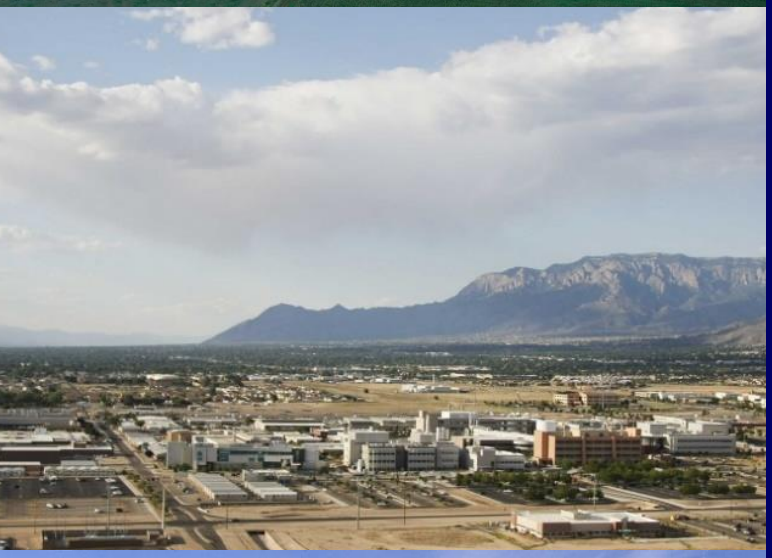

Defense Nuclear Facilities Safety Board

34th Annual Report to Congress

Required by Section 316 of the

Atomic Energy Act of 1954, as amended

"The mission of the Board shall be to provide independent analysis, advice, and recommendations to the Secretary of Energy to inform the Secretary, in the role of the Secretary as operator and regulator of the defense nuclear facilities of the Department of Energy, in providing adequate protection of public health and safety at such defense nuclear facilities, including with respect to the health and safety of employees and contractors at such facilities"
42 USC § 2286a(a)

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DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

March 18, 2024

To the Congress of the United States:

The Defense Nuclear Facilities Safety Board (Board) is pleased to submit its *34th Annual Report to Congress* for calendar year 2023. The Board is an independent, executive branch agency responsible for making recommendations to the Secretary of Energy, and in certain cases, to the President, to provide adequate protection of public health and safety at U.S. Department of Energy (DOE) defense nuclear facilities.

In 2023, the Board performed nuclear safety oversight of high-priority operations within the nuclear weapons complex. The Board's oversight priorities were based on the nuclear safety risk of proposed and ongoing activities. The Board also sought to further coordinate with the National Nuclear Security Administration (NNSA) to improve its responsiveness to the safety concerns communicated by the Board and its staff.

The Board directly engaged with NNSA leadership at the Savannah River Site (SRS) to reemphasize the need to improve worker protection at the Savannah River Tritium Enterprise, following up on Recommendation 2019-2, *Safety of the Savannah River Site Tritium Facilities*, which DOE had rejected on the grounds that it already planned actions to remedy the safety issues detailed in the recommendation.

The Board focused substantially on the safety of nuclear operations at SRS and the Waste Isolation Pilot Plant (WIPP), conducting full Board visits to these sites to advance important safety goals.

The Board continues to be interested in the application of federal oversight to ensure the safety of operations across the complex, as well as in defense nuclear waste operations to include the interconnection between generator sites and WIPP.

Further, the Board transmitted the final Recommendation 2023-1, *Onsite Transportation Safety*, to the Secretary of Energy on January 26, 2024, which the Board had transmitted to DOE as a draft for comment in 2023. The recommendation is intended to strengthen DOE's regulatory safety framework related to onsite transportation of radioactive materials and to address safety deficiencies in Los Alamos National Laboratory's transportation safety document to ensure adequate protection of public health and safety.

In 2023, the Board continued to focus on DOE's safety framework, nuclear criticality safety, emergency management and response, reactive materials, nuclear explosive safety, seismic hazards, and other safety management programs.

The Board communicated to DOE on several cross-cutting safety areas including aging infrastructure, conduct of disciplined operations, nuclear safety requirements, and software quality assurance. The Board continues to review and comment on DOE directives that define nuclear safety requirements for safety basis documents, quality assurance, startup and restart of nuclear facilities, fire protection, and chemical safety management programs.

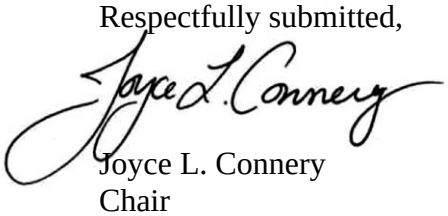
The Board also focused on DOE milestones related to Board Recommendation 2020-1, *Nuclear Safety Requirements*. The recommendation is intended to strengthen DOE's regulatory framework, including 10 Code of Federal Regulations Part 830, *Nuclear Safety Management*, and relevant DOE orders and standards.

Throughout 2023, Board members conducted discussions with senior DOE management and presented on nuclear safety topics at several conferences and workshops, including the 2023 Waste Management Symposium, Energy Facility Contractors Group meetings, and an Emergency Management Issues Special Interest Group meeting. Board members also met with special interest groups to hear about their safety concerns and inform them of Board activities and issues. These groups included the Hanford Advisory Board, Citizens for Nuclear Technology Awareness, Los Alamos Study Group, Nuclear Watch New Mexico, Concerned Citizens for Nuclear Safety, Honor our Pueblo Existence, Tewa Women United, Nevada Environmental Management Site-Specific Advisory Board, and the Oak Ridge Environmental Peace Alliance.

The James M. Inhofe National Defense Authorization Act for Fiscal Year 2023 included a provision to enable the Board to continue to serve its DOE safety oversight function if Board membership fell below the three-member minimum required for a quorum. In October 2023, the Board fell below quorum with only two members. Thanks to the additional flexibilities granted by Congress, the Chair has continued to carry out the Board's safety oversight functions in consultation with the other remaining Board member. The flexibility granted by Congress for the Chair to exercise these safety oversight responsibilities will expire in October 2024, necessitating the restoration of quorum or further congressional action to continue full DOE safety oversight responsibilities after that date.

As required by 42 United States Code § 2286e(a), this report describes the Board's accomplishments, current safety initiatives, assessments regarding improvements in the safety of defense nuclear facilities, and unresolved safety issues, and includes more details on the Board's interface with DOE and DOE's safe execution of its mission.

Respectfully submitted,



Joyce L. Connery
Chair

c: The Honorable Jennifer Granholm

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EXECUTIVE SUMMARY

EX. Executive Summary

Under the Atomic Energy Act of 1954, as amended, the Defense Nuclear Facilities Safety Board (Board) is charged with providing independent safety oversight of the Department of Energy's (DOE) defense nuclear facilities complex. The mission of the complex is to design, manufacture, test, maintain, and decommission nuclear weapons and weapons production facilities, as well as other national security priorities. The act mandates that the Board review the content and implementation of DOE standards, facility and system designs, and events and practices at DOE defense nuclear facilities to provide independent analysis, advice, and recommendations to inform the Secretary of Energy regarding issues of adequate protection of public health and safety at DOE defense nuclear facilities.

The Board prioritizes its safety oversight activities based on risk to the public and workers, the types and quantities of nuclear and hazardous material at hand, and hazards of the operations involved. This annual report summarizes the Board's significant safety oversight initiatives and some high-priority safety issues at defense nuclear facilities subject to the Board's oversight during 2023. Foremost among these initiatives and issues were:

- ***Implementation of Recommendation 2020-1, Nuclear Safety Requirements***—In February 2020, the Board issued Recommendation 2020-1, *Nuclear Safety Requirements*. The recommendation is intended to strengthen DOE's regulatory framework, including 10 Code of Federal Regulations (CFR) Part 830, *Nuclear Safety Management*, and relevant DOE orders and standards. In 2023, DOE completed several milestones from its Recommendation 2020-1 implementation plan issued on June 27, 2022. The Board remains actively engaged with DOE's execution of the implementation plan, for example by observing writing team meetings and providing feedback on DOE directives related to the recommendation. Overall, DOE's actions in response to Recommendation 2020-1 have been positive and are poised to improve critical aspects of its regulatory framework governing nuclear safety. However, the Board sent letters to DOE in October and November 2023 outlining concerns with DOE's response to elements of the recommendation related to aging infrastructure management. The Board is concerned that DOE's planned and completed actions will not be sufficient to drive necessary safety improvements to the requirements and processes that ensure safe and effective management of decades-old defense nuclear facilities.

- ***Onsite Transportation Safety***—The Board identified safety weaknesses in Los Alamos National Laboratory's (LANL) transportation safety document, stemming in part from weaknesses in the safe harbors that govern transportation safety document development under 10 CFR 830, *Nuclear Safety Management*. The Board communicated its safety concerns to the Secretary of Energy in a January 6, 2022, letter. The National Nuclear Security Administration's (NNSA) management and operating contractor at LANL implemented compensatory safety measures for onsite transportation of radioactive materials in March 2023. These safety measures represent an improvement to the safety of such operations at LANL; however, more work is needed to ensure the LANL transportation safety document appropriately

identifies all hazards, analyzes all pertinent accident scenarios, and evaluates the effectiveness of all credited safety controls. Further, until DOE revises the safe harbors for onsite transportation of radioactive materials to provide clear and effective safety requirements, the risk remains that LANL, or other defense nuclear sites, may regress to inadequate transportation safety documents that fail to provide an effective set of safety controls. Therefore, on January 26, 2024, the Board transmitted Recommendation 2023-1, *Onsite Transportation Safety*, to the Secretary of Energy. The recommendation is intended to strengthen DOE's regulatory safety framework related to onsite transportation and to address safety deficiencies in LANL's transportation safety document to ensure adequate protection of public health and safety.

- ***Implementation of Recommendation 2019-1, Uncontrolled Hazard Scenarios and 10 CFR 830 Implementation at the Pantex Plant***—In Recommendation 2019-1, the Board discussed safety-related conditions of approval imposed by NNSA for safety basis documentation at the Pantex Plant (Pantex) that had remained open for many years. In January 2023, the Board issued a letter to the NNSA Administrator summarizing conclusions from its review of the path to closure for various safety-related conditions of approval, as well as other planned improvements identified in Pantex safety basis documentation. The Board found that actions NNSA and the site contractor had taken to close these legacy conditions of approval and accomplish planned safety improvements were consistent with the Recommendation 2019-1 implementation plan and were addressing most of the associated safety concerns. Notable safety improvements implemented at Pantex include: (1) replacing wood-framed false ceilings in nuclear explosive cells, (2) fixing errors in fire protection calculations and drawings, (3) addressing potential inappropriate applications of certain weapon response rules within the safety basis, and (4) modifying acquisition requirements for vacuum chamber oil to protect safety basis assumptions regarding a potential fire scenario.

- ***Los Alamos National Laboratory Plutonium Facility Safety Posture***—NNSA is working to improve the safety basis and engineered safety systems for the LANL Plutonium Facility to support the facility's increased mission scope. The Board conducted a public hearing on nuclear safety and increased production activities within the Plutonium Facility in November 2022, and subsequently requested additional information needed to better understand and judge the adequacy of NNSA's planned safety posture in a June 20, 2023, letter to the Secretary of Energy. The NNSA Administrator provided five deliverables to answer these questions, the last two of which the Board received in January 2024. The Board is using this information to evaluate the assumptions that underpin NNSA's passive confinement strategy for the facility, the functional requirements of the facility fire suppression system, and the design and performance requirements for the facility's confinement ventilation system.

- ***Worker Protection and Federal Oversight at the Savannah River Site***—The Board visited the Savannah River Site (SRS) in May 2023, and conducted walkdowns of the

Savannah River Tritium Enterprise, Savannah River Plutonium Processing Facility Project, K-Area Complex, Surplus Plutonium Disposition Project Area, Savannah River National Laboratory, and H-Tank Farms. Discussions centered primarily on safety issues identified in the Board's March 29, 2023, letter to the Secretary of Energy, particularly the adequacy of worker protection at SRS and the overall effectiveness of federal safety oversight.

- ***Savannah River Tritium Enterprise Safety Posture***—The Board reviewed NNSA's progress toward improving safety at the Savannah River Tritium Enterprise during its site visit in May 2023. NNSA, in coordination with its management and operating contractor, has initiated several efforts to reduce risk and improve safety of the tritium facilities in terms of physical facility changes, analytical changes, and improvements to safety management programs such as emergency preparedness and response. While these plans and actions are encouraging, NNSA has only accomplished limited improvements to date, and a significant amount of work remains to reduce the safety risk to an acceptable level. On October 4, 2023, the Board sent a letter to the Secretary of Energy establishing a reporting requirement starting in early 2024 for DOE to provide an annual report and briefing on DOE's progress on safety improvements at the Savannah River Tritium Enterprise.

- ***Controls for Worker Safety at the Savannah River Plutonium Processing Facility Project***—During the Board's visit to SRS in May 2023 and in letters dated August 3, 2023, and November 28, 2023, the Board questioned the adequacy of NNSA's safety strategy for facility worker protection, focusing on impacts to long-lead procurements, such as glovebox systems. The Board is concerned with the project's position that facility workers could "self-protect" or use their natural senses to detect postulated accidents such as a glovebox spill or fire and could exit the area before receiving significant radiological exposure. This approach resulted in a proposed safety control set for a new facility that significantly departed from DOE's other operating plutonium facilities. The Board first documented this safety concern in its letter on the conceptual design dated January 24, 2022. In a response letter dated January 17, 2024, NNSA stated it concurred with the Board's safety concern and will elevate oxygen monitors, differential pressure alarms, and all gloveboxes containing plutonium to safety significant for facility worker protection. NNSA is evaluating additional safety significant controls and has issued guidance on facility worker self-protection to all NNSA program and field office management.

- ***Oversight at the Waste Isolation Pilot Plant (WIPP)***—The Board visited WIPP in August 2023 and performed walkdowns of WIPP's underground facilities, the Waste Handling Building, and capital asset acquisition projects including the Safety Significant Confinement Ventilation System, and utility shaft projects. The Board focused on safety concerns that underlined the overall importance of WIPP to the DOE complex. In particular, the Board emphasized the importance of understanding the effectiveness of corrective actions taken following the 2014 radiological release

event, managing federal staffing, addressing equipment reliability issues, and aligning the WIPP safety basis with modern safety standards.

- **Flammable Gas Hazards in Nuclear Waste Drums at Idaho National Laboratory**—The Board sent a letter to DOE on February 24, 2023, identifying safety concerns with the handling of flammable gas hazards at Idaho National Laboratory (INL). The Board established a reporting requirement regarding INL's implementation of actions taken to mitigate existing safety hazards in accordance with DOE STD-5506-2021, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities*. DOE subsequently implemented safety upgrades including installing lid restraints on drums with known elevated flammable gas hazards, improved securing of drums on vehicles for transportation between Advanced Mixed Waste Treatment Project facilities, and continued sampling of drums with unknown flammable gas concentrations.

In 2023, the Board's correspondence was accessed more than 7,890 times via its public website. This represents a four-fold increase over 2022. In addition to letters, technical reports, and recommendation, the Board publishes resident inspector weekly reports for most DOE sites subject to the Board's jurisdiction and monthly reports for the remainder. The table below provides information on the number of times resident inspector weekly reports and other publications were accessed via the public website in 2023.

Table ES-1. *Access of Board Publications via Public Web Site in 2023*

Type of Publication	Number of Times Accessed
Resident Inspector Weekly Reports, Hanford Site	580
Resident Inspector Weekly Reports, Savannah River Site	330
Resident Inspector Weekly Reports, Los Alamos National Laboratory	590
Resident Inspector Weekly Reports, Y-12 National Nuclear Complex and Oak Ridge National Laboratory	409
Resident Inspector Weekly Reports, Pantex Plant	350
Letters	7890
Technical Reports	278
Recommendations	1615
Public Hearings/Meetings	1093

BOARD STATUTORY MISSION

I. The Board's Statutory Mission

Congress established the Defense Nuclear Facilities Safety Board (Board or DNFSB) in 1988 as an independent federal agency within the executive branch of the government, subject to congressional oversight and direction. The Board consists of up to five members, who are appointed by the President and are subject to Senate confirmation. Board members are required to be "respected experts in the field of nuclear safety with a demonstrated competence and knowledge relevant to the independent investigative and oversight functions of the Board." The Board is a collegial agency, meaning that its actions are determined by the Board as a whole. The Board's Chair serves as the chief executive officer and performs this function subject to Board policies.

The Board's essential mission is to provide independent analysis, advice, and recommendations to the Secretary of Energy to inform the Secretary, in their role as operator and regulator of Department of Energy (DOE) defense nuclear facilities, on providing adequate protection of public health and safety, which includes the health and safety of workers. The term "defense nuclear facilities" is defined in the Atomic Energy Act of 1954, as amended. It includes nuclear facilities operated by DOE that have a function related to national defense or that store nuclear waste (excluding Yucca Mountain and other facilities operated pursuant to the Nuclear Waste Policy Act). "Defense nuclear facilities" thus do not include two major classes of government-regulated nuclear facilities: DOE's nuclear projects that are civilian in purpose and commercial nuclear facilities regulated by the Nuclear Regulatory Commission. The Board's oversight jurisdiction also does not extend to the U.S. Navy's nuclear propulsion program or to environmental hazards regulated by other federal and state agencies. Table 1 lists the major sites with defense nuclear facilities that the Board oversees.

Table 1. *Major Sites Subject to the Board's Jurisdiction*

Site	Location	Operations	Website
Hanford Site	Richland, WA	Management and treatment of radioactive wastes; facility decommissioning	www.hanford.gov
Idaho National Laboratory	45 miles west of Idaho Falls, ID	Storage and processing of radioactive waste	www.inl.gov
Lawrence Livermore National Laboratory	Livermore, CA	Research to support the nuclear weapons arsenal	www.llnl.gov

Site	Location	Operations	Website
Los Alamos National Laboratory	Los Alamos, NM	Research to support the nuclear weapons arsenal; manufacturing of nuclear weapon components; disposition of legacy transuranic waste	www.lanl.gov
Nevada National Security Site	65 miles northwest of Las Vegas, NV	Disposition of damaged nuclear weapons; critical and subcritical experiments; waste management	www.nnss.gov
Oak Ridge National Laboratory	Oak Ridge, TN	Energy research; treatment and disposal of radioactive wastes	www.ornl.gov
Pantex Plant	17 miles northeast of Amarillo, TX	Maintenance of the nuclear weapons stockpile	pantex.energy.gov
Sandia National Laboratories	Albuquerque, NM	Nuclear research; support for the weapons stockpile maintenance program	www.sandia.gov
Savannah River Site	Aiken, SC	Tritium extraction, recycling, and storage; management and treatment of radioactive wastes; nuclear materials storage and disposition; research and development	www.srs.gov
Waste Isolation Pilot Plant	26 miles east of Carlsbad, NM	Disposal of transuranic waste in underground repository	wipp.energy.gov
Y-12 National Security Complex	Oak Ridge, TN	Manufacturing and surveillance of nuclear weapons components; processing of weapons-grade uranium	www.y12.doe.gov

The Board's oversight mission covers all phases in the life cycle of a defense nuclear facility: design, construction, operation, and decommissioning. Congress granted the Board a suite of statutory tools to carry out its mission. Principal among these is the Board's authority to issue formal recommendations to the Secretary. The Atomic Energy Act requires the Secretary to either accept or reject a Board recommendation, and in the case of an acceptance, to write and execute an implementation plan. In the case of a rejection, the Secretary must report to the relevant congressional committees the reasoning for the rejection. This process takes place on the public record. In addition to issuing recommendations that require a secretarial response, the

Atomic Energy Act requires the Board to review and evaluate DOE requirements and standards affecting safety at defense nuclear facilities. Evaluation of these standards may result in recommendations or other appropriate analysis and advice provided to DOE.

To obtain information needed for its oversight responsibilities, the Board is empowered to hold public hearings (and subpoena witnesses or documents, if necessary), conduct investigations, and obtain information and documents needed for the Board's work from DOE and its contractors. DOE is required by law to grant the Board prompt and unfettered access to facilities, personnel, and information that the Board considers necessary to carry out its responsibilities. In addition, the Board welcomes information from interested members of the public who have reason to believe an unsafe condition may exist at a defense nuclear facility. These safety allegations come most frequently from DOE employees or contractors who have relevant expertise and access to specific defense nuclear facilities. The Board fully evaluates each safety allegation and follows up using the complete range of statutory powers at its disposal. Finally, the Board has resident inspectors stationed at several DOE sites with defense nuclear facilities. These resident inspectors provide real-time information to the Board regarding operations and safety issues at their respective sites.

Continuation of Functions and Powers During Loss of Quorum

The James M. Inhofe National Defense Authorization Act for Fiscal Year 2023 included a provision to enable the Board to continue to serve its DOE safety oversight function if Board membership fell below the three-member minimum required for a quorum. In October 2023, with the retirement of a Board member, the Board fell below quorum with only two members. Thanks to the additional flexibilities granted by Congress, the Chair has continued to carry out the Board's safety oversight functions in consultation with the other remaining Board member. The flexibility granted by Congress for the Chair to exercise these safety oversight responsibilities will expire in October 2024, necessitating the restoration of quorum or further congressional action to continue full DOE safety oversight responsibilities after that date.

Nonpublic Collaborative Discussions

The National Defense Authorization Act for Fiscal Year 2021 included a change to the Atomic Energy Act of 1954 allowing Board members to hold "nonpublic collaborative discussions" without following the requirements of the Government in the Sunshine Act, so long as certain requirements are met.[1] In calendar year 2023, the Board held 11 nonpublic collaborative discussions on a variety of topics. Summaries of these discussion topics are available on the Board's public website at www.dnfsb.gov/public-hearings-meetings. The allowance for nonpublic collaborative discussions has facilitated candid discussion among Board members while still ensuring public transparency. In addition, nonpublic collaborative discussions have supported the Board's efforts over the past year on matters ranging from

[1] The requirements for nonpublic collaborative discussions are: (1) the Board may not vote on any matters; (2) each individual present must be a Board employee; (3) at least one Board member from each political party represented on the Board must be present; (4) the Board's general counsel must be present; and (5) within two days of the discussion the Board must publish a summary of the matters discussed.

evaluating deliverables from DOE to evaluating candidates for the position of executive director of operations.

Executive Director of Operations

The National Defense Authorization Act for Fiscal Year 2020 created a new senior executive service position at the Board. The executive director of operations is responsible for the day-to-day operations of DNFSB, provides supervision to technical and administrative staff, and performs other duties delegated by the Chair. This position was vacant from August 2022 to December 2023. The new executive director of operations onboarded on December 4, 2023.

On January 4, 2024, the Chair signed delegations to the executive director of operations. These delegations include: the administrative functions of the Board; appointment and supervision of employees of the Board, excluding employees of the Office of the General Counsel; distribution of business among the employees and administrative units and offices of the Board; and preparation of proposals for the reorganization of the administrative units or offices of the Board, the budget estimate for the Board, and the proposed distribution of funds according to purposes approved by the Board. The Board will continue to update the agency's directives and supporting documents to incorporate the roles and responsibilities of the executive director of operations.

DNFSB Workforce

DNFSB's foundation is built on the expertise of its Board members and its staff in support of the Board's mission. DNFSB is working to build a multi-year human capital strategic plan to guide training and development, recruiting and retention practices, and succession planning. This holistic approach will help ensure that appropriate human capital resources support the Board's critical nuclear safety oversight mission, which in turn supports the U.S. nuclear deterrent. Implementing its new Human Capital Plan will help ensure that the Board can recruit or develop the necessary expertise and depth in highly specialized and highly competitive technical disciplines.

Approximately two-thirds of the agency's annual budget is dedicated to salaries and benefits. In fiscal year 2023, DNFSB executed an aggressive staffing plan focused on hiring professionals to support its mission and fill vacant operational staff positions. Filling these roles reversed a significant decrease in staffing in prior years when staffing dropped precipitously by over 20 percent. Aggressive hiring efforts resulted in 116 full-time equivalent usage for the fiscal year, just below the budgeted level of 120 full-time equivalents and below the statutory cap of 130 full-time equivalents.

In addition to the new executive director of operations position, the Board implemented several additional staffing changes. The Office of the Technical Director created and filled 10 new topical cognizant engineer positions, which allows for increased focus on certain safety areas (e.g., nuclear criticality safety and safety management programs) and design and construction projects. In addition, two new resident inspectors reported for duty at the Pantex Plant (Pantex) in 2023, as described in the Field Operations section of this report. On

November 2, 2023, the Board celebrated the impactful career and significant nuclear safety achievements of Board Member Jessie Roberson upon her retirement. The staff has developed an onboarding package to facilitate the seamless and efficient transition of any newly appointed Board member(s) and will update it as appropriate.

Management Improvements

DNFSB continues to make management improvements in the conduct of its operations. In 2023, DNFSB closed out 50 percent of all open recommendations from the Office of the Inspector General. These included implementing key improvements in DNFSB's cybersecurity posture. The agency additionally kicked off a transition to Interior Business Center as the primary service provider for financial, personnel, drug testing, and other foundational agency functions. This transition will introduce efficiencies in processing payroll and other actions and improve financial transaction accounting and reporting. Significant transition activities will occur in 2024.

Five-Year Workload Projection

The Board foresees an enhanced need for oversight of defense nuclear facilities that aligns to DOE's modernization efforts, which will result in a workload demand increase on DNFSB. Additionally, DNFSB is working on initiatives to modernize the agency's operations. Successful execution of DNFSB's mission requires attracting, recruiting, and retaining a talented and highly skilled workforce. Over the next several years, DNFSB plans to fill additional positions as well as hire to compensate for normal attrition in specialized technical disciplines in criticality safety, nuclear weapons design and manufacturing, software quality assurance, confinement ventilation, fire protection, and field resident inspectors at key defense nuclear facility sites. In addition, DNFSB plans to reinvigorate its professional development program by hiring several new staff members to fill these positions. In the past, the professional development program has been very successful in producing DNFSB's current leaders.

Safety Allegations Process and Status

Since its creation, DNFSB has received and evaluated safety allegations concerning defense nuclear facilities from interested members of the public. In 2022, the Board documented and formalized its practices for receipt, evaluation, and disposition of these allegations. All DNFSB employees received training on the new process in early 2023. Information is available to the public on how to submit a safety allegation at www.dnfsb.gov/safety-allegations.

In 2023, DNFSB received six new allegations. Of these, three have been successfully dispositioned, two more should close early in 2024, and one remains under evaluation. Some allegations are referred to a more appropriate federal entity, such as one regarding the West Valley Demonstration Project that was referred to the Nuclear Regulatory Commission in late 2022. Some allegations resulted in additional follow-on evaluation incorporated into the Board's work planning processes. Finally, the allegations program has served as a resource for Board employees who hear information and concerns from members of the public, usually DOE employees or contractors, while carrying out daily oversight responsibilities.

Interface with DOE

Congress directed the Board to work with DOE to develop a bilateral memorandum of understanding to address ongoing interface issues between the two agencies. The Board and DOE developed a memorandum of understanding that was signed by the Deputy Secretary of Energy and the Chair on February 17, 2022 (www.dnfsb.gov/content/memorandum-understanding-between-us-department-energy-and-defense-nuclear-facilities-safety). In accordance with the memorandum of understanding, the Board and DOE also developed a supplementary agreement, signed on June 1, 2022, that defines additional interface agreements that are consistent with the memorandum of understanding (www.dnfsb.gov/content/supplementary-agreement-memorandum-understanding-between-us-department-energy-and-defense). The Board conducted training for all technical staff on the content and expectations relative to the memorandum of understanding and supplementary agreement. The Board also reviewed and is revising, where needed, internal procedures and processes. Board Members and their DOE counterparts, to include the Secretary of Energy, Deputy Secretary of Energy, NNSA Administrator, and Senior Advisor for the Office of Environmental Management, meet periodically to discuss technical issues and raise interface issues when they occur.

The Board's semiannual report to Congress dated July 31, 2023, noted that there had been no information denials within the previous six months. However, the Board has noticed delayed responses to questions for the record from the public hearing on legacy cleanup activities, nuclear safety, and increased production activities at LANL.

DOE Best Practices

The Board encourages DOE to share successes and challenges throughout the complex. To support this process, the Board has endeavored to acknowledge best practices and DOE safety successes in its correspondence. For example, the February 28, 2023, Board letter on the integration of safety bases at the Waste Treatment and Immobilization Plant at the Hanford Site (Hanford) noted that the contractor plans to elevate a waste characteristics administrative control to a safety administrative control, which the Board views as a positive addition to the safety approach at the Waste Treatment and Immobilization Plant. In addition, the June 27, 2023, letter on engineered controls at the Hanford's 242-A Evaporator noted that "the Board is encouraged by the revised path forward for the design and installation of several engineered controls to replace the administrative controls" at the facility. The August 15, 2023, Board letter on seismic safety at the LANL plutonium facility documented that the Board considers LANL's approach in assessing the seismic risk for the plutonium facility as a best practice that DOE should consider applying at other defense nuclear facilities.

In addition, the Board reviewed NNSA's safety initiatives for the Savannah River Tritium Enterprise during its site visit in May 2023, finding that NNSA, in coordination with its management and operating contractor, has initiated several efforts to reduce risk and improve safety of the tritium facilities in terms of physical facility changes, analytical changes, and improvements to safety management programs such as emergency preparedness and response.

After the Board's site visit, NNSA's associate administrator for environment, safety, and health traveled with a team to Savannah River Site (SRS) to discuss nuclear activities and issues and identified several safety basis topics for further evaluation. The Board is encouraged by NNSA headquarters' engagement to drive these longstanding safety issues toward resolution.

In the same vein, Board members highlight best practices and successes from DOE during their testimonies, speeches, and other public statements. For example, during a DOE and NNSA Emergency Management Issues Special Interest Group virtual panel discussion in December 2023, Board Vice Chair Thomas Summers recounted his visits to the impressive new emergency operations centers at Lawrence Livermore National Laboratory (LLNL), Sandia National Laboratories (SNL), and Y-12. In addition, he discussed significant effort and coordination of the LLNL demonstration that included shelter-in-place for its entire site for 15 minutes, with controllers positioned around the site to assess how well the instructions were heeded.

Nuclear Safety Framework and Requirements

II. Nuclear Safety Framework and Requirements

A substantial area of the Board's focus is DOE's nuclear safety framework and requirements. DOE's nuclear safety framework is the collection of policies, rules, orders, manuals, guides, and standards that flow from the Atomic Energy Act of 1954, the Energy Reorganization Act of 1974, and the Department of Energy Organization Act, which collectively give authority and responsibility to DOE to regulate nuclear safety at DOE facilities. Many of the facilities owned by DOE are beyond their life expectancy, with some key facilities dating back to the Manhattan Project[2].

As a government agency, DOE faces inherent challenges, including frequently changing missions, priorities, budgets, leadership, and world events, that complicate its ability to maintain continuity on long-term programs like infrastructure renewal. This challenge is exacerbated by a changing workforce and loss of corporate knowledge and experience. Therefore, it is crucially important for DOE to have well-articulated, uniformly implemented requirements to create an integrated, systematic nuclear safety framework for managing its operations and infrastructure. It is the Board's statutory responsibility to review and evaluate the content and implementation of orders, regulations, and requirements related to operation of DOE defense nuclear facilities. To that end, the following sections summarize the Board's engagement with orders and standards that the Board considers to be fundamental to a strong nuclear safety framework.

Board Recommendation 2020-1, Nuclear Safety Requirements—On June 1, 2021, the Board reaffirmed Recommendation 2020-1, which provided recommendations on aging infrastructure, hazard categories, DOE approvals, safety basis preparation and review processes, and safety basis requirements. The following are orders and standards that are currently being revised with input from efforts initiated by Recommendation 2020-1.

- DOE Order 421.1, *Nuclear Safety Basis*—New DOE Order 421.1 will establish requirements for the unreviewed safety question process, technical safety requirements, specific administrative controls, and other safety basis topics. During 2023, members of the Board's staff observed the DOE writing team develop draft requirements. The Board submitted comments to DOE on January 10, 2024.

- DOE Order 420.1C, *Facility Safety*—DOE began the review and comment period for a revision to DOE Order 420.1C, *Facility Safety*, in November 2023. DOE is updating this order in parallel with DOE Order 421.1 to keep the two directives appropriately aligned. The Board submitted comments to DOE on January 10, 2024.

- DOE Standard 1104, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents*—DOE issued a project justification statement to revise DOE Standard 1104 in June 2023. The DOE writing team began meeting in November 2023, and has included a member of the Board's staff as an observer.

[2] The Manhattan Project was a program of research and development undertaken during World War II to produce the first nuclear weapons. It was initiated in 1942 and disbanded in 1947.

- DOE Standard 1027, *Hazard Categorization of DOE Nuclear Facilities*—DOE issued a project justification statement to revise DOE Standard 1027 in June 2023. DOE has since begun work and members of the Board's staff have observed those writing team meetings.

DOE Order 251.1, Departmental Directives Program—Because of the importance of the upcoming revisions of these important nuclear safety standards, the Board is particularly concerned about DOE's proposed changes to DOE Order 251.1, *Departmental Directives Program*. DOE Order 251.1 defines the requirements for developing, revising, and implementing DOE policies, orders, notices, manuals, and guides. At the end of 2023, the draft of DOE Order 251.1 removed key directives processes because they were either cumbersome or were not being effectively implemented. Lack of fundamental directive process requirements in the order could allow DOE to easily change certain processes without appropriate levels of review and approval. The Board transmitted a letter on January 24, 2024, noting concern about the removal of key directives process requirements and requesting a report and briefing from DOE regarding DOE's path forward on the revision to this order. The Board's Chair also highlighted this concern during a meeting with the Deputy Secretary of Energy on January 11, 2024.

Delayed Implementation of Nuclear Safety Standards—The Board has also noticed delays in implementing important nuclear safety standards. For example, DOE issued DOE Standard 3009-2014, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, almost 10 years ago in response to Board Recommendation 2010-1, *Safety Analysis Requirements for Defining Adequate Protection for the Public and the Workers*, and clarified several concepts that were previously inconsistently used (e.g., evaluation guidelines, bounding parameters, unmitigated and mitigated hazard evaluations, standard industrial hazards). However, very few DOE facilities have so far adopted the updated standard. The Board is concerned the same could be the case for DOE Standard 5506-2021, *Preparation of Safety Basis Documents for Transuranic Waste Facilities*, which also contains numerous safety improvements including new requirements for preventing potential undesired chemical reactions and updated methods for estimating the severity of potential accidents.

Aging Infrastructure—DOE needs to have a robust and consistently implemented nuclear safety framework that provides sufficient structure such that both aging and new defense nuclear facilities continue to provide adequate protection of workers and the public. In Recommendation 2020-1, the Board recommended that DOE develop and implement an integrated approach—including requirements—for the management of aging infrastructure. In DOE's approved implementation plan for Recommendation 2020-1, commitments related to aging infrastructure management center around producing a benchmarking report that characterizes and compares different program secretarial offices' approaches to managing aging facilities and assets. DOE transmitted the benchmarking report to the Board in September 2023. In October and November 2023, the Board sent letters to DOE outlining concerns with the report. Given the scope of the benchmarking effort and proposed process enhancements, the Board is concerned that DOE's planned and completed actions will not be sufficient to drive necessary safety improvements to the requirements and processes that ensure safe and effective

management of aging defense nuclear facilities. Therefore, in 2024 the Board intends to conduct a series of public hearings focused on aging infrastructure management to develop further analysis, advice, and/or recommendations addressing this vital issue.

NUCLEAR WEAPON OPERATIONS

III. Nuclear Weapon Operations

In 2023, the Board performed nuclear safety oversight of high-priority operations within the nuclear weapons complex. The Board's safety oversight priorities were based on the nuclear safety risk of proposed and ongoing activities. The Board placed significant emphasis on safety oversight at Pantex, LANL, Y-12, and SRS during 2023. The Board also sought to foster improved responsiveness on the part of NNSA to the safety concerns communicated by the Board and its staff. As discussed below, the Board focused on maintaining and improving the safety of nuclear explosive operations at Pantex during a period when NNSA was placing significant emphasis on achieving production milestones. Similarly, the Board focused on addressing safety vulnerabilities at LANL as NNSA prepares the Plutonium Facility, together with supporting facilities and activities, to produce 30 plutonium pits per year for the nuclear weapon stockpile. The Board also directly engaged with NNSA leadership at SRS to reemphasize the need to improve worker protection at the Savannah River Tritium Enterprise, following up on Recommendation 2019-2, *Safety of the Savannah River Site Tritium Facilities*, which NNSA had rejected on the basis that it was already taking action to address the Board's safety concerns.

For LANL, Pantex, the Savannah River Tritium Enterprise, and Y-12, the Board maintained full-time resident inspectors to monitor operations. Cognizant engineers on the Board's headquarters staff are dedicated to monitoring LLNL, the Nevada National Security Site (NNSS), and SNL. Figure 1 shows the weapon types that are in the active U.S. nuclear stockpile.

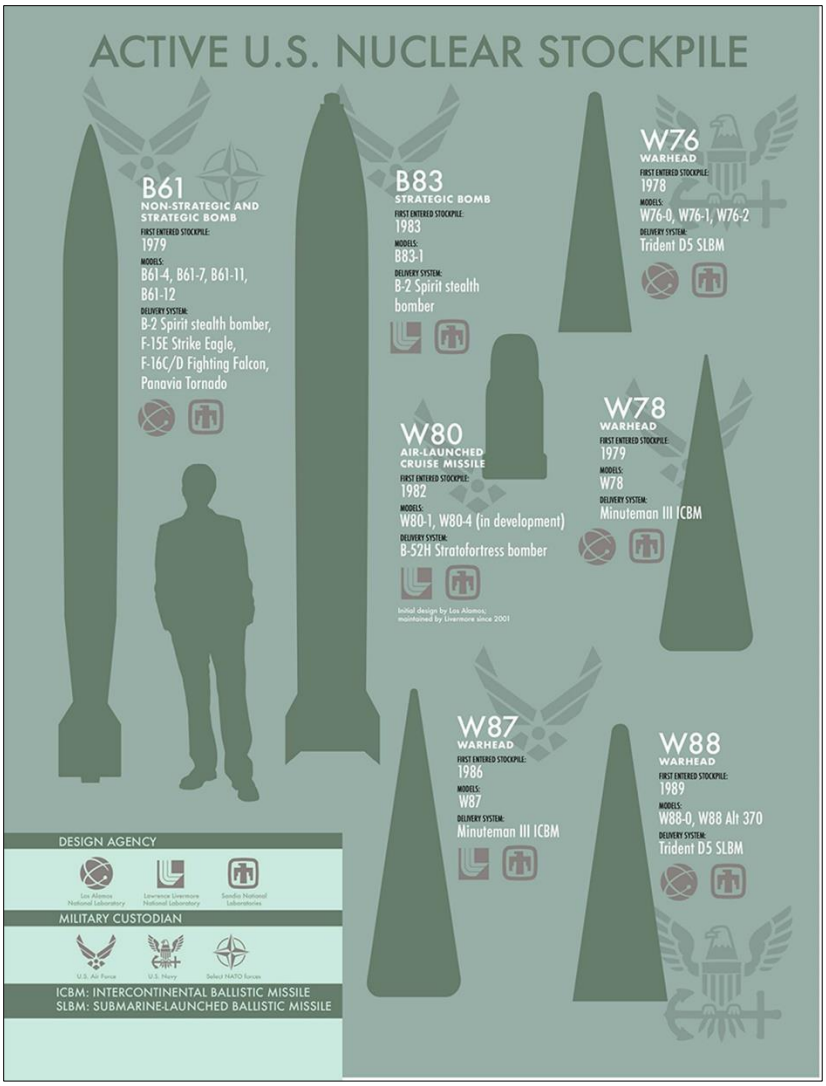

Figure 1. *Weapon Types in the Active U.S. Nuclear Stockpile (image from LANL.gov)*

Pantex Plant

Conduct of Operations and Organizational Culture

Board letters on June 9, 2021, and July 20, 2022, identified safety concerns regarding the conduct of operations, training and qualification, and organizational culture at Pantex. In response, NNSA and its contractor completed various initiatives, including increasing direct safety oversight and augmenting personnel resources to provide greater attention to the safe conduct of operations. The Board has continued to monitor the effectiveness of these corrective actions amid the continual emphasis at Pantex on meeting weapon production milestones. During 2023, the Board noted quality assurance lapses in weapon production operations—e.g., nuclear explosives discovered with swapped cables and incorrectly installed components, as detailed in the resident inspectors' Pantex Plant Activity Reports for the weeks ending September 15, November 17, and December 8. The particular deficiencies the Board observed did not present immediate safety issues; however, these events indicate that further improvement

is needed in formality of operations to ensure nuclear explosive operations are performed safely and as intended. In response, NNSA and its contractor intend to implement additional corrective actions, such as enhancing the reader-worker-checker process (i.e., the process for communicating and then executing nuclear explosive and special nuclear material operations). The Board plans to review the effectiveness of the most recent iteration of corrective actions for this safety issue during 2024.

Legacy Conditions of Approval and Planned Improvements

In Recommendation 2019-1, *Uncontrolled Hazard Scenarios and 10 CFR 830 Implementation at the Pantex Plant*, the Board found that some safety-related conditions of approval[3] in the Pantex safety basis documents remained open for many years after being imposed by the NNSA field office. This approach allowed the Pantex contractor to operate under an approved safety basis but without making the safety upgrades that NNSA required. As part of the implementation plan for Recommendation 2019-1, NNSA committed to disposition the open legacy conditions of approval. On January 4, 2023, the Board issued a letter for NNSA's information and use that summarized the conclusions from its review of the path to closure for various legacy conditions of approval and planned improvements identified in Pantex's safety basis documentation. The Board reviewed the closure packages for several of these items and assessed the progress Pantex achieved toward closing the remaining open actions.

Generally, NNSA and the site contractor provided adequate responses to support closure of the various conditions of approval and planned safety improvements. Furthermore, the Board found that NNSA and its contractor took actions consistent with the Recommendation 2019-1 implementation plan and are addressing most of the Board's safety concerns about these legacy safety conditions.

Noteworthy safety improvements implemented by the Pantex contractor included (1) correcting errors in fire protection calculations and drawings; (2) addressing potential inappropriate applications of certain weapon response rules within the safety basis either by requesting design agency confirmation for applying the weapon response rule or by assuming conservative weapon responses in the safety analysis; and (3) modifying acquisition requirements for vacuum chamber oil to protect safety basis assumptions regarding a potential fire scenario. However, NNSA and its contractor administratively closed a few legacy conditions of approval by reclassifying them as continuous improvement initiatives without fully addressing the specific safety improvements. The Board concluded that this approach may result in Pantex failing to implement valuable safety improvements—including finding alternatives to flammable cleaning solvents and reengineering processes to minimize hoisting of nuclear weapon components—and identified that it would be prudent for NNSA to track these initiatives to prevent them from languishing.

[3] Conditions of approval are the conditions DOE outlines in the safety evaluation report for a facility to address inadequacies in the safety basis that are not significant enough to warrant rejection of the safety basis. The process for defining conditions of approval is outlined in DOE Standard 1104-2016, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents.*

In response to Recommendation 2019-1, NNSA committed to address one legacy condition of approval by replacing wood-framed false ceilings in two nuclear explosive cells. In March 2023, Pantex completed replacing the wood-framed false ceilings with metal. The Board commenced a review in 2023 of the false ceiling replacement work packages and supporting documentation. The Board found that the Pantex contractor and its subcontractors applied strong quality assurance practices for the false ceiling replacement project (see Figure 2). This review is ongoing, but the Board has discussed opportunities to improve quality assurance for future defense nuclear facility construction projects at Pantex with NNSA and the site contractor, including commercial grade dedication practices (e.g., use of calibrated time-measuring equipment), configuration control for engineered electrical bonds, monitoring of storage conditions for welding electrodes, and updating design calculations to address a fastener strength error. NNSA and the site contractor were receptive to the feedback. The Board will complete this review in 2024.

Figure 2. *Upgraded False Ceiling within a Nuclear Explosive Cell*

Welding Program

On February 24, 2023, the Board transmitted a letter and report to NNSA documenting the results of a review of safety-related welding for facility structures, special tooling, and nuclear material containers at Pantex. The review focused on the site contractor's welding program and its incorporation of requirements important to weld quality into welding procedures, processes, and work packages.

Overall, the Board found that Pantex is implementing a robust welding program. The review determined that the welding program is consistent with industry practices and that

program requirements are being properly implemented. The Board's review identified opportunities for safety improvements, including that (1) Pantex used non-conservative weld strengths for aluminum in analyses for 14 credited tools employed in nuclear explosive operations, and (2) the site contractor did not conduct the required annual quality assessment of the welding electrode storage area. The Pantex contractor subsequently corrected both problems.

Alternate Methodology

As part of the Pantex Safety Basis Redesign Project, NNSA is pursuing a Pantex-specific alternate methodology for safety basis development for nuclear explosive operations. Currently, Pantex develops such safety bases using the requirements and guidance from DOE Standard 3009-1994, Change Notice 3, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, and DOE Standard 3016-2023, *Hazard Analysis Reports for Nuclear Explosive Operations.* The alternate methodology would still draw heavily from these two standards but would be tailored to the unique hazards of nuclear explosive operations. In August 2023, the Board received a draft version of the proposed alternate methodology from NNSA for review. The Board's staff met with NNSA and the site contractor in December 2023 to discuss the proposed new methodology. NNSA and site contractor personnel were receptive to feedback and incorporated numerous comments, including topics related to identification and screening of hazard scenarios, identification and control of scenarios involving both radiological and chemical releases, evaluation of control effectiveness, and documentation of the technical basis for determining that certain events have only low-order consequences. The Board also noted areas for improvement related to incorporation of additional defense-in-depth concepts, protection against chemical release hazards, and potentially inappropriate screening of operational deviations from hazard evaluation and control selection. The Board plans to review the final alternate methodology when it is released in 2024.

Nuclear Explosive Safety Oversight

During 2023, the Board provided oversight of nuclear explosive operations at Pantex. For example, the Board's staff observed and evaluated the W80 Operational Safety Review, Approved Equipment Program Master Studies associated with the special tooling program and electrical tester program, and W80-4 Nuclear Explosive Safety Design Review. The Board also assessed various nuclear explosive safety change evaluations associated with off-normal conditions encountered with B61 and W88 units and operating procedure modifications.

During such activities, the Board evaluated execution of the nuclear explosive safety evaluation by the NNSA-led study group, assessed the operations against the requirements in DOE and NNSA directives, and provided value added, safety-related observations to the study group and project team. For instance, while observing disassembly operations for a specific weapon program in a nuclear explosive cell, the Board identified that a component was suspended above the unit for several minutes while a cleaning activity was performed, presenting an unnecessary impact hazard to the nuclear explosive. Based on this observation, the Pantex contractor revised the nuclear explosive operating procedure to remove the component prior to the cleaning activity, eliminating the impact hazard.

Fire Protection Program

In 2023, the Board reviewed the Pantex fire protection program, evaluating associated requirements; fire hazard analyses; fire prevention practices; fire protection system inspection, testing, and maintenance; and fire department response against DOE and industry standards. This review is ongoing, but the Board has found that Pantex is implementing an adequate fire protection program, with all expected major components, consistent with DOE requirements and expectations. The Board has identified several best practices (e.g., fire suppression system maintenance procedure updates), as well as opportunities for improvement related to fire protection system impairments, false alarms, and requirements for manual fire extinguisher use within the technical safety requirements.

In addition, following Board inquiries related to five-year inspections of wet-pipe fire suppression systems, the Pantex contractor discovered that a required internal pipe assessment for a safety class system had not been performed for one nuclear explosive cell within its required periodicity and took necessary recovery actions. Also, during fire suppression system walkdowns, the staff observed sprinkler damage and discrepancies, which the site contractor corrected. The Board will complete this review in 2024.

Probabilistic Seismic Hazard Analysis Update

The Board is conducting a review of Pantex's updated probabilistic seismic hazard analysis. This new analysis incorporates the latest data, models, and methods in characterizing seismic sources, ground motions, and site response, ensuring a technically defensible seismic hazard assessment for existing facilities and for potential new construction at the site. The Board has not identified any significant concerns with the analysis. However, both the Pantex contractor and the Board found that the new seismic spectra exceed the design spectra at a specific frequency range. In response, the Pantex contractor determined this represented an unreviewed safety question.[4] The Board will complete this review in 2024 and will monitor implementation of the updated analysis.

Los Alamos National Laboratory

Onsite Transportation Safety

Following a 2021 safety review of the LANL transportation safety document, the Board identified safety issues with both the LANL transportation safety document and the safe harbors that govern development of onsite transportation safety documents under 10 CFR 830. The Board documented these safety issues in a letter to the Secretary of Energy dated January 6, 2022. DOE responded on September 13, 2022, stating its agreement with, and plans to address, the Board's safety concerns. However, DOE's response only partially addressed the

[4] An unreviewed safety question is defined in 10 CFR 830 as a situation where (1) The probability of the occurrence or the consequences of an accident or the malfunction of equipment important to safety previously evaluated in the documented safety analysis could be increased; (2) The possibility of an accident or malfunction of a different type than any evaluated previously in the documented safety analysis could be created; or (3) The documented safety analysis may not be bounding or may be otherwise inadequate.

safety concerns identified by the Board, so the Board continued to evaluate DOE's subsequent actions.

NNSA's management and operating contractor at LANL implemented compensatory safety measures for onsite transportation of radioactive materials in March 2023, following a letter of direction from the NNSA Los Alamos Field Office. The contractor formally incorporated the compensatory measures into revisions of the LANL transportation safety document and technical safety requirements, which the field office approved in August 2023, with two conditions of approval. These measures and conditions of approval represent an improvement in the safety of onsite transportation of radioactive materials at LANL; however, more work is necessary to ensure the LANL transportation safety document appropriately identifies all hazards, analyzes all pertinent accident scenarios, and evaluates the effectiveness of all credited safety controls.

NNSA had approved the LANL contractor's deficient transportation safety document on the basis that it met the applicable safe harbors for safety analysis identified in 10 CFR 830. Until DOE revises the safe harbors for onsite transportation of radioactive materials to provide clear and effective safety requirements, the risk remains that LANL or other defense nuclear sites may regress to inadequate transportation safety documents that fail to provide an effective set of safety controls. Therefore, on January 26, 2024, the Board transmitted Recommendation 2023-1, *Onsite Transportation Safety*, to the Secretary of Energy. The recommendation is intended to strengthen DOE's safe harbor related to onsite transportation safety and to address safety deficiencies in LANL's transportation safety document to ensure adequate protection of public health and safety.

Plutonium Facility Safety Posture

NNSA continues to prepare the LANL Plutonium Facility for increased mission scope. Over the next few years, NNSA intends to significantly increase plutonium pit production to meet national security requirements, as well as to increase operations with heat source plutonium for defense and space exploration missions.

The Board discussed these and other topics with senior NNSA officials at a public hearing in Santa Fe, New Mexico, on November 16, 2022, and requested additional information in a June 20, 2023, letter to the Secretary of Energy. In this letter, the Board asked DOE to provide information on three topics to better understand and judge the adequacy of the planned safety posture at the Plutonium Facility: (1) data pertaining to facility evacuation assumptions; (2) mechanisms by which the fire suppression system will perform its intended safety functions; and (3) a crosswalk between the current status of the active confinement ventilation system and improvements needed to achieve several different levels of improved robustness and reliability.

The NNSA Administrator replied to the Board's letter on September 15, 2023, providing high-level responses to these requests and committing to provide five additional deliverables before the end of 2023: (1) the report from a recent facility-wide evacuation drill; (2) the results of a computer-based simulation of a facility-wide evacuation; (3) a crosswalk of ventilation system requirements for the configurations identified in the Board's reporting requirement; (4) a

parametric study of effects of several variables on the leak path factor under passive confinement conditions (a key parameter in dose consequence calculations); and (5) a listing of the functional requirements for the facility fire suppression system. The Board received the first three deliverables in 2023 and the final two in January 2024. The Board is reviewing the deliverables to inform its conclusions regarding the safety posture at the Plutonium Facility.

Plutonium Facility Seismic Risk Assessment

On August 15, 2023, the Board transmitted a letter to the Secretary of Energy regarding the seismic probabilistic risk assessment conducted for the LANL Plutonium Facility. The Board commended the approach to evaluating seismic risk at the Plutonium Facility as a best practice that DOE should consider adopting across its other facilities. The Board found that the conclusion from the analysis was defensible, and the accompanying peer review process was robust. The analysis provided information on the likelihood of the Plutonium Facility's structure failing to perform its credited safety function, considering all earthquake scenarios specific to LANL. The Board noted that DOE could enhance the documentation associated with the analysis to enhance transparency and facilitate better understanding and dissemination of the information. After receiving the Board's correspondence, DOE opted to develop an overall report to summarize the analysis.

Testing of Fire Suppression System Fittings

In a letter dated May 12, 2016, the Board identified safety concerns regarding the fire suppression system at LANL's Plutonium Facility, including assumptions related to the material properties of the system's existing cast iron pipe fittings (instead of carbon steel, which is a better-performing material for these applications). LANL personnel recently completed testing on the cast iron fittings as part of an effort to qualify the system to withstand certain seismic events (see Figure 3). The Board reviewed the testing plan and subsequent report and agrees with the conclusion that the fittings will perform as necessary during seismic events.

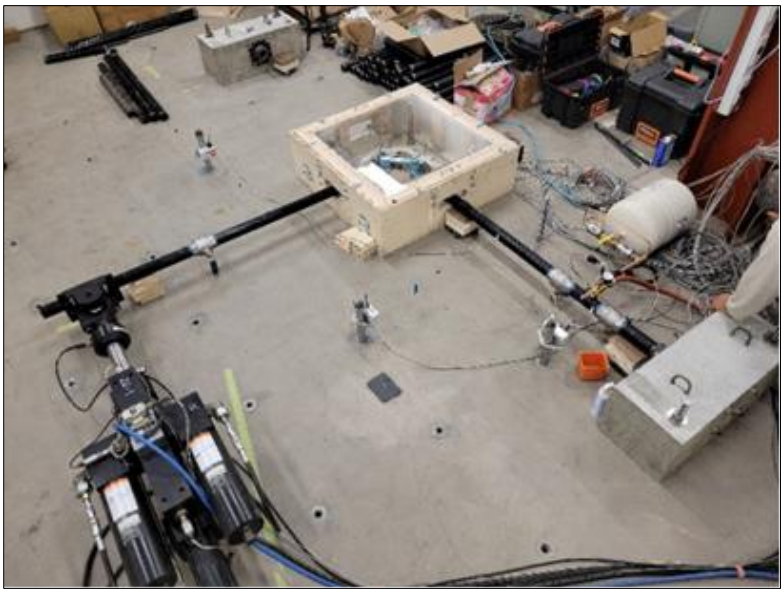

Figure 3. *Test Apparatus for LANL's Plutonium Facility Fire Suppression System Fittings*

Revised Atmospheric Dispersion Modeling Protocol for NNSA Facilities

In September 2023, the Board completed a review of a revised atmospheric dispersion modeling protocol for use in safety analyses for LANL defense nuclear facilities. DOE Standard 3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, allows site contractors to perform dispersion calculations using site-specific methods and parameters if they are defined in a DOE-approved atmospheric dispersion modeling protocol. The revised protocol will support updates for safety bases for NNSA facilities such as the Plutonium Facility. The Board does not have significant concerns with the version of the protocol reviewed. However, the laboratory contractor is continuing to make changes to the proposed protocol so the Board will evaluate the appropriateness of the final protocol used in safety basis updates.

Savannah River Site

Savannah River Tritium Enterprise Safety Posture

The Board directly engaged with NNSA leadership at SRS in 2023 to reemphasize the need to improve worker protection at the Savannah River Tritium Enterprise, following up on Recommendation 2019-2, *Safety of the Savannah River Site Tritium Facilities*. DOE rejected Recommendation 2019-2 on the grounds that it already planned action to remedy the safety issues detailed in the recommendation. The Board reviewed NNSA's progress on improving safety at the Savannah River Tritium Enterprise during its May 2023 site visit. NNSA, in coordination with its management and operating contractor, has initiated several efforts to reduce risk and improve safety of the tritium facilities in terms of physical facility changes, analytical changes, and improvements to safety management programs such as emergency preparedness and response. Key efforts and improvements include:

- NNSA plans to implement a safety basis revision in 2024 that partially addresses issues that the Board has previously raised, including using updated dispersion modeling parameters and ceasing to credit the emergency preparedness program as a substitute for safety controls for mitigating worker dose consequences.

- In the five years since NNSA's Savannah River Field Office directed the tritium enterprise contractor to propose strategies to reduce the calculated dose consequences to the co-located worker, the contractor has performed (and continues to perform) evaluations on safety-related structures, systems, and components to narrow down which potential upgrades would be feasible and beneficial.

- The tritium enterprise contractor has self-identified several weaknesses in its emergency preparedness program, including in the areas of drills, training, and administration. The contractor has developed and executed several additional drill scenarios leading up to the annual emergency exercise (see Figure 4), but neither the drills nor the recently completed annual exercise encompassed a high-consequence event.

Figure 4. *Emergency Preparedness Exercise at the Savannah River Tritium Enterprise*

These actions are encouraging, but NNSA only has accomplished limited improvements to date, and a significant amount of work remains to reduce the safety risk to an acceptable level. Moreover, although NNSA identified that its long-term plan to address the safety vulnerabilities at the H-Area Old Manufacturing facility is to replace this facility with the Tritium Finishing Facility (see Figure 5), NNSA subsequently placed the Tritium Finishing Facility project on hold. On October 4, 2023, the Board followed up on its site visit with a letter to the Secretary of Energy

establishing a reporting requirement for DOE to provide an annual report and briefing starting within six months on DOE's progress on safety improvements at the Savannah River Tritium Enterprise. The Board also continues to monitor site efforts to develop, test, and implement a site evacuation and relocation plan.

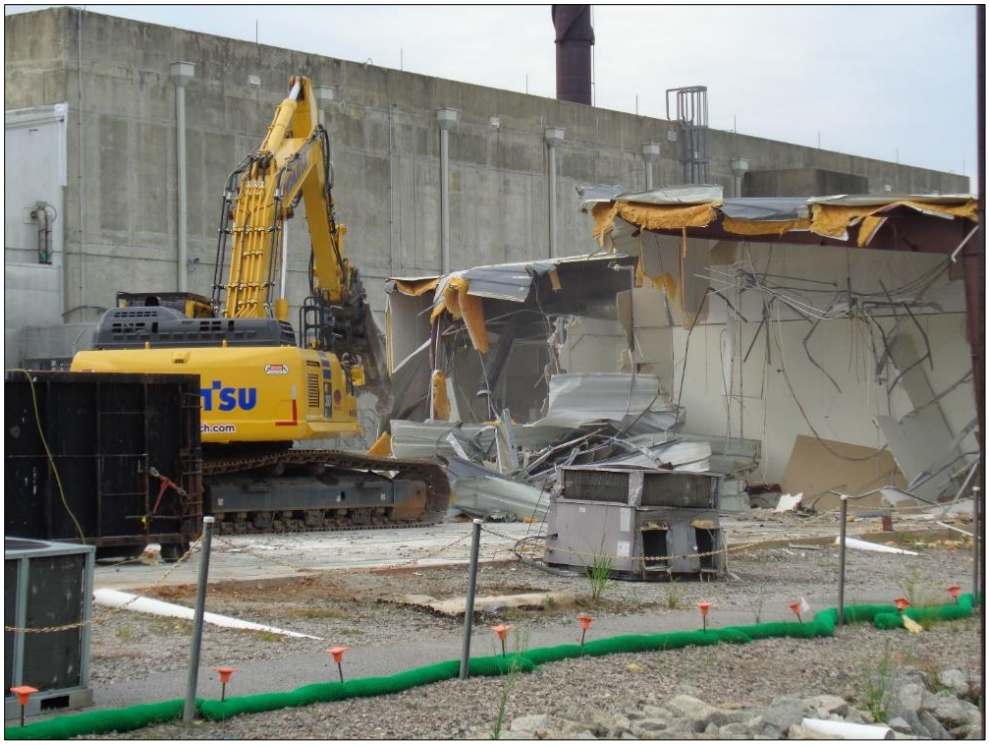

Figure 5. *Demolition Activities Supporting Site Preparation for the Tritium Finishing Facility*

Y-12 National Security Complex

Nuclear Criticality Safety and Conduct of Operations

The Board provided close oversight of corrective actions following a nuclear criticality safety violation in Building 9215 at Y-12 on April 14, 2023. During removal of a lathe formerly used to machine uranium components, workers cut into a machine coolant supply line believed to have been drained and isolated, and the line started to leak coolant. This coolant comes in direct contact with enriched uranium during machining operations and is therefore subject to nuclear criticality safety controls. The workers improperly collected the leaked coolant in two five-gallon buckets, an unsafe geometry for such liquids from a nuclear criticality safety perspective.

Y-12 conducted a special event investigation that identified numerous deficiencies in conduct of operations and work planning associated with the lathe removal activity. In addition to the improper collection of coolant in buckets, several other improper actions from the event were identified: maintenance workers sealed cut pipes containing residual substances using unauthorized materials (rubber gloves) instead of approved capping materials (see Figure 6); workers did not verify nondestructive assay results of the coolant line prior to starting work, as required; supervisors did not pause the demolition work after workers raised safety questions; and

the work team did not enter procedures for spill response and abnormal conditions. These improper actions and additional items identified by the investigation demonstrate that significant disciplined operations issues persist at Y-12.

The investigation team concluded that Y-12 management needs to understand, demonstrate, enforce, and reinforce higher standards of conduct of operations, and improve processes for detecting negative indicators and adverse trends before an event occurs. Y-12 has taken several actions to improve conduct of operations at the site level, facility management level, and worker level. Additionally, Y-12 is taking actions to improve work planning and the site's contractor assurance system. The Board continues to closely monitor these improvement initiatives as they are implemented, particularly since nuclear criticality safety issues have persisted.

Figure 6. *Machine Coolant Piping Capped with Rubber Glove***s**

Reactive Materials Hazards at Y-12

On November 18, 2022, the Board sent a letter and report to the Secretary of Energy on safety hazards for reactive materials at Y-12. The Board advised that Y-12 should implement additional safety control strategies to prevent or mitigate potential thermal runaway reactions during processing of uranium materials. The Board also identified that Y-12 could take further actions to improve the site's safety posture by ensuring that the pyrophoric and chemical reactivity hazards of uranium are adequately addressed consistent with DOE guidance. Lastly, the Board advised that Y-12 should consider revisiting its safety control strategies for new process technologies, including those to be installed in the Uranium Processing Facility, to ensure that facility worker hazards related to uranium pyrophoricity are addressed.

NNSA and its Y-12 contractor provided a written response and briefing to the Board on February 24, 2023, and March 29, 2023, respectively. The letter and briefing identified actions being implemented to mitigate and prevent pyrophoric events at Y-12. As part of NNSA's

response, the Y-12 contractor issued two technical reports that discussed safety control strategies implemented to mitigate uranium pyrophoric events at Y-12.

During the briefing, the Y-12 contractor discussed additional pyrophoric events that had occurred at Y-12 defense nuclear facilities following the Board's letter, including the site area emergency declared due to a pyrophoric fire involving a briquette of uranium machining chips (see Figure 7) in Building 9212 on February 22, 2023. Despite the process changes made after this event, another briquette pyrophoric event occurred in the same glovebox on August 9, 2023. After that event, Y-12 further revised its strategy for maintaining an inert atmosphere in nuclear material cans to help to prevent further briquette fires.

The Board plans to perform a follow-up review in 2024 to evaluate the effectiveness of corrective actions for preventing pyrophoric events during processing, handling, and storage of uranium materials at Y-12.

Figure 7. *Uranium Chip Briquettes*

Nevada National Security Site

Device Assembly Facility Documented Safety Analysis Rewrite Project

The NNSS contractor is rewriting the documented safety analysis for the Device Assembly Facility (pictured in Figure 8) in accordance with DOE Standard 3009-2014. Adoption of this modern safe harbor methodology is an important safety effort that should lead to improved protection of workers and the public. The Board performed a review of a 90 percent complete documented safety analysis submittal. While this is not a final product, NNSA's Nevada Field Office has stated that it expects 90 percent safety basis deliverables to be approval-ready.

The Board's review identified several safety issues, and NNSA's Nevada Field Office also had a significant number of comments on the 90 percent submittal. The Board previously communicated a safety concern with the quality of documented safety analysis submittals at NNSS in a letter to the Secretary of Energy dated August 26, 2021. NNSA's response to that letter highlighted several corrective actions the NNSS contractor was implementing to improve the quality of its documented safety analysis submittals.

Given the number of safety issues identified in the 90 percent submittal for the Device Assembly Facility, additional quality improvement actions may be warranted. The Board issued a letter to the Secretary of Energy on December 12, 2023, requesting a briefing from NNSA addressing the effectiveness of corrective actions to improve documented safety analysis submittals at NNSS and any additional measures that NNSA's Nevada Field Office may be considering. The Board also requested that NNSA discuss how safety issues in the 90 percent submittal for the Device Assembly Facility will be addressed in the final version of the documented safety analysis.

Figure 8. *Device Assembly Facility at the Nevada National Security Site*

Sandia National Laboratories

Emergency Preparedness and Response

In 2023, the Board completed a review of the emergency preparedness and response program at SNL in New Mexico. Since 2019, NNSA and its management and operating contractor have made substantial changes to the site's emergency management program, including revising its base support agreement and memorandum of understanding with Kirtland Air Force Base to provide primary fire and rescue services to the site; restructuring the emergency management organization; adding new, key emergency response organization roles; and construction of a new emergency operations center, expected to be operational in 2024.

In its review, the Board identified examples of nonconservative assumptions used in emergency planning hazards assessment for some emergency scenarios for the defense nuclear facilities at Technical Area V. The Sandia contractor subsequently developed and implemented a

revised hazards assessment via temporary order that addressed these concerns. The contractor is developing a full revision that will use a newer dispersion methodology for analyzing contaminated plumes released in accident scenarios.

Lawrence Livermore National Laboratory

Plutonium Facility Recovery Glovebox Line

The Board evaluated the readiness preparations and readiness reviews for startup of the Recovery Glovebox Line, which comprises three newly installed glovebox lines in the Plutonium Facility at LLNL. The Recovery Glovebox Line consolidates several aqueous process recovery operations for the purification of plutonium. Plutonium feedstock materials are processed using aqueous separation methods to generate high purity plutonium for the intended applications.

The Board reviewed the documented safety analysis and process hazards associated with operations in the Recovery Glovebox Line and evaluated the process controls for the different stages of purifying plutonium using ion exchange. The Board's staff also observed the contractor readiness assessment and the subsequent federal readiness assessment for startup of the glovebox line. The Board found that the Plutonium Facility effectively demonstrated Recovery Glovebox Line operations. The Board provided observations to the NNSA Livermore Field Office and the laboratory contractor on the ion exchange equipment and on the potential for material holdup in the system. The laboratory successfully completed startup and processing of initial batches of plutonium oxide through the Recovery Glovebox Line in 2023.

Software Quality Assurance for Plutonium Facility Continuous Air Monitors

The Board evaluated LLNL's quality assurance process for safety software installed in new continuous air monitors in the laboratory's Plutonium Facility (see Figure 9). The Board communicated the results of this review in a January 5, 2024, letter to the NNSA Administrator. The review indicates that the software quality assurance practices at the laboratory need improvement. A recent report by the DOE Office of Enterprise Assessments reached similar conclusions regarding the software quality assurance program at the laboratory. Based on discussions with the Board, the laboratory contractor reclassified the software installed in continuous air monitors as safety software to ensure it would be properly controlled and maintained. In addition, NNSA's Livermore Field Office rescinded an exemption contained in the laboratory's quality assurance process that improperly classified the continuous air monitors as measurement and test equipment, which had exempted the software in the monitors from quality assurance requirements.

Figure 9. *Representative Continuous Air Monitor*

DEFENSE NUCLEAR WASTE OPERATIONS

IV. Defense Nuclear Waste Operations

In 2023, the Board performed nuclear safety oversight of high priority Office of Environmental Management operations within the nuclear weapons complex. The Board based its oversight priorities on the nuclear safety risk of proposed and ongoing activities. As discussed below, the Board focused substantially on the safety of nuclear operations at SRS and WIPP, conducting full Board visits to these sites to advance important safety goals. Hanford Site advanced important Central Plateau clean-up efforts and made progress towards beginning operations at the Waste Treatment and Immobilization Plant, both areas of high interest resulting in significant safety oversight resources moving into 2024. The Board continues to focus on the application of federal oversight to ensure the safety of operations across the complex, particularly in defense nuclear waste operations due to the interconnectedness between generator sites and WIPP.

For the Hanford Site, SRS, LANL, and Oak Ridge National Laboratory, the Board maintained full-time resident inspectors to monitor operations. Cognizant engineers on the Board's headquarters staff are dedicated to monitoring Idaho National Laboratory (INL) and WIPP.

Savannah River Site

Board Visit

On March 29, 2023, the Board issued a letter to the Secretary of Energy in advance of the Board's visit to the SRS during the week of May 8, 2023. The letter established a reporting requirement for DOE to provide a briefing while the Board was onsite to discuss ongoing safety concerns. While these safety concerns primarily focused on the Savannah River tritium facilities and worker protection strategies for NNSA projects (discussed in the Nuclear Weapons Operations section of this report), the Board also highlighted overarching concerns with federal oversight provided by the DOE Savannah River Operations Office. The Board then engaged with the Savannah River Operations Office management regarding their federal safety oversight capabilities. Topics included recurring issues with event investigations, facility representative staffing levels, and facility representative assessments. In a visit to SRS in October 2023, the Board's Chair engaged further regarding federal oversight, with a focus on DOE's response to recent conduct of operations issues at the Defense Waste Processing Facility.

Following the Board's May visit, the Board issued a follow-up letter on October 4, 2023, requiring a briefing and establishing an annual reporting requirement for DOE to provide updates on Savannah River Tritium Enterprise safety basis improvements, the co-located worker dose reduction strategy, Tritium Finishing Facility construction, and necessary improvements to the Savannah River Tritium Enterprise emergency preparedness program, which is a site-wide safety concern.

Savannah River National Laboratory Safety Basis

On April 5, 2023, the Board issued a letter to the Senior Advisor for the Office of Environmental Management describing persistent safety basis issues at Savannah River National Laboratory. Based on the long-standing nature of the safety basis deficiencies, the Board requested a report and briefing on DOE's plans to resolve issues involving improper designation of specific administrative controls and inappropriate classification of vital fire protection equipment. In response to the Board's letter, laboratory management initiated important corrective actions, including formally identifying new specific administrative controls and performing a backfit analysis of fire water supply system components against safety significant requirements.

Building 235-F

In 2023, the Board reviewed the state of Building 235-F at SRS after site personnel completed deactivation efforts and the building entered transitional surveillance and maintenance mode. Additionally, the Board examined the site's current plans for decommissioning Building 235-F, including (1) assessing the residual risk associated with Building 235-F following actions taken by DOE to deactivate the facility, (2) assessing the adequacy of surveillances performed to ensure changing conditions are identified and corrected, and (3) confirming planned and completed actions needed to support eventual decommissioning. The Board determined that the surveillances and inspections being conducted in transitional surveillance and maintenance mode are adequate to verify that the facility remains in a safe condition or that facility personnel will identify anomalous conditions.

Decommissioning efforts for Building 235-F are in the early stages of planning with top level design requirements already developed, but the engineering documents and associated revision to the safety basis remain to be completed. The Board continues to follow progress towards decommissioning and plans to evaluate the potential for increased risk of fire during decommissioning activities.

The Board received DOE's annual briefing in July 2023 regarding progress made to deactivate and decommission Building 235-F and associated inspections, corrective actions, and activities. Recommendation 2012-1, *Savannah River Site Building 235-F Safety*, remains open, with the Board's focus being on monitoring the results of periodic inspections. This topic is covered in more detail in Appendix A: Board Recommendations.

Criticality Safety of Accelerated Basin De-inventory

The Board reviewed the criticality safety impact of a change in spent nuclear fuel processing at SRS that eliminates uranium recovery to accelerate the disposition of legacy material stored in the site's L-Basin facility. This new accelerated basin de-inventory approach results in higher concentrations of fissile material in the SRS liquid waste system compared to conventional processing that included uranium recovery. Based on the results of the Board's review, SRS management will clarify the applicability of certain criticality safety controls governing the use of gadolinium as a soluble neutron absorber.

Hanford Site

242-A Evaporator Safety Strategy

The Board sent a letter to the Secretary of Energy on July 19, 2022, on long-standing concerns regarding safe operation of the 242-A Evaporator, requesting a briefing to discuss how the final revised safety strategy for operating the facility will meet DOE's safety requirements and address the Board's safety concerns. Figure 10 shows the exterior of the Hanford's 242-A Evaporator Facility.

Figure 10. *242-A Evaporator Facility at the Hanford Site*

In response to the letter, DOE briefed the Board on October 12, 2022. However, the briefing did not address all the Board's concerns or provide a sufficient technical basis to support use of the control strategy. Following subsequent Board engagement, in April 2023 the DOE manager of the Office of River Protection and Richland Operations Office transmitted a letter to the Board committing to additional actions to address the Board's remaining technical concerns with the 242-A Evaporator safety strategy. Specifically, DOE committed to institute a design change to install a safety-significant evaporator vessel dump device and a safety-significant seismic detection system with automatic actuation of the dump device.

While DOE's actions will address the open technical issues, the Board expressed concern that DOE was allowing the evaporator to be restarted before it implemented planned design changes. On June 27, 2023, the Board issued a letter to DOE regarding the revised path forward for the design and installation of several engineered controls. This letter established a semi-annual reporting requirement for DOE to brief the Board regarding (1) the design, procurement,

and installation of the planned improvements; (2) any emergent technical issues and funding constraints; and (3) compensatory measures or interim controls to be used if DOE decides to commence evaporator operations before completing implementation of the revised engineered controls.

On September 19, 2023, DOE and its contractor provided the Board with the first semi-annual brief on 242-A Evaporator engineered controls. DOE and its contractor discussed that the evaporator would potentially be in operation for several years before the safety upgrades were implemented. DOE committed to implement an interim control strategy that includes designating manual action of the vessel dump device in response to a seismic event and control of combustible material in the 242-A Evaporator condenser room as credited specific administrative controls. The Board will continue to monitor DOE's path forward on 242-A Evaporator engineered controls in 2024.

Low-Activity Waste Facility Start-Up

The Low-Activity Waste facility (see Figure 11) is part of the Hanford's Waste Treatment and Immobilization Plant, which is DOE's selected approach for treating the radioactive and chemical waste stored in Hanford's tank farms so that it can be safely and permanently dispositioned. Hanford will treat waste from the tank farms in batches using the tank-side cesium removal system and then send it directly to the Low-Activity Waste facility. This is called the direct feed low activity waste approach. After the Low-Activity Waste facility vitrifies the waste, it will be placed into stainless steel containers and stored at the Integrated Disposal Facility.

Figure 11. *Hanford Low-Activity Waste Facility*

The Low-Activity Waste facility is currently in a start-up and commissioning phase. Over the next year and a half, DOE plans to complete melter testing, cold commissioning (testing without radioactive constituents), and hot commissioning (testing with radioactive constituents). Transition from the construction phase to the operational phase presents numerous risks and vulnerabilities. In 2023, the Board began the preliminary review of conduct of operations and maintenance, which will continue into 2024.

Tank Side Cesium Removal System Operation

The tank-side cesium removal system (see Figure 12) represents the initial phase of filtration of cesium and solids removal from tank waste.

Figure 12. *Tank-Side Cesium Removal Enclosure with Doors Open, Showing Ion Exchangers and Process Filters*

The Board sent a letter to the Secretary of Energy on October 6, 2022, documenting safety concerns with the contractor's actions to restore the operability of damaged ion exchange column threaded connections. The Board found that the contractor's evaluation and repairs were not performed consistent with the safety requirements in the American Society of Mechanical Engineers' nuclear quality assurance standard. Also, the technical safety requirements safety control credited for ensuring that workers are not injured by dislodged ion exchange column components during or after a postulated flammable gas explosion did not require a quantitative verification that would ensure that a connection is fully engaged to support compliance with the technical safety requirements.

DOE and its contractor briefed the Board on December 20, 2022, stating that they had updated several procedures to address the issue. The updated procedures included those that govern entry into the causal analysis and non-conformance processes. DOE described improvements to assembly instructions for the ion exchange column threaded fittings. The

contractor also performed empirical testing of fittings to show the damaged fittings would be able to maintain structural integrity during a deflagration.

The Board remains engaged to ensure that the contractor and DOE document and use lessons learned from the tank-side cesium removal system in developing the future advanced modular pretreatment system, which will be an expansion of the tank-side cesium removal system with additional capability and throughput.

Central Plateau Cleanup and Risk Reduction

The Hanford Site contains former plutonium production, processing, and refining facilities, waste disposal sites, and other excess facilities. Among these facilities are decommissioned reactors and canyons along with their support facilities, the Solid Waste Operations Complex, and waste burial grounds. Current activities in this area are focused on risk reduction, achieved through characterizing, removing, and remediating nuclear and chemical hazards; interim maintenance and stabilization of facilities; and interim safe storage or disposal of waste products. Projects of highest interest to the Board include the following.

105-K West Basin Conduct of Operations—Stabilization of the 105-K West reactor and its basin (see Figure 13) is one of the few remaining high hazard activities along the Hanford Site River Corridor. The contractor's ongoing efforts are focused on final preparations for dewatering the basin. Once dewatered, the remaining material in the basin will be stabilized with grout, and the basin will be demolished. Most of the resulting demolition material will be placed in the Environmental Restoration Disposal Facility.

Figure 13. *Hanford Site 105-K Area; 105-KW Reactor Building Marked by Arrow*

The Board reviewed conduct of operations at 105-K West facility in 2023 to assess the contractor's preparedness to begin basin dewatering and demolition activities. The review included observation of an emergency drill, basin operations (see Figure 14), a mockup used to

plan and practice high hazard work activity and testing of the 105-K West basin dewatering and filtering system.

The Board determined that 105-K West operations generally comply with conduct of operations requirements established by DOE Order 422.1, *Conduct of Operations*, related to the reviewed areas of communications, technical procedures, shift routines, and operating practices. The Board noted minor weaknesses in operators' communications during the emergency drill and the mockup activity and passed these observations to appropriate contractor and DOE managers for corrective actions.

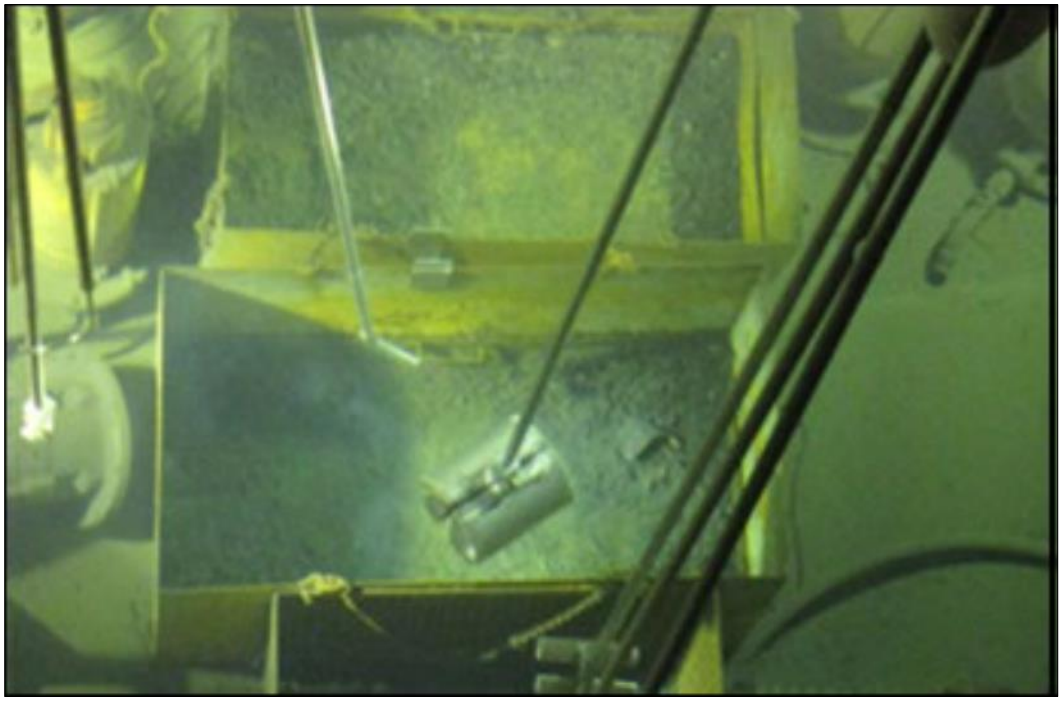

Figure 14. *Underwater Debris Sorting at 105-KW Basin*

Building 324 Conduct of Operations—Building 324 is being decommissioned after operating for more than 30 years. Building 324's mission was to conduct studies on the chemical and physical properties of radioactive materials and irradiated targets. From October 2018 to November 2019, 13 contamination events occurred during cleanup and stabilization activities in Building 324, culminating in a November 2019 "stop work" order.

Full-scale soil remediation activities began in 2022. Concurrently, the Board evaluated conduct of operations, conduct of maintenance practices, radiological controls corrective action implementation, and DOE's oversight of Building 324 during the resumption of soil remediation activities. As of March 2023, the contractor no longer considered the current approach for recovering radiologically contaminated soil below Building 324 viable and recommended termination of that work. The decision was largely driven by the September 2022 discovery of an additional waste plume under the building. The remotely operated excavators that had been designed to remove the highly contaminated soil from under Building 324's B-Cell could not reach all the newly identified contamination, and radiation readings at deeper depths were higher

than previously detected. The total volume of contaminated soil to be extracted is also larger than previously calculated and exceeds the volume of the planned storage locations.

The Board identified a number of safety observations before DOE terminated the Building 324 soil remediation project, but will continue to monitor DOE's selection of a new strategy for soil remediation and facility demolition and will communicate any relevant observations.

Los Alamos National Laboratory

Chemical Compatibility Program for Transuranic Waste at NNSA Facilities

The Board reviewed the chemical compatibility program that LANL uses to evaluate the chemical compatibility of radioactive wastes generated at nuclear facilities overseen by NNSA. These evaluations are a new requirement for waste generator sites in DOE Standard 5506-2021, *Preparation of Safety Basis Documents for Transuranic Waste Facilities*. This requirement resulted from lessons learned from the February 2014 energetic chemical reaction that ruptured a waste drum and spread radioactive contamination at WIPP.

In a January 19, 2024, letter, the Board noted that, while LANL has implemented several notable process upgrades that reduce the risk of radiological releases caused by adverse chemical reactions in transuranic waste, LANL still has not defined how the chemical compatibility program will interface with the nuclear safety bases of its facilities. Further, the Board noted opportunities for improvement within the chemical compatibility program.

Review of Atmospheric Dispersion Modeling Protocol for Area G

The Board completed a review of an atmospheric dispersion modeling protocol at LANL in September 2023. DOE Standard 3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, allows site contractors to perform dispersion calculations using site-specific methods and parameters if they are defined in a DOE-approved atmospheric dispersion modeling protocol. The LANL protocol will support the upcoming revision to the safety basis for Area G. The Board identified concerns with an earlier version of the protocol that would have underpredicted calculated dose consequences in the safety basis. After LANL revised the protocol, the Board concluded that the protocol was better aligned with DOE Standard 3009-2014.

Oak Ridge National Laboratory

U-233 Initial Processing Campaign

The Board continues to monitor the Building 2026 Initial Processing Campaign to down-blend uranium-233 materials from Building 3019 for disposal as low-level waste. Small batches of the material are transferred to the Oak Ridge National Laboratory's Building 2026 hot cells to extract thorium-229 for future use as a medical isotope. The remaining material is solidified and shipped to the NNSS for burial. The Initial Processing Campaign began in October 2022 and

currently is only processing oxide materials. The contractor has completed processing lower hazard oxides and is preparing for processing higher hazard oxides.

After the conclusion of the Initial Processing Campaign, Oak Ridge plans future campaigns to process uranium-233 materials in other forms besides oxides. Oak Ridge will develop safety basis revisions for activities involving non-oxide materials because the current safety bases for Buildings 3019 and 2026 only authorize oxide activities. The Board will continue to monitor the uranium-233 processing activities.

Idaho National Laboratory

Flammable Gas Hazards in Nuclear Waste Drums

The Board sent a letter to DOE on February 24, 2023, providing its report entitled, *Flammable Gas Hazards in Idaho National Laboratory's Nuclear Waste Drums,* and established a 90-day reporting requirement for a briefing that addresses (1) whether, when, and how DOE intends to implement DOE STD-5506-2021, *Preparation of Safety Basis Documents for Transuranic Waste Facilities*, at INL's defense nuclear facilities and (2) any actions DOE is taking regarding the safety issues described in the report.

This February 2023 letter and report followed an April 2018 drum deflagration event and a related March 2019 Board letter. DOE provided a briefing to the Board in May 2023 outlining its intended actions on DOE-STD-5506-2021 and safety issue resolution. After the briefing, DOE implemented safety upgrades including installing lid restraints on drums with known elevated flammable gas hazards (see Figure 15), improved securing of drums on flatbed trucks for transportation between Advanced Mixed Waste Treatment Project facilities and continued sampling of the population of drums with unknown flammable gas concentrations. DOE also directed the contractor to develop detailed cost and schedule proposals for implementing DOE STD-5506-2021 at INL. DOE received these proposals in November 2023 and is reviewing them.

Figure 15. *Lid Restraints on Drums with Flammable Gas*

Integrated Waste Treatment Unit

The Integrated Waste Treatment Unit is designed to process approximately 900,000 gallons of sodium-bearing liquid radioactive waste as well as newly generated liquid waste. After nearly a decade of solving process issues, DOE reached a milestone in April 2023 and began processing radiological waste from the tank farm. DOE processed approximately 68,000 gallons of liquid waste in 2023.

During the first few months of operation, the Integrated Waste Treatment Unit experienced several unanticipated waste processing challenges. Waste feed nozzle clogs and unexpected temperature variations necessitated temporary system shutdowns of the Denitration Mineralization Reformer, which is the main waste processing equipment. In September 2023, INL detected unanticipated mercury concentrations in the granulated activated charcoal filters of the process off-gas system, which required an unplanned outage in waste operations to replace the charcoal material in these filters. During this outage, INL executed planned maintenance activities and conducted studies at an off-site scale facility to better understand and improve clogging and temperature conditions in the Denitration Mineralization Reformer. DOE plans to implement these improvements in early 2024 and expects to return to radiological waste processing in the second quarter of 2024. The Board plans to closely follow implementation of the process improvements and restart activities.

DOE Idaho Operations Office Oversight of Fire Protection and Electrical Safety

The Board is reviewing the effectiveness of safety oversight activities in fire protection and electrical safety. DOE's Idaho Operations Office currently does not have staff with specific expertise in either of these disciplines. Issues identified during a review of fire watch and fire protection system maintenance documentation suggest that additional oversight may be needed

beyond that generally provided by facility representatives and members of the facility safety team. A similar review of electrical safety is ongoing.

Waste Isolation Pilot Plant

In support of WIPP's important role as the only U.S. deep geological repository for defense-generated transuranic waste, the Board visited the site in August 2023 (see Figure 16). The visit included meetings with managers from the DOE Carlsbad Field Office and Salado Isolation Mining Contractors, LLC regarding WIPP operations, the National Transuranic Program, and capital investments to improve nuclear safety. During the visit, the Board emphasized the importance of understanding the effectiveness of corrective actions taken following the 2014 radiological release event, managing federal staffing, addressing equipment reliability issues, and aligning the WIPP safety basis with modern safety standards. The Board also emphasized the importance of incorporating reliable safety components into the future Safety Significant Confinement Ventilation System to mitigate occupational and environmental impacts due to a potential radiological release (discussed further in the WIPP Underground Ventilation System Projects section of this report).

Figure 16. *Board Visit to WIPP*

In February 2023, a new contractor assumed responsibility for operations at WIPP. With the transition came the distinct challenge of developing strategies to manage aging mining infrastructure, which posed operational risks throughout 2023.

The Salt Handling Shaft, which serves to transport personnel into the mine and to take mined salt out of the underground, is more than 40 years old. The shaft cuts through a salt seam, which is a geological layer highly susceptible to plastic deformation (i.e., creep). As the salt seam deformed over time, loads increased on the structural steel reinforcing the lower part of the shaft, causing some steel members to fail. Shaft maintenance personnel installed steel bracing as a temporary mitigation measure until project funding is available to comprehensively refurbish the structural steel frame. Carlsbad Field Office and contractor personnel are evaluating alternatives to preserve safety and operational capabilities at WIPP if the Salt Handling Shaft goes out-of-service as a function of the changing structural conditions. The Board plans to review the nuclear safety risk associated with these options as the site evaluates the path forward. Nonetheless, this issue highlights the complexity of managing operational capability at WIPP against ongoing infrastructure challenges.

New infrastructure projects also created safety setbacks for the new contractor. Three major hoisting and rigging incidents occurred at the Utility Shaft Project in the fall of 2023, necessitating a formal stop work on all construction activities for the project in November 2023. The work discontinuation remained in place for the rest of the calendar year. Construction cannot resume at the Utility Shaft until workers develop and implement improved hoisting and rigging policies, as well as demonstrate proficiency with working safely.

National Transuranic Program

Generator Site Technical Review Process

DOE's Carlsbad Field Office manages the National Transuranic Program. Carlsbad Field Office personnel implemented several new processes and enhancements to existing waste certification and acceptance criteria because of corrective actions implemented after the 2014 radiological release event at WIPP. Carlsbad Field Office personnel developed a process and conducted generator site technical reviews at waste generator sites to support resuming transuranic waste shipments to WIPP. In 2023, the WIPP contractor initiated reviews based on revision of the governing guidance from a Carlsbad Field Office document to a contractor management control procedure.

In July of 2023, the Board's staff observed the conduct of a generator site technical review to support corrective actions associated with an unexpected February 26, 2021, sparking event involving pyrophoric titanium fine materials during waste packaging in a Plutonium Facility glovebox at LANL. The generator site technical review team reviewed the casual analysis and corrective action plan provided by NNSA's contractor at LANL. The generator site technical review identified opportunities for improvement with six issues and two noteworthy practices.

In October of 2023, the Board's staff observed the conduct of a generator site technical review to support a new process to re-size, ship, and recover a corrugated metal pipe waste stream. The generator site technical review team evaluated the corrugated metal pipe process from waste retrieval to waste packaging. The generator site technical review team identified

additional opportunities for improvement with six issues, three recommendations, and one noteworthy practice.

Overall, the Board recognizes the value of generator site technical reviews to assist generator sites to continue to refine and improve waste activities to support safe shipments to WIPP.

Radiologically Contaminated Transuranic Waste Shipments from INL to WIPP

As discussed in last year's annual report, the Board followed up on two events related to radiologically contaminated shipping containers that arrived at WIPP from INL. WIPP personnel determined that the contents of shipments in March and August 2022 (TRUPACT 148 and 180) did not meet waste acceptance criteria when they found unexpected liquids inside a shipping container and radiological contamination on the outside of some drums. The shipments were sent back to INL.

After issues with the TRUPACT-II 148 and 180 shipments, INL personnel developed a Timely/Long Term Order to allow shipment of newer drums that had not been overpacked. By the end of 2022, INL personnel had successfully shipped more than 600 drums to WIPP. In 2023, INL shipped several hundred additional drums to WIPP. The Board will continue to monitor INL shipments to WIPP.

Waste Control Specialists: Status of Waste Storage and Disposition

The 2014 WIPP radiological release event involved LANL waste with inappropriately remediated nitrate salts. The waste underwent an autocatalytic runaway reaction in the WIPP underground that ruptured the drum and spread radioactive contamination, leading to a three-year shutdown of the facility. An extent-of-condition review identified many additional non-compliant remediated nitrate salt waste containers. Prior to the event, more than 100 of these non-compliant containers had been shipped to a Waste Control Specialists' facility for temporary storage in Andrews, Texas. A DOE-sponsored integrated project team including relevant hazardous waste regulators and Nuclear Regulatory Commission representatives continues to work on a safe disposition path for these remaining drums.

Figure 17. *WIPP Underground Waste Room*

The Board has engaged in active oversight to ensure continued adequate protection of public health and safety while DOE has worked on a disposition path for the remaining drums stored at the Waste Control Specialists' facility in Texas. A report from Sandia National Laboratories titled "Scoping Thermal Response Calculations of [Remediated Nitrate Salt] Waste During Transport to and Disposal at the WIPP" was issued in November 2023. The report discusses thermal calculations related to the ignitability risk of the remediated nitrate salts waste drums during transportation from the Waste Control Specialists' facility to WIPP, and subsequent permanent disposal at WIPP.

Based on a July 2016 reporting requirement, DOE will brief the Board on the plan before this waste is transferred to any DOE defense nuclear facility and the Board will independently evaluate the technical merits of the information regarding the safety of waste processing and disposition.

DESIGN AND CONSTRUCTION

V. Design and Construction

Consistent with its prioritization of overall nuclear safety risk in the DOE enterprise, the Board in 2023 performed nuclear safety oversight of DOE projects to construct new or modified defense nuclear facilities. As the basis for identifying any nuclear safety deficiencies, the Board evaluates staff analyses and other sources of data such as input from resident inspectors, Board member field visits, DOE project status briefings, and Board hearings.

Table 2 lists major design and construction projects that the Board evaluated in 2023. Most of the Board's identified safety concerns in 2023 involved ensuring the safety of workers inside and co-located to DOE projects. Table 2 outlines those concerns and summarizes the Board's project evaluations.

Table 2. *Design and Construction Projects Reviewed in 2023*

Project Name	Location	Status of Project	Status of Review
Waste Treatment and Immobilization Plant, High-Level Waste Facility	Hanford Site	Concurrent design and construction	Ongoing—project letters issued 05/09/2019, 10/14/2020, 7/19/2022
Waste Treatment and Immobilization Plant, Low-Activities Waste Facility	Hanford Site	Construction completed; testing in progress	Ongoing—project letter issued 06/25/2020
Enhanced Capabilities for Subcritical Experiments	Nevada National Security Site	Concurrent design and construction	Ongoing
Savannah River Plutonium Processing Facility	Savannah River Site	Preliminary design	Ongoing—Project letters issued 1/24/2022, 8/3/2023, 11/28/2023
Surplus Plutonium Disposition Project	Savannah River Site	Preliminary design	Ongoing—Project letter issued 1/6/2022
Safety Significant Confinement Ventilation System	Waste Isolation Pilot Plant	Construction	Ongoing—project letters issued on 03/26/2018, 08/27/2019, 8/17/2022
Uranium Processing Facility	Y-12 National Security Complex	Construction	Ongoing—project letter issued on 06/26/2017

Hanford Waste Treatment and Immobilization Plant

In the late 1990s, DOE began work on the Waste Treatment and Immobilization Plant, which will be used to vitrify Hanford's tank waste prior to permanent disposal. This planned radiochemical processing plant consists of four primary facilities: Pretreatment, Low-Activity Waste, High-Level Waste, and the Analytical Laboratory. DOE will dispose of the low-activity

waste glass onsite and will ship the high-level waste glass offsite for permanent disposal once a national repository is available. Since initial design efforts began, numerous technical issues have arisen at the Waste Treatment and Immobilization Plant, primarily related to the design of the planned Pretreatment and High-Level Waste facilities.

High-Level Waste

In 2022, DOE conducted an analysis of alternatives to evaluate options for progressing the high-level waste mission. DOE also initiated a second effort titled, "High-Level Waste Facility Firm the Foundation Team," to validate assumptions and design inputs, review design criteria, and clarify proposed approaches. During 2023, DOE and the Waste Treatment and Immobilization Plant contractor have been developing the safety design strategy for the new path forward to provide direct feed to the High-Level Waste Facility—analogous to the approach used for Low-Activity Waste. This approach will use the current versions of DOE directives to develop safety basis documents and integrate the safety requirements into the design. The Waste Treatment and Immobilization Plant contractor has also spent this year modifying project guidance for developing the revised safety basis, anticipating that the resulting safety control set will be more practical to implement. The Board has scheduled an evaluation of these revised approaches to begin early in 2024. Figure 18 shows facility construction of the High-Level Waste Facility.

Figure 18. *High-Level Waste Facility Construction*

Low-Activity Waste

The Low-Activity Waste Facility is undergoing cold commissioning and readiness activities to demonstrate that it can safely produce vitrified low-activity waste. This is discussed

in more detail in Low-Activity Waste Facility Start-Up section of this report. In 2023, the Board completed a review of the integration of the safety bases of the facilities involved in the treatment of the low-activity waste: Hanford Tank Farms, the Low-Activity Waste Facility, and the Liquid Effluent Retention Facility. On February 28, 2023, the Board sent DOE a letter providing the results of this review and establishing a reporting requirement for a written response on DOE's plans to ensure effective implementation of a specific administrative control to de-energize pumps or isolate the waste pipeline to protect tank farms workers from spray leak hazards. In a letter dated April 28, 2023, DOE responded and committed to ensure that the specific administrative control will be incorporated into the safety bases for the Hanford Tank Farms as well as the Low-Activity Waste Facility.

NNSS Enhanced Capabilities for Subcritical Experiments

NNSA performs subcritical experiments at the Principal Underground Laboratory for Subcritical Experimentation (PULSE), formerly known as the U1a Complex, in support of the Stockpile Stewardship Program. In 2014, NNSA identified the need for higher energy x-ray diagnostics to measure the final stages of implosion using plutonium and a neutron diagnostic to infer neutron multiplication during an implosion. The Enhanced Capabilities for Subcritical Experiments project consists of three subprojects:

- **Advanced Sources and Detectors**—A major equipment installation project that will design, fabricate, install, and commission a 22-million electron volt accelerator (referred to as Scorpius), which will generate x-ray images of subcritical implosion experiments to measure the dynamic behavior of plutonium under weapons-relevant conditions;

- **Laboratory and Support Infrastructure**—A major modification to the underground laboratory that will support the Advanced Sources and Detectors project and includes mining new tunnels, modifying existing tunnels, constructing power and cooling utilities aboveground, and constructing diagnostic and control rooms belowground; and

- **Z-Pinch Experimental Underground System Test Bed Facility Infrastructure Project**—A major modification to the underground laboratory that will repurpose existing drifts to create a new experiment room and install the Neutron Diagnosed Subcritical Experiments diagnostic equipment.

In 2023, the Board reviewed the preliminary documented safety analysis for the project related to the Scorpius x-ray machine and the draft preliminary documented safety analysis for the Z-Pinch project. The objective of the review was to assess the adequacy of the safety analyses and determine whether the site contractor identified appropriate controls to protect workers and the public. The Board’s staff performed several interactions with the site regarding these PULSE projects and expects to complete its review in 2024.

SRS Savannah River Plutonium Processing Facility

The 2018 Nuclear Posture Review, conducted jointly by the Departments of State, Energy, and Defense, recommended establishing "the enduring capability and capacity to produce plutonium pits at a rate of no fewer than 80 pits per year by 2030." NNSA is designing the Savannah River Plutonium Processing Facility to produce 50 of these pits per year using the partially constructed building intended for the canceled Mixed Oxide Fuel Fabrication Facility project. Figure 19 shows a rendering of the completed Savannah River Plutonium Processing Facility**.** On June 25, 2021, the Deputy Secretary of Energy approved critical decision 1, *Approve Alternative Selection and Cost Range*, marking completion of the project definition phase and conceptual design.

Figure 19. *Rendering of the Completed Savannah River Plutonium Processing Facility*

NNSA stated in its critical decision 1 approval letter that it estimated project completion between fiscal years 2032 and 2035. The project is now in preliminary design. Project personnel are preparing early procurement packages and began dismantling and removal of equipment installed in the existing building that was part of the Mixed Oxide Fuel Fabrication Facility (e.g., gloveboxes, conduits, ductwork).

In 2023, the Board completed a follow-up review on facility worker safety concerns that were documented in its letter on the conceptual design dated January 24, 2022. In a letter dated March 29, 2023, the Board reiterated these safety concerns to DOE and announced an onsite visit to SRS with the Savannah River Plutonium Processing Facility being one of the discussion topics.

On May 11, 2023, project personnel briefed the Board at SRS on their basis for why the facility does not require safety controls that are typically credited at other plutonium processing facilities in the DOE complex (e.g., gloveboxes, glovebox ventilation, and glovebox fire controls). Project personnel stated that they believed facility workers could use their natural senses to detect and self-protect from postulated accidents, such as a glovebox spill or fire, and exit the area before receiving significant radiological exposure. The Board expressed

disagreement during the onsite visit and issued a follow-up letter to DOE dated August 3, 2023, that requested, "a written report and briefing in 45 days providing DOE's position on the adequacy of the safety strategy for facility worker protection."

Following the Board's onsite visit, NNSA conducted its own independent review of facility worker safety and found that the hazard analysis and resulting safety control set over-relied on the expectation that workers would take self-protective actions to avoid significant radiological exposures from postulated hazards. The report dated September 7, 2023, also indicated that project personnel too often selected mitigative controls over available preventive controls for hazard scenarios, which is inconsistent with the hierarchy of controls in DOE Standard 1189-2016, *Integration of Safety into the Design Process*.

On October 25, 2023, in response to a request from NNSA, the DOE Office of Environment, Health, Safety, and Security issued a memorandum with interpretations of DOE requirements for developing the project's safety basis. The memorandum indicates concerns with the selection of controls for worker safety. It states that "it is especially concerning that this type of protection strategy [facility worker self-protection] is being discussed during the design phase of a new DOE nuclear facility when the development and crediting of controls are attainable and will be integral to the long-term safe operations of the facility."

On November 28, 2023, the Board issued an additional letter to DOE noting "Now that three of DOE's applicable nuclear safety organizations have documented safety concerns with the project's safety approach, the Board is renewing its request for a final response." Since DOE's response to its August 3, 2023, letter did not commit to a date for the reporting requirement, the Board reiterated its request for a response and briefing by January 19, 2024.

On January 17, 2024, NNSA responded to the Board's reporting requirement in its November 28, 2023, and August 3, 2023, letters. The NNSA response letter states "NNSA concurs with the Board's concerns regarding the previous facility worker control strategy at SRPPF [Savannah River Plutonium Processing Facility] and will ensure that all gloveboxes with plutonium material at risk are credited as Safety Class or Safety Significant." NNSA also stated that it elevated glovebox oxygen monitors and differential pressure alarms to safety significant, and it is considering additional safety controls. Finally, NNSA stated that it will publish lessons learned on this topic, and it issued guidance on the use and application of facility worker self-protection to all NNSA program and field office management.

SRS Surplus Plutonium Disposition Project

The SRS Surplus Plutonium Disposition Project, currently in the preliminary design phase, involves a major modification to Building 105-K in the K-Area Complex, including construction of an additional structure to house ventilation and electrical equipment. The project's mission is to expedite removal of plutonium from South Carolina by expanding the capability to disposition surplus weapons-grade plutonium using the dilute and dispose approach.

The four primary activities to be covered by the Surplus Plutonium Disposition Project are (1) un-packaging plutonium oxide, (2) dry blending plutonium oxide with adulterant, (3)

performing non-destructive assay and packaging, and (4) preparing diluted plutonium oxide for shipment. The project achieved critical decision 1, *Approve Alternative Selection and Cost Range*, in October 2019. In 2023, the Board's staff conducted multiple interactions to review the results of fire testing on storage containers conducted by SNL (see Figure 20). The review is expected to conclude in early 2024.

Figure 20. *Assembly Used for Fire Testing of Plutonium Storage Containers*

Y-12 Uranium Processing Facility

Uranium Processing Facility project personnel continue construction progress on facility structures (see Figure 21). In 2023, project personnel installed key process equipment in the main process building and the salvage and accountability building. Interior walls and electrical power to component cabinets for the credited safety detection and response system are in place. The main fire pump has been delivered to the building but is not yet connected to the fire protection system. The credited fire protection water storage tank has been insulated, and the secondary diesel fire pumps for the project are being manufactured. Factory acceptance testing and delivery to the project site is scheduled for 2024.

Figure 21. *Uranium Processing Facility Construction in 2023*

In 2023, the Board completed a review of safety-related equipment installation throughout the main process building and the salvage and accountability building (see Figure 22). This review focused on quality assurance compliance and the installation procedures of key enriched uranium process equipment, as well as several building infrastructure systems. The Board identified several observations and brought them to the attention of project personnel. These included enhancements to the preventive maintenance program, exposure protection of the structural rebar for the connector between the Uranium Processing Facility and the existing Highly Enriched Uranium Materials Facility, monitoring of environmental conditions for several pieces of process equipment, and correction of damaged fire protection components that occurred during installation. Project personnel are implementing corrective measures. Also in 2023, the Board independently reviewed the safety integrity level calculations for the credited safety detection and response system and found the calculations to be complete and in accordance with the applicable DOE standard.

Figure 22. *Main Process Building Batch Makeup Staging Enclosure Installation*

WIPP Underground Ventilation System Projects

The Board and DOE have been corresponding on various aspects of the overall effort to improve underground ventilation at WIPP since the 2014 accident due to energetic chemical reactions in waste drums that resulted in the release of radiological materials. DOE is undertaking several projects to improve safety of the underground ventilation. The underground ventilation system improvements include the safety significant confinement ventilation system to allow high volumes of filtered exhaust to mitigate design basis accidents for the facility and co-located workers while also meeting air quality requirements for the mine workers.

The air flow improvements in the underground will also be enhanced by a new utility shaft that will include supply air fans to increase the fresh air supplied into the mine. The

improvements will support mining of new waste panels. Figure 23 shows the filter housing assemblies inside the new filter building.

The Board continued to provide safety oversight on these projects. It has followed DOE's corrective actions program response to quality assurance findings that involved construction of the safety significant confinement ventilation system and hoisting-related events at the utility shaft. The Board has also continued to evaluate DOE's response to the Board's letter of August 27, 2019, regarding the adequacy of design requirements for the continuous air monitoring system needed to place the exhaust ventilation systems into a safe configuration if radiological contamination is detected in the underground.

Figure 23. *Filter Housing Assemblies Inside the New Filter Building*

NUCLEAR SAFETY FRAMEWORK, PROGRAMS AND STANDARDS

VI. Nuclear Safety Framework, Programs, and Standards

A robust nuclear safety framework established in rules, directives, and technical standards is fundamental to safe operations at DOE's defense nuclear facilities. In 2023, the Board continued to focus on DOE's safety framework, criticality safety, emergency management, and other safety management programs. The Board communicated to DOE on several cross-cutting safety areas including nuclear safety requirements and software quality assurance. The Board also continued to review and comment on DOE directives that define nuclear safety requirements for safety basis documents, quality assurance, startup and restart of nuclear facilities, fire protection, and chemical safety management programs. The Board will continue to prioritize cross-cutting safety areas that impact nuclear safety across the defense nuclear complex.

Nuclear Safety Framework

Recommendation 2020-1, Nuclear Safety Requirements

The Board issued Recommendation 2020-1, *Nuclear Safety Requirements*, in February 2020, with the intent of strengthening DOE's nuclear safety regulatory framework including 10 CFR 830, *Nuclear Safety Management*, and relevant DOE orders and standards. The Board revised the recommendation based on feedback from DOE and approved the final version on June 1, 2021. Recommendation 2020-1 provides recommendations in the following areas:

- ***Aging Infrastructure***—The Board recommended that DOE develop requirements for aging management, including a formal process for identifying and performing infrastructure upgrades needed to ensure facilities and structures, systems, and components can perform their safety functions.

- ***Hazard Categories***—The Board recommended that DOE revise DOE Standard 1027-2018, *Hazard Categorization of DOE Nuclear Facilities*, mandate use of the revised standard for new defense nuclear facilities, and review existing hazard category 3 and below hazard category 3 defense nuclear facilities to ensure they are appropriately categorized.

- ***DOE Approvals***—The Board recommended that DOE establish a required periodic review of contractor documented safety analyses to ensure they meet the requirements of 10 CFR 830.

- ***Evaluation of Safety Basis Preparation and Review Processes***—The Board recommended that DOE conduct an independent review of contractor and federal processes to identify and evaluate underlying issues that prevented the annual submittal and approval of high-quality safety basis documents, and use the findings to improve the relevant processes.

- ***Safety Basis Process and Requirements***—The Board recommended that DOE incorporate specific implementation requirements for unreviewed safety questions,

technical safety requirements, and specific administrative controls in its regulatory framework, including 10 CFR 830.

The Secretary of Energy accepted Recommendation 2020-1 on September 8, 2021, and transmitted DOE's implementation plan for the recommendation on June 27, 2022. The Board responded on August 18, 2022, stating that while DOE's implementation plan does not fully endorse some actions recommended by the Board, execution of the plan could result in safety improvements to DOE's nuclear safety framework consistent with the objectives of the recommendation. The Board further noted that achievement of those objectives would be contingent on DOE executing the implementation plan with the goal of addressing the Board's safety concerns.

DOE transmitted the first few implementation plan deliverables in 2022 and completed several additional milestones in 2023. Overall, DOE's actions in response to Recommendation 2020-1 have been positive and are poised to improve critical aspects of its regulatory framework governing nuclear safety.

- ***Hazard Categories***—On March 8, 2023, DOE transmitted to the Board a regulatory analysis of possible approaches to enhance its current hazard categorization requirements. DOE determined in that analysis that it would develop a single, updated, and consolidated hazard categorization standard to be codified in 10 CFR 830. DOE issued a project justification statement to develop a new version of DOE Standard 1027, *Hazard Categorization of DOE Nuclear Facilities*, and sent it to the Board on June 13, 2023. DOE has since begun work to develop a draft revision to the standard, and members of the Board's staff have observed those writing team meetings. DOE included in the project justification statement its goal for issuing the revised standard in May 2024.

- ***DOE Approvals***—DOE's June 13, 2023, letter also included a project justification statement for a revision to DOE Standard 1104, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents*. DOE included in the project justification statement its goal for issuing the revised standard in November 2024. The DOE writing team began meeting in November 2023 and included a member of the Board's staff as an observer.

- ***Evaluation of Safety Basis Preparation and Review Processes***—In December 2022, DOE transmitted to the Board a review plan for a DOE Office of Enterprise Assessments review of the safety basis development process. During 2023, the DOE team conducted the review in two phases: a broadly scoped document review and a site-specific review at a subset of sites. In December 2023, the DOE team issued its report documenting the review and providing recommendations to DOE field office and headquarters organizations regarding potential improvements to safety basis preparation, review, and approval processes. The report recommends actions for DOE's program offices to improve safety basis review and approval processes and for the DOE Office of Environment, Health, Safety, and Security to update DOE

Standard 1104. In accordance with the implementation plan, DOE will begin implementing these actions by mid-2024.

- ***Safety Basis Process and Requirements*—**In June 2023, DOE transmitted its revised approach for developing new nuclear safety basis requirements to the Board. DOE has begun developing a new DOE Order 421.1, *Nuclear Safety Basis*, which will establish requirements for the unreviewed safety question process, technical safety requirements, specific administrative controls, and other safety basis topics. During 2023, members of the Board's staff observed the DOE writing team develop requirements. In November 2023, DOE began the formal review and comment period for draft DOE Order 421.1. At the same time, DOE began the review and comment period for a revision to DOE Order 420.1C, *Facility Safety*, that includes changes to that order to align it with DOE Order 421.1. In January 2024, the Board completed its review of both draft orders and provided comments to DOE. DOE's goal is to complete these efforts in the spring of 2024.

- ***Aging Infrastructure***—While DOE's actions responding to most areas of the recommendation have been positive, DOE's response to elements of the recommendation related to aging infrastructure management require continued leadership attention. DOE's main commitment in this area was to execute a benchmarking review to identify best practices and process enhancements regarding management of aging infrastructure. DOE transmitted the benchmarking report to the Board in September 2023. In October and November 2023, the Board sent letters to DOE outlining concerns with the report. Given the scope of the benchmarking effort and proposed process enhancements, the Board is concerned that DOE's planned and completed actions will not be sufficient to drive necessary safety improvements to the requirements and processes that ensure safe and effective management of aging defense nuclear facilities.

Aging Management

Considering the mutually recognized importance of safely managing aging infrastructure by the Board and DOE, the Board continued work on two efforts in 2023 to better define existing safety weaknesses and to identify potential improvements. The first effort reviewed relevant DOE documents, internal and external assessments, and congressional reports to understand the current state of DOE's defense nuclear facilities. The second effort was a review of field implementation of requirements related to aging management at four DOE sites, specifically Pantex, Y-12 (see Figure 24), SRS (both EM and NNSA facilities), and Hanford (both EM and Office of Science facilities). The review also included interactions with two headquarters organizations, specifically DOE-EM's Office of Infrastructure Management and Disposition Policy, and NNSA's Office of Infrastructure Lifecycle Management. The Board is currently analyzing the gathered data from these two efforts to inform potential Board correspondence and/or public hearings on this topic in 2024.

Figure 24. *Y-12 Building 9215 Roof Remediation*

Implementation of DOE Standard 3009-2014, Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses

DOE Standard 3009-2014 was approved in November 2014. However, nearly 10 years later, most nuclear facility safety bases have not been updated to incorporate the safety improvements outlined in the standard. Notably, the updated standard clarifies several concepts that were previously used inconsistently (e.g., evaluation guideline, bounding parameters, unmitigated and mitigated hazard evaluations, standard industrial hazards). Because of this trend in delayed implementation, the Board initiated a review of the implementation of DOE Standard 3009-2014, which will focus on identifying safety impacts for facilities at which the standard has not yet been implemented.

Technical Report 47, Seismic Hazard Assessments

On June 10, 2021, the Board sent a letter to DOE, which included Technical Report 47, *Seismic Hazard Assessments*, that highlighted safety concerns with the seismic hazard assessment process used at DOE sites. On June 16, 2022, the Board sent an additional letter to DOE requesting clarification on when DOE expected sites to enter the unreviewed safety question process in cases where a probabilistic seismic hazard analysis update identifies an increased seismic hazard that exceeds qualification assumptions for seismic safety controls.

On November 2, 2022, DOE responded to the Board's follow-up letter and clarified that "when the Contractor determines that the increase in hazard identified in the [probabilistic seismic hazard analysis] update is potentially not bounded by the safety analysis, the contractor

is required to follow the process in 10 CFR § 830.203(f) because there is a potential inadequacy in the safety analysis." In February 2023, the DOE Office of Environment, Health, Safety, and Security published a Frequently Asked Question document to provide further unreviewed safety question process guidance as it applies to an updated probabilistic seismic hazard analysis. The document states, "if an updated [probabilistic seismic hazard analysis] identifies, or it becomes apparent at any point before completion, that a hazard increase is potentially not bounded by the [documented safety analysis], then the results of the new assessment should be considered "new information," and the [potential inadequacy in the safety analysis] process should be followed."

In May 2023, DOE issued an Operating Experience Level 3 document titled, *Implementation of the Unreviewed Safety Question (USQ) Process Following a New Probabilistic Seismic Hazard Analysis (PSHA)*, to raise awareness of revised DOE guidance regarding the unreviewed safety question process following a new probabilistic seismic hazard analysis. The document states that DOE nuclear facilities should review the Frequently Asked Question document and use the information accordingly. The Frequently Asked Question and Operating Experience Level 3 documents represent a significant safety improvement to ensure DOE's expectations for the potential inadequacy of the safety analysis and unreviewed safety question processes following a probabilistic seismic hazard assessment update are known and implemented.

Nuclear Safety Programs

DOE Oversight

The purpose of DOE's safety oversight is to proactively identify contractor performance deficiencies and promote timely correction of issues to ensure adequate protection. In 2022, the Board completed a comprehensive review of DOE's safety oversight across the defense nuclear complex, including DOE's methods for evaluating its own effectiveness by reviewing documents, interviewing DOE personnel, and conducting interactions with multiple DOE headquarters organizations and field offices.

On August 17, 2022, the Board sent the Secretary a letter outlining improvements DOE should pursue to ensure its safety oversight approach is effective in the following areas:

- **Effectiveness Assessments**—DOE needs to improve its required effectiveness assessments for safety oversight at all levels within DOE's safety oversight framework. For example, DOE safety oversight leverages contractor assurance systems without a sufficient, documented federal assessment basis to justify that contractor assurance systems are reliable and effective. There is also a lack of documented DOE "effectiveness" reviews validating that the remainder of federal oversight is effective.

- **Staffing**—DOE needs to improve its staffing plans and implementation to ensure sufficient technical capability is applied to safety oversight activities.

- **Proactive Safety Oversight**—DOE needs to increase proactive safety oversight to ensure safety issues are identified in a timely manner.

- **Safety Issues Management**—DOE needs to implement an effective safety issues management system to ensure timely and effective correction of safety issues.

The Board's August 17, 2022, letter requested that DOE provide a briefing and written report on its plans to address these safety matters. On April 26, 2023, DOE sent the Board a written report that described DOE's evaluation of safety oversight processes at defense nuclear facilities and presented ongoing and new DOE actions taken to improve the effectiveness of safety oversight. DOE subsequently briefed the Board on May 22, 2023, on these planned oversight improvement actions. DOE concluded that its current safety oversight is adequate but recognized there are opportunities to improve, particularly in contractor assurance system effectiveness.

Safety Software Central Registry

The DOE Safety Software Central Registry is currently a database of eight software packages that DOE's contractors use for safety purposes such as estimating the consequences of potential accidents. An overall goal of the central registry is to provide enhanced quality assurance of the software used in safety analysis. The central registry also includes guidance from DOE on how to use the software. Per DOE Standard 3009-2014, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, DOE encourages its contractors to use the software in the central registry.

On August 24, 2022, the Board sent a letter to DOE regarding its review of the central registry. The Board found that DOE has struggled to maintain the central registry. As a result, DOE contractors sometimes use outdated versions of software for safety calculations. This situation is problematic because older versions of software could contain errors and/or pose a cybersecurity risk. The Board also found that DOE's guidance on the use of the codes has become outdated.

On October 4, 2023, DOE briefed the Board on its plans for the central registry. While DOE officials stated that they were not aware of any safety issues from the use of the older software, they did intend to revamp the program. As an example, DOE plans to put more emphasis on notifying users of errors in software packages and is planning changes to make the central registry more relevant and sustainable. In the medium term, DOE also plans to focus on guidance and training on the use of software in the registry. The Board will continue to follow DOE's improvements in 2024.

Emergency Preparedness and Response

The Board continued its efforts to evaluate DOE's current competencies and capabilities for emergency response in the field. In 2023, Board Vice Chair Thomas Summers and members of the Board's staff observed emergency response exercises at NNSS, Pacific Northwest National Laboratory, Hanford, Pantex, LLNL, and Y-12. The Board's staff also observed

emergency response exercises at SRS, SNL, INL, LANL, and WIPP. The Board Vice Chair provided remarks at a DOE Emergency Management Issues Special Interest Group virtual panel discussion in December 2023.

Common issues observed during emergency exercises in 2023 included radiological contamination monitoring and control, and poor communication between operations personnel and other emergency responders responsible for determining emergency classifications and protective actions. While feedback from exercise participants was generally self-critical, this feedback has not consistently led to effective corrective actions at all sites as demonstrated by verification and validations of previously identified findings. Some sites also struggled with communications equipment (e.g., public address systems, radios) not providing adequate coverage and with emergency management staffing.

The Board also communicated concerns in its October 4, 2023, letter to the Secretary of Energy regarding weaknesses of the emergency training and drill program for the Savannah River Tritium Enterprise (as discussed in the Savannah River Tritium Enterprise Safety Posture section of this report). The Board intends to closely monitor these efforts in 2024 as SRS prepares to transition sitewide emergency services from DOE Environmental Management to NNSA as part of the landlord transition.

The Board closely monitored the emergency response associated with the site area emergency declared on February 22, 2023, for a fire in Building 9212 at Y-12 (additional detail is in the Reactive Materials Hazards at Y-12 of this report). While the response was conducted safely and the event resulted in no direct impacts to worker health and safety, site personnel identified valuable lessons learned regarding timely communication of event conditions and worker evacuation of nuclear facilities.

DOE and NNSA are currently revising DOE's emergency preparedness and response directive, DOE Order 151.1, *Comprehensive Emergency Management System*. The current version of the directive was responsive to several safety issues raised in Board Recommendation 2014-1, *Emergency Preparedness and Response*. The Board reviewed a preliminary draft of this revision and expects to provide additional feedback in 2024.

The Board observed new emergency operations centers in use during annual emergency exercises at LLNL and Y-12. The Board continues to monitor ongoing efforts at SNL, NNSS, and SRS to build and operate new emergency operations centers. These new facilities are safety investments expected to provide substantial, long-term improvements in site emergency response capabilities.

DOE Corporate Operating Experience Program Implementation

The Board continued a safety review of DOE's implementation of its operating experience program under DOE Order 210.2A, *DOE Corporate Operating Experience Program*. DOE Order 210.2A provides requirements governing identification, evaluation, dissemination, and use of operating experience (i.e., lessons learned from operational events or issues) within the DOE complex. DOE originally issued Order 210.2A in 2006 in response to Board

Recommendation 2004-1, *Oversight of Complex, High-Hazard Nuclear Operations,* to provide for a more robust operating experience program for feedback and improvement within DOE.

The Board has gathered information and conducted interactions with DOE headquarters and field organizations including the DOE Office of Environment, Health, Safety, and Security, NNSA, DOE Office of Environmental Management, and SRS. The purpose of these interactions was to better understand coverage and emphasis of relevant operating experience, including appropriate coverage of events/issues related to nuclear operations or nuclear safety at defense nuclear facilities. The Board plans to complete the review in early 2024.

Criticality Safety

Over the last several years, the Board has observed persistent criticality safety staffing challenges and increased significance of criticality safety infractions. As a result, in 2023, the Board began a multi-site review to evaluate the health of nuclear criticality safety programs and analyze trends in implementing applicable DOE directives and requirements. The review involves three sites—SRS, LANL, and Y-12—based on overall significance of the nuclear criticality safety hazard and the complexity of operations. During 2023, the Board's staff completed seven site visits and had several teleconferences with DOE and DOE contractors and is currently finalizing its observations and conclusions from this review.

The Board held a workshop on October 20, 2023, between the Board and DOE staff to discuss nuclear criticality safety topics. The goal of the workshop was to facilitate candid discussion between the Board and DOE's various organizations. The workshop was attended by representatives from multiple DOE headquarters organizations from NNSA, Office of Environmental Management, Office of Nuclear Energy, and Office of Science. The topics included nuclear criticality safety metrics, the Board's nuclear criticality safety reviews, DOE directives and standards, and complex-wide challenges (e.g., staffing and infractions).

Nuclear Safety Standards

DOE Resolution of Board Comments

The Board provided comments on revisions to DOE Limited Standard 3016, *Hazard Analysis Reports for Nuclear Explosive Operations,* and DOE Standard 1066, *Fire Protection,* that were issued in April 2023 and June 2023, respectively. In the final versions, DOE incorporated many of the comments that contained significant safety improvements.

Review and Comment in Calendar Year 2023

The Board conducted several reviews of DOE directives that were being revised in DOE's online review, comment, and approval process in 2023. For DOE Order 414.1, *Quality Assurance,* and DOE Order 251.1, *Departmental Directives Program,* the Board transmitted substantive comments to DOE and met with DOE personnel to discuss proposed changes to the directives that could adversely affect safety. These efforts will continue in 2024. For DOE

Handbook 1224, *Hazard and Accident Analysis Handbook*, the Board's staff met with DOE personnel on several occasions in 2023 to discuss its comments.

The Board also reviewed and sent significant comments to DOE on development of several other technical standards: DOE Standard 1239, *Chemical Safety Management Program*; DOE Standard 1234, *Radioactive Material Storage Containers*; and DOE Handbook 1545, *Seismic Evaluation Procedure for Equipment in U.S. DOE Facilities*. DOE's acceptance of the comments would improve the safety posture of these standards, and the Board will continue its efforts in 2024. The Board sent comments and will follow-up with NNSA in 2024 on NNSA Supplemental Directive 251.1, *Directives Management.*

Conduct of Readiness Reviews

The Board reviewed DOE's proposed revision to DOE Order 425.1, *Verification of Readiness to Start Up or Restart Nuclear Facilities*, that provides requirements governing conduct of readiness reviews by DOE and its contractors to confirm readiness for safe start up or restart of a facility or activity. DOE's proposed revision included new provisions that would (1) extend from 12 months to 18 months the time that a facility or activity could be shut down without requiring restart readiness reviews, and (2) allow lower levels of DOE management to authorize parallel contractor and DOE readiness reviews for certain occasions rather than sequentially conducting those reviews. The Board's December 5, 2023, letter to the Secretary of Energy discussed safety concerns with these new provisions, urged that DOE address the safety concerns prior to issuing the revised order, and requested that DOE report to the Board on DOE's path forward on the revision to the order. At year's end, DOE was developing its response.

Planned Reviews in 2024

In 2023, the Board reviewed preliminary drafts of DOE Order 151.1, *Comprehensive Emergency Management System*; DOE Order 435.1, *Radioactive Waste Management*; DOE Standard 1020, *Natural Phenomena Hazards Analysis and Design Criteria for DOE Facilities*; and DOE Handbook 1220, *Natural Phenomena Hazards Analysis and Design Handbook for DOE Facilities*. In 2024, the Board plans to continue these reviews in DOE's online review, comment, and approval process, as well as evaluate others that have complex-wide effects and those that establish controls for high-hazard activities, such as DOE Order 433.1, *Maintenance Management Program for DOE Nuclear Facilities*, and DOE Standard 3006, *Planning and Conducting Readiness Reviews*. The Board also plans to resume discussions with DOE on DOE Handbook 3010, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*. The Board may elect to add reviews of DOE directives and technical standards as it deems appropriate.

FIELD OPERATIONS

VII. Field Operations

The Board stations full-time resident inspectors at Hanford, LANL, Pantex, SRS, and Y-12 to monitor operations. In 2023, two new resident inspectors reported for duty at Pantex. This office had been vacant for several months and this is the first time the Board has had two permanent resident inspectors at Pantex since 2020. A third resident inspector is pending relocation to Pantex. Six additional resident inspectors completed their resident inspector training in 2023. The Board is actively interviewing candidates to fill vacancies at SRS and LANL. To increase the pool of possible resident inspector candidates, the Board continued to directly hire resident inspectors rather than solely relying on internal transfers. This allowed the Board to hire staff with extensive commercial, Navy, and field operations experience.

In 2023, the resident inspectors conducted focused reviews on seven topics such as cold weather preparations, use of contract fees to improve safety performance, fire system inspections, and safety system assessments. Their data and field observations were analyzed to identify facility, site, and cross-cutting trends; identify unsafe field conditions; and communicate best practices. These reviews were also used to train resident inspectors and provide lines of inquiry that could be used for future reviews. The resident inspectors shared site safety observations and overall safety trends with DOE headquarters and site managers. This resulted in actions to address several safety issues identified by the resident inspectors. For example, due to resident inspectors' observations and inputs to DOE, DOE made procedure changes, declared a technical safety requirement violation, revised a calculation, and reperformed inadequate fire system inspections.

APPENDICES

Appendix A: Board Recommendations

Recommendations Open in 2023

Recommendation 2020-1, *Nuclear Safety Requirements* (REMAINS OPEN)

In February 2020, the Defense Nuclear Facilities Safety Board (Board) issued Recommendation 2020-1, *Nuclear Safety Requirements*. The recommendation is intended to strengthen the regulatory framework of the Department of Energy (DOE), including 10 Code of Federal Regulations (CFR) Part 830, *Nuclear Safety Management*, and relevant DOE orders and standards. Following DOE's response rejecting most of the recommendation in 2020, the Board revised and reaffirmed Recommendation 2020-1 in June 2021. Recommendation 2020-1 provides recommendations in the following areas: aging infrastructure, hazard categories, DOE approvals, evaluation of safety basis preparation and review processes, and safety basis process and requirements.

In September 2021, the Secretary of Energy provided their final decision to the Board accepting Recommendation 2020-1. DOE issued its implementation plan for Recommendation 2020-1 on June 27, 2022. The Board responded on August 18, 2022, stating that while DOE's implementation plan does not fully endorse some actions recommended by the Board, execution of the plan could result in safety improvements to DOE's nuclear safety framework consistent with the objectives of the recommendation. The Board further noted that achievement of those objectives would be contingent on DOE executing the implementation plan with the goal of addressing the Board's safety concerns.

DOE transmitted the first few implementation plan deliverables in 2022, and in 2023 completed several additional milestones. The Board remains actively engaged with DOE's progress towards execution of the implementation plan by observing writing team meetings and providing feedback on DOE Order 421.1, *Nuclear Safety Basis* (new order), DOE Order 420.1D, *Facility Safety*, DOE Standard 1027, *Hazard Categorization of DOE Nuclear Facilities,* and DOE Standard 1104, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents)*. Overall, DOE's actions in response to Recommendation 2020-1 have been positive and are poised to improve critical aspects of its regulatory framework governing nuclear safety.

While DOE's actions responding to most areas of the recommendation have been positive, DOE's response to elements of the recommendation related to aging infrastructure management require continued leadership attention. DOE's main commitment in this area was to execute a benchmarking review to identify best practices and process enhancements regarding management of aging infrastructure. DOE transmitted the benchmarking report to the Board in September 2023. In October and November 2023, the Board sent letters to DOE outlining concerns with the report. Given the scope of the benchmarking effort and proposed process enhancements, the Board is concerned that DOE's planned and completed actions will not be sufficient to drive necessary safety improvements to the requirements and processes that ensure safe and effective management of aging defense nuclear facilities.

Recommendation 2019-2, *Safety of the Savannah River Tritium Facilities* (REJECTED)

The National Nuclear Security Administration (NNSA) rejected Recommendation 2019- 2, *Safety of the Savannah River Site Tritium Facilities*, on the grounds that it was already addressing the Board's safety concerns with proposed and ongoing actions. In the Board's assessment, NNSA still has not shown that its proposed and ongoing plans will result in sufficient improvement to the safety posture of the tritium facilities.

In December 2019, NNSA approved a new combined documented safety analysis for the Savannah River Tritium Enterprise, which contained some improvements but did not address all the Board's safety concerns. Specifically, the calculated dose consequences for co-located workers impacted by major accidents involving the tritium facilities are still unacceptably high (based on DOE's own safety requirements); calculated dose consequences for the public challenge DOE's evaluation guideline for consideration of safety class controls; and no new controls have been identified and implemented that reduce the calculated dose consequences to acceptable levels in accordance with DOE's safety directives. Moreover, the tritium enterprise contractor (with NNSA's consent) will not implement improved safety controls identified in the new combined safety basis until 2024 and has not implemented any compensatory measures to ensure safety in the interim. Safety management programs that could help mitigate accident consequences, such as the site's emergency preparedness and response program, have not been tested to demonstrate their effectiveness for a major accident involving the tritium facilities.

On July 13, 2021, the Board held a public hearing focused on these concerns. NNSA previously directed the tritium enterprise contractor to develop a risk reduction strategy for co-located workers impacted by major accidents involving the tritium facilities. Shortly before the Board's public hearing, NNSA approved the contractor's strategy to reduce the risks presented by several postulated accidents at the tritium facilities. The actions in the strategy focus on either refining the accident analysis parameters to reduce the predicted consequences or completing calculations to determine whether existing structures can be credited to reduce the calculated consequences in the safety basis. Most of the proposed actions do not represent actual improvements to safety, but rather analytical reductions in accident consequence calculations, unless done in conjunction with physical modifications to install or upgrade engineered controls.

On May 10, 2022, the Savannah River Site (SRS) conducted its site annual emergency exercise, which was observed by a Board member and the Board's staff. The exercise scenario involved an explosion at the Tritium Extraction Facility and a release of tritium oxide. The exercise tested the ability of the site emergency response organization to respond to radiation exposures greater than 5 rem total effective dose and tritium exposures outside the tritium facilities' fence line, including collection of radiological bioassay samples from potentially exposed workers to determine which workers may be at risk of a significant tritium uptake. Demonstration of these capabilities was responsive to concerns described in the Board's recommendation and discussed during the Board's July 13, 2021, public meeting and hearing.

In 2022, the Board conducted a series of safety reviews aimed at identifying opportunities to strengthen the engineered and administrative safety controls at the Savannah River Tritium Enterprise that protect the workers and the public. On July 26, 2022, the Board communicated to

DOE its findings from a structural evaluation of the 296-H tritium stack that challenged the assumptions of the combined safety basis that collapse of the stack would not impact a nearby tritium storage vault. On August 11, 2022, the Board transmitted a letter to NNSA detailing concerns with an unanalyzed accident progression in which tritium was released and subsequently drawn into a tritium processing building by the building's ventilation system on January 30, 2022. The Board also completed safety reviews of the electrical systems and the implementation of safety management programs and specific administrative controls at the tritium facilities.

In 2023, the Board conducted a series of interactions to evaluate NNSA's progress to date. The Board reviewed NNSA's safety improvements at the Savannah River tritium enterprise during its site visit in May 2023, when NNSA provided an update on many of the initiatives. The Board continued to review and evaluate NNSA's co-located worker dose reduction strategy for short-term and long-term measures to prevent or mitigate the potential for high radiological consequences. On October 4, 2023, the Board followed up on its site visit with a letter to the Secretary of Energy establishing a reporting requirement for DOE to provide an annual report and briefing starting within six months on DOE's progress on safety improvements at the Savannah River Tritium Enterprise. The Board also continues to monitor site efforts to develop, test, and implement a site evacuation and relocation plan.

The Board continues to evaluate NNSA's progress towards completion of its proposed and ongoing safety actions, and to evaluate whether those actions will effectively address safety issues at the SRS tritium facilities. The Board has shared its concerns with NNSA leadership and remains concerned with the risk to workers and the public associated with postulated accident scenarios at the Savannah River Tritium Facilities. After the Board's site visit, the NNSA associate administrator for environment, safety, and health traveled with a team to SRS to discuss nuclear activities and issues and identified several safety basis topics for further evaluation. The Board is encouraged by NNSA Headquarters' engagement to drive these longstanding safety issues toward resolution.

Recommendation 2019-1, *Uncontrolled Hazard Scenarios and 10 CFR Part 830 Implementation at the Pantex Plant* (REMAINS OPEN)

On February 20, 2019, the Board issued Recommendation 2019-1 and identified the following safety issues: (1) portions of the safety basis for Pantex nuclear explosive operations do not meet 10 CFR 830, including high-consequence hazard scenarios that are not adequately controlled; (2) multiple components of the process for maintaining and verifying implementation of the Pantex safety basis are deficient; and (3) the Pantex federal and contractor organizations have been unable to resolve known safety basis deficiencies.

The Board recommended that DOE: (1) implement compensatory measures to address all deficiencies described within the recommendation's appendices; (2) perform an extent-of-condition evaluation of the Pantex safety basis and implement subsequent corrective actions to ensure compliance with DOE regulations and directives; (3) implement actions to ensure process design and engineered controls eliminate or protect the nuclear explosives from impact and falling technician scenarios, including those identified in the recommendation's enclosure; (4) ensure the

design, procurement, manufacturing, and maintenance of special tooling is commensurate with its safety function; and (5) train safety basis personnel to ensure future revisions to the safety basis comply with 10 CFR 830 requirements.

DOE accepted the recommendation on April 16, 2019, and transmitted its implementation plan on July 16, 2019. Upon review, the Board found that the "language and terms of the implementation plan in fact reject significant parts of the recommendation," and reaffirmed Recommendation 2019-1 in a letter dated August 22, 2019. In a public meeting on December 12, 2019, NNSA personnel committed to revise the implementation plan to address the Board's concerns. NNSA transmitted the revised implementation plan to the Board on June 5, 2020, and briefed the Board on the revised plan on August 4, 2020. In a September 16, 2020, letter, the Board informed the Secretary of Energy that the revised implementation plan addressed the Board's concerns with the original plan, and that the Board found the revised implementation plan to be responsive and indicative of DOE's acceptance of Recommendation 2019-1. The Board's letter emphasized that the frequent and constructive staff-level interactions during the revision process of the implementation plan greatly facilitated productive discussions and resulted in a product that addressed the safety recommendations. The Board also advised DOE to consider adding or expanding the use of engineered controls such as transfer carts, where applicable, to reduce hazards by eliminating both hand lifts of tools and swing arms in tooling.

On June 15, 2023, NNSA transmitted a revised implementation plan, modifying two deliverables associated with establishing special tooling performance criteria in Pantex's safety basis documents. The changes resulted from merging these initiatives with a broader effort to establish performance criteria for all design features and specific administrative controls. Given the expanded scope, rather than providing all the upgraded safety basis documents as initially planned, NNSA revised the implementation plan to instead provide the revised B61 hazard analysis report as a model, along with a schedule to upgrade the remaining safety basis documents, including NNSA's review and approval of those documents.

By the end of 2023, NNSA and its contractor completed all 69 deliverables identified in the revised implementation plan, and the Board continued to review these actions. In 2023, the Board issued a letter summarizing conclusions from its evaluation of closure documentation for various legacy conditions of approval and planned safety improvements that have remained open for more than a decade. Additionally, the Board continued reviews of various safety basis changes resulting from Recommendation 2019-1, as well as the projects to replace wood-framed false ceilings in two nuclear explosive cells with metal. These review activities are described in greater detail in the Pantex Plant section of this report. In 2024, the Board plans to conclude these reviews and evaluate the effectiveness of the completed implementation plan deliverables. Per the implementation plan, NNSA will commence its own effectiveness review of all completed actions during this same timeframe.

Recommendation 2012-1, *Savannah River Site Building 235-F Safety (REMAINS OPEN)*

In 2012, the Board identified safety concerns related to the hazards associated with plutonium-238 hold-up material in Building 235-F at SRS. At present Building 235-F is deactivated, with facility structure and radiological condition inspections being conducted on

prescribed periodicities. Design and safety analysis efforts to support eventual decommissioning are ongoing.

The Board issued Recommendation 2012-1, *Savannah River Site Building 235-F Safety*, on May 9, 2012, which documented the Board's concerns and recommended several actions that DOE should take to improve the Building 235-F safety posture. In response, DOE developed an implementation plan and completed several actions to improve the safety of Building 235-F, including removing some material-at-risk, combustibles, and ignition sources.

In May 2020, DOE developed a revised implementation plan outlining significant changes to the overall strategy used to address the hazards in Building 235-F, which focused on eliminating fire risks instead of removing additional material-at-risk. DOE subsequently indicated to the Board that all actions identified in the revised implementation plan were completed on June 22, 2020.

On November 2, 2021, the Board established a new reporting requirement for an annual report and briefing regarding (1) progress made to deactivate and decommission Building 235-F; (2) results of radiological surveys and inspections to verify that contamination is not spreading; (3) status and schedule for establishing a final end state determination with regulatory authorities; (4) results of structural integrity inspections, and any corrective actions identified and implemented from these inspections; and (5) any changes to the status of the E-5 ventilation system and sand filter, including any maintenance activities performed. DOE conducted the second annual briefing under the new reporting requirement to the Board on July 13, 2023, addressing requested elements. This included the results of structural and radiological inspections and an updated timeline for decommissioning activities.

The Board understands and supports DOE's approach to monitor conditions in the facility, particularly in the performance of structural integrity and radiological condition inspections, to ensure that safety risk is sufficiently mitigated for the remaining life of the facility. Until associated hazards are fully eliminated, the Board will continue to follow these monitoring efforts closely, along with design progress supporting eventual decommissioning of the facility.

Appendix B: Substantive Board Communications

The table below summarizes substantive Defense Nuclear Facilities Safety Board (Board) communications in 2023. All Board correspondence is available on the public website (www.dnfsb.gov), which aids in enhancing the Board's public outreach.

Table B-1. *Substantive Communications in 2023*

Congressional and Intragovernmental Outreach	
January 31	An update on agency activities to the Senate Appropriations Committee, Subcommittee on Energy and Water Development, and the House Appropriations Committee, Subcommittee on Energy and Water Development, on the budget
February 1	An update on agency activities to the Senate Armed Services Committee, Subcommittee on Strategic Forces and the House Armed Services Committee, Subcommittee on Strategic Forces
February 16	Briefing to staff of Senator Ben Ray Luján (D-NM)
March 2	Briefing to Senate Armed Services Committee, Subcommittee on Strategic Forces and the House Armed Services Committee, Subcommittee on Strategic Forces, on legislation
March 21	Briefing to the House Appropriations Committee, Subcommittee on Energy and Water Development, on the budget
July 14	Briefing to Senate Committee on Homeland Security and Government Affairs on legislation
July 28	An update on agency activities to House Appropriations Committee, Subcommittee on Energy and Water Development
October 23	Briefing to Senate Appropriations Committee, Subcommittee on Energy and Water Development, and the House Appropriations Committee, Subcommittee on Energy and Water Development, on issues covered in resident inspector weekly reports
Interactions with Senior Department of Energy Leadership	
January 25	Board discussion with Secretary's Senior Advisor for the Office of Environmental Management (EM-1)
January 31	Chair discussion with National Nuclear Security Administration (NNSA) Administrator (NA-1)
April 19	Vice Chair discussion with Deputy Administrator for Defense Programs (NA-10)
May 1	Board discussion with NNSA Administrator (NA-1)
August 10	Board discussion with Secretary's Senior Advisor for the Office of Environmental Management (EM-1)
September 14	Vice Chair discussion with Deputy Administrator for Defense Programs (NA-10)
September 22	Board discussion with Secretary of Energy
October 12	Board discussion with NNSA Administrator (NA-1)
December 7	Board discussion with Director of Office of Enterprise Assessments (EA-1)

Board Presentations at Conferences and Workshops	
March 1	Vice Chair remarks at Waste Management Symposia
June 14	Vice Chair presentation at Office of Environment, Health, Safety, and Security Emergency Management Assessment Working Group
June 22	Chair presentation at Energy Facility Contractors Group Annual Executive Council Meeting
September 12	Chair presentation at 2023 Nuclear & Facility Safety Programs Workshop
October 24	Chair speech at Citizens for Nuclear Technology Awareness Annual Teller Lecture
October 25	Vice Chair presentation at Energy Facility Contractors Group Cybersecurity Working Group 2023 Workshop
December 13	Vice Chair remarks at Department of Energy and National Nuclear Security Administration Emergency Management Issues Special Interest Group
Letters	
January 4	Pantex planned improvements
February 24	Safety-related welding at Pantex
February 24	Flammable gas hazards at Idaho National Laboratory
February 28	Safety bases at Hanford's Waste Treatment and Immobilization Plant
March 29	Adequate protection and oversight effectiveness at SRS
April 5	Savannah River National Laboratory safety basis review
June 20	Safety posture of Plutonium Facility at Los Alamos National Laboratory
June 27	Engineered controls for Hanford's 242-A Evaporator
July 13	DOE Safety Software Central Registry
August 3	Facility worker safety at Savannah River Plutonium Processing Facility
August 15	Seismic safety at the Plutonium Facility at Los Alamos National Laboratory
September 8	2022 Annual Safety System Oversight Award
September 8	2022 Facility Representative of the Year
October 4	Savannah River Tritium Enterprise safety issues
October 11	DOE's Benchmark Review Final Report for Aging Infrastructure Management
November 27	DOE's actions related to aging infrastructure management
November 28	Facility worker safety at Savannah River Plutonium Processing Facility
December 5	DOE Order 425.1D, *Verification of Readiness to Start Up or Restart Nuclear Facilities*
December 12	Documented safety analysis for the Device Assembly Facility at Nevada National Security Site
December 19	Fiscal Year 2023 summary of reviews of DOE safety directives and standards

Appendix C: List of Illustrations

Appendix D: List of Tables

Appendix E: Acronym List

CFR	Code of Federal Regulations
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
INL	Idaho National Laboratory
LANL	Los Alamos National Laboratory
LLNL	Lawrence Livermore National Laboratory
NNSA	National Nuclear Security Administration
NNSS	Nevada National Security Site
PULSE	Principal Underground Laboratory for Subcritical Experimentation
SNL	Sandia National Laboratories
SRNL	Savannah River National Laboratory
SRS	Savannah River Site
WIPP	Waste Isolation Pilot Plant

AFFIRMATION OF BOARD VOTING RECORD

SUBJECT: 34th Annual Report to Congress

Doc Control#: 2024-100-0011

The Board acted on the above document on 03/01/2024. The document was Approved.

The votes were recorded as:

	APRVD	DISAPRVD	ABSTAIN	NOT PARTICIPATING	COMMENT	DATE
Joyce L. Connery	✔	☐	☐	☐	☐	03/01/2024
Thomas Summers	✔	☐	☐	☐	☐	03/01/2024

This Record contains a summary of voting on this matter together with the individual vote sheets, views and comments of the Board Members.

Shelby Qualls
Executive Secretary to the Board

Attachments:

1. Voting Summary
2. Board Member Vote Sheets

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

NOTATIONAL VOTE RESPONSE SHEET

FROM: Joyce L. Connery

SUBJECT: 34th Annual Report to Congress

Doc Control#: 2024-100-0011

DATE: 03/01/2024

VOTE: Approved

COMMENTS:

None

Joyce L. Connery

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

NOTATIONAL VOTE RESPONSE SHEET

FROM: Thomas Summers

SUBJECT: 34th Annual Report to Congress

Doc Control#: 2024-100-0011

DATE: 03/01/2024

VOTE: Approved

COMMENTS:

None

Thomas Summers