. However, several items in this report represent safety weaknesses that should be addressed by DOE.

Appendix A: Exercises Observed

This report is based on observations at the following emergency exercises.

- Hanford Site, Pacific Northwest National Laboratory:
  - May 18, 2023, Radiochemical Processing Laboratory.[1]
- Idaho National Laboratory:
  - June 15, 2022, multiple facilities.
  - April 18, 2023, Idaho Nuclear Technology and Engineering Center.
  - June 15, 2023, Idaho Nuclear Technology and Engineering Center.
  - May 21, 2024, Radioactive Waste Management Complex.[1]
- Los Alamos National Laboratory:
  - July 13, 2022, Technical Area 55 Plutonium Facility.[1]
  - July 12, 2023, Weapons Engineering Tritium Facility.
- Lawrence Livermore National Laboratory:
  - July 19, 2023, Superblock.[1]
- Nevada National Security Site:
  - March 15, 2023, Radioactive Waste Management Complex.[1]
  - September 5, 2024, Device Assembly Facility.[1]
- Pantex Plant:
  - June 21, 2023, Zone 12 South.[1]
  - November 8, 2023, Zone 12 South.
- Sandia National Laboratories in New Mexico:
  - March 29, 2022, Technical Area V.
  - August 23, 2023, Mesa 858 Complex.
  - June 18, 2024, multiple facilities.[1]
- Savannah River Site:
  - May 10, 2022, Tritium Extraction Facility.[1]
  - January 24, 2023, F-Area.
  - August 29, 2023, Tritium Facilities.
  - August 15, 2024, Tritium Facilities.
- Waste Isolation Pilot Plant:
  - September 14, 2022, Waste Handling Building.[1]
  - October 18, 2023, Waste Handling Building.
  - October 2, 2024, Waste Handling Building.[1]
- Y-12 National Security Complex:
  - June 15, 2022, Building 9212.[1]
  - August 30, 2023, multiple facilities.[1]

DNFSB resident inspectors and cognizant engineers observed other emergency exercises as part of routine oversight activities, but those exercises were not evaluated as part of this report.

[1] This exercise was observed directly by a Board Member.