Defense Nuclear Facilities Safety Board

31st Annual Report to Congress
March 2021

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 U.S.C. § 2286a(a)

Joyce L. Connery, Chair
Thomas A. Summers, Vice Chair
Jessie H. Roberson

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

March 23, 2021

To the Congress of the United States:

The Defense Nuclear Facilities Safety Board (Board) is pleased to submit to Congress its *31st Annual Report to Congress* for Calendar Year 2020. 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 Department of Energy (DOE) defense nuclear facilities.

During 2020, the Board continued to fulfill its public health and safety mission while addressing the challenges with the coronavirus disease 2019 (COVID-19) pandemic. As an expertise-based safety oversight agency, the Board's ability to perform its mission is dependent on its ability to ensure the safety and well-being of its workforce. In March 2020, the Board activated the Continuity of Operations Plan, which encouraged, and later required, most employees to telework and curtailed official travel. On-site resident inspectors were directed to follow DOE's guidance for the respective sites. On September 15, 2020, the Board approved its Pandemic Response and Recovery Plan. In February 2021, the Office of the Inspector General at the Nuclear Regulatory Commission reviewed this plan and verified its implementation.

The Board has proven its effectiveness while in maximum telework posture, despite the unexpected challenges of adapting work practices to remote work situations. On December 18, 2020, the Board successfully held a virtual open meeting, which it plans to use as a model for conducting future public hearings and meetings as required by conditions of the pandemic or future challenges. The Board hired several new employees, including an executive director of operations, a general counsel, a chief information officer, as well as other staff members. New hires were provided with comprehensive virtual orientations and training curricula. While the pandemic resulted in delays to some planned and ongoing activities and reviews, the Board was able to refocus efforts to reviews that could be completed via remote interactions.

The Board closely monitored DOE's pandemic response actions. In March 2020, DOE began ramping down operations at its defense nuclear facilities while maintaining work activities that supported primary mission essential functions. In response, the Board's staff established routine remote interactions with DOE program and field offices to gather information on and discuss DOE's rapidly evolving pandemic response actions. These interactions formed the basis for a case study of DOE's pandemic response actions. In its case

study conducted through July 2020, the Board's staff identified several opportunities for improvement and best practices that could help DOE improve its pandemic response actions. The Board communicated this information to DOE leadership on October 13, 2020.

As the pandemic extends into 2021, the Board continues to assess both its own internal response actions and DOE's response actions to evolving conditions. The Board will continue to study and adopt its own best practices aimed at minimizing the risk of the pandemic to its employees. The Board will continue to monitor DOE's defense nuclear facilities for potential impacts on nuclear safety.

As required by 42 USC § 2286e(a), this report describes the Board's accomplishments, current safety initiatives, assessments regarding improvements in the safety of defense nuclear facilities, unresolved safety issues, and more detail regarding the interface with DOE, which affects the Board's ability to execute its mission.

Respectfully submitted,

Joyce L. Connery

Joyce Connery
Chair

c: The Honorable Jennifer Granholm

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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—a complex with the mission to design, manufacture, test, maintain, and decommission nuclear weapons, 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, 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 2020. Foremost among these initiatives and issues were:

- ***Safety Control Strategies for Nuclear Explosive Facilities at Pantex***—On February 20, 2019, the Board transmitted Recommendation 2019-1, *Uncontrolled Hazard Scenarios and 10 CFR 830 Implementation at the Pantex Plant*, to the Secretary of Energy. The recommendation identified the following safety issues: (1) portions of the safety basis for Pantex nuclear explosive operations do not meet Title 10, Code of Federal Regulations, Part 830, *Nuclear Safety Management* (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. DOE accepted the recommendation, but the initial implementation plan provided by DOE's National Nuclear Security Administration (NNSA) in July 2019 did not adequately address the safety issues identified in the recommendation. After further interactions, including a public meeting held by the Board in December 2019 and staff-level discussions during 2020, NNSA transmitted a revised plan in June 2020 that the Board considers acceptable. 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. NNSA completed a number of the plan's deliverables in 2020 and is working to complete all of the identified safety improvements by September 2023.

- ***Safety of the Tritium Facilities at the Savannah River Site***—On June 11, 2019, the Board transmitted Recommendation 2019-2, *Safety of the Savannah River Tritium Facilities*, to the Secretary of Energy. The Board recommended that DOE (1) identify and implement near-term compensatory measures and long-term controls to prevent or mitigate potentially high radiological dose consequences, and

(2) evaluate the adequacy of emergency preparedness programs and upgrade them as necessary. DOE rejected the recommendation, both in its initial response in September 2019 and following the Board's reaffirmation in December 2019. On June 24, 2020, the Board provided the Secretary of Energy its evaluation of the ongoing and planned actions to improve safety that NNSA had cited in arguing that the recommendation was unnecessary and redundant. The Board noted the following concerns:

- The new safety basis NNSA cited in its rationale for rejecting the recommendation is projected to be implemented in 2025; moreover, it presents calculated dose consequences to co-located workers from multiple accident scenarios that are still nearly 100 times higher than DOE's guideline.

- The Tritium Facilities contractor's proposed actions to improve safety for the co-located workers do not include new engineered controls; instead they focus on refining accident analysis parameters or crediting existing structures to reduce the calculated dose consequences. The contractor does not expect to complete them until 2025.

- Although NNSA cites the proposed Tritium Finishing Facility as the primary long-term solution for improving safety at the Tritium Facilities, the new facility will not replace the facilities that contain the largest fraction of readily dispersible tritium.

The Board remains concerned about the safety of the Tritium Facilities and continues to monitor operations and actions to improve safety.

- ***Hazards Associated with the Material-at-Risk at Savannah River Site***—The Board issued Recommendation 2012-1, *Savannah River Site Building 235-F Safety*, on May 12, 2012. The recommendation identified the need for actions to reduce the hazards associated with the material-at-risk that remained as residual contamination within Building 235-F. In May 2020, DOE submitted a revised implementation plan under this recommendation, outlining significant changes to the overall strategy. In June 2020, DOE informed the Board that it has completed all actions identified in the revised implementation plan. The Board recognizes that DOE has taken positive steps to reduce the risks posed by the hazards in Building 235-F. However, the Board notes that the revised implementation plan focuses on reducing the risk by preventing fires, whereas the original strategy reduced risk by removing the material-at-risk from Building 235-F. The Board is concerned that the revised implementation plan does not ensure that DOE will maintain Building 235-F in a safe condition as the facility awaits its final end-state. On December 23, 2020, the Board issued a letter to DOE requesting a response within 60 days regarding DOE's intentions to address the Board's concerns. The letter included an enclosure that identified potential issues that might warrant further consideration as DOE moves forward to revise the implementation plan and complete the deactivation of

Building 235-F. These issues included (1) safety basis deficiencies associated with source term, hazards analysis, and controls; (2) inadequate confinement strategy; (3) fires impacting enclosure material-at-risk; (4) unprotected assumptions in independent fire evaluations and fire hazards analysis; (5) heavy reliance on safety management programs; and (6) unclear deactivation end points for Building 235-F.

- ***Flammable Gas Safety Strategy at Hanford Tank Farms***—Recommendation 2012-2, *Hanford Tank Farms Flammable Gas Safety Strategy*, identified the need for safety-related ventilation systems to aid in preventing flammable gas events in the double-shell tanks at the Hanford Tank Farms. The recommendation also identified the need to upgrade several other systems necessary to provide accurate and reliable indications of abnormal conditions associated with flammable gas events. DOE has addressed all the items outlined in its implementation plan. These actions have resulted in tangible safety improvements that provide adequate protection of the public and workers at the Hanford site. Based on these improvements, the Board closed Recommendation 2012-2 in a letter to the Secretary dated July 15, 2020.

- ***Safety of Solid Nuclear Waste***—DOE experienced two significant events in which waste drums released radiological materials due to energetic chemical reactions involving the waste: one event in 2014 at the Waste Isolation Pilot Plant and the other in 2018 at the Idaho National Laboratory. In 2020, the Board issued two reports to the Secretary of Energy relevant to these release events.

    - The first report highlighted safety issues and deficiencies with DOE Standard 5506, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities*. DOE is currently revising DOE Standard 5506 and the Board is working with DOE on safety improvements.

    - The second report, Technical Report 46, *Potential Energetic Chemical Reaction Events involving Transuranic Waste at Los Alamos National Laboratory*, determined that Los Alamos National Laboratory's facility safety bases do not consistently or appropriately analyze a potential energetic chemical reaction involving transuranic waste. As a result, additional credited safety controls may be necessary to protect workers and members of the public at these facilities.

- ***Interface with DOE***—The Board and DOE took several actions to improve their relationship and to address the communication challenges described in the *30th Annual Report to Congress*. Specifically, the Board increased communications with DOE across all organizational levels through a series of ongoing and routine meetings. DOE revised Order 140.1, *Interface with the Defense Nuclear Facilities Safety Board*, which addressed many of the Board's interface concerns. On October 29, 2020, the Board jointly with DOE provided a briefing to the Senate and House Armed Services Committees on progress and plans for resolving interface issues. Finally, the Board and DOE established a working group to develop a memorandum

of understanding that will improve communication, transparency, and better define key interface points between the two agencies. Overall, the Board is encouraged by these efforts, but more work is needed to restore the Board's long-standing productive relationship with DOE.

- ***Nuclear Safety Requirements***—On February 21, 2020, the Board issued Recommendation 2020-1, *Nuclear Safety Requirements*. The recommendation is intended to strengthen DOE's nuclear safety regulatory framework, such that it provides sufficient structure that both aging and new defense nuclear facilities continue to provide adequate protection. Specifically, the Board made recommendations in the areas of aging infrastructure, hazard categories, DOE approvals, and safety basis processes and requirements. On June 11, 2020, DOE rejected most of the Board's recommendations for reasons related to the ongoing rulemaking for 10 CFR 830, rather than on substantive technical grounds. In the cases where DOE indicated that it partially accepted the Board's recommendations, DOE neither engaged with the Board's technical arguments nor clearly identified actions that would address the Board's concerns. The Board sent a letter to DOE on September 25, 2020, expressing that it is well within the Board's jurisdiction to make recommendations related to DOE regulations, and that the Board expects DOE to accept or reject Board recommendations based on technical substance. The Board is continuing to evaluate DOE's response to the recommendation, as well as the final version of the revised 10 CFR 830, which DOE published on October 19, 2020. To that end, the Board conducted a virtual public meeting on December 4, 2020, during which members of the Board's technical staff presented information regarding the status of issues outlined in Recommendation 2020-1. The Board is currently considering its options.

- ***Technical Safety Requirements Implementation***—The Board's staff completed a review of practices for declaration and reporting of violations of technical safety requirements at defense nuclear facilities. The review found differing interpretations across the complex by DOE and contractor personnel on what constitutes a violation of technical safety requirements. The review identified concerns with a lack of requirements and guidance in applicable DOE directives. Due to these concerns, on August 7, 2020, the Board transmitted Technical Report 45, *Violations of the Nuclear Safety Basis*, to the Secretary of Energy. Technical Report 45 provides results of the review and outlines potential improvements.

- ***Salt Waste Processing Facility at Savannah River Site***—In August 2020, DOE approved Critical Decision-4, *Approve Start of Operations or Project Completion*, for the Salt Waste Processing Facility and issued an authorization to operate. However, maintenance and other issues delayed start-up of radiological operations until October 2020. In a September 29, 2020, letter to DOE, the Board acknowledged DOE's approval of this milestone and noted the Board's review activities toward

commissioning and the start of radiological operations. During and following start-up, the Board's staff closely monitored waste transfers, processing operations, shielding verification surveys, and start-up review boards.

The table below summarizes substantive Board communications in 2020. All Board correspondence is available on the public website (www.dnfsb.gov), which aids in enhancing the Board's public outreach.

Substantive Communications in 2020

Public Outreach	
February 28	Briefing to the New Mexico staff delegation on Sandia National Laboratories, Los Alamos National Laboratory, and the Waste Isolation Pilot Plant
July 31	Briefing to the House Armed Services Committee, Subcommittee on Strategic Forces on Lawrence Livermore National Laboratory
September 11	Briefing to the Senator Patty Murray's office on the Hanford Site
October 1	Resident inspector presentation on the state of nuclear safety at Los Alamos National Laboratory to the Princeton Program on Science and Global Security and Los Alamos Study Group workshop
October 29	Briefing to the House and Senate Armed Services Committees on a memorandum of understanding with DOE
October 30	Briefing to the House Appropriations Committee, Subcommittee on Energy and Water Development, and Related Agencies on a memorandum of understanding with DOE
November 28	Technical director presentation to Northern New Mexico Citizens' Advisory Board on transuranic waste safety at Los Alamos National Laboratory
Letters	
January 29	DOE Standard 5506, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities*
February 11	Board report, *Report to Congress—DNFSB Access to Information*, for the six-month period ending December 31, 2019
February 28	DOE's draft Revision A to Order 140.1, *Interface with the DNFSB*
March 4	A listing of DOE standards and their implementation that the Board selected for review in Fiscal Year 2020
April 16	Denial of Board's staff access to nuclear explosive safety deliberations at the Pantex Plant
May 13	Hoist control system used for lowering subcritical experiments at the Nevada National Security Site's U1a Complex
May 21	Request for access to documents from NNSA's Savannah River Field Office
May 29	Safety basis at the Waste Isolation Pilot Plant

Letters (continued)	
June 1	Storage of materials at the Highly Enriched Uranium Materials Facility at the Y-12 National Security Complex
June 3	NNSA's response on granting the Board's staff access to nuclear explosive safety deliberations at the Pantex Plant
June 23	Technical basis for the W88 weapon response
June 24	NNSA's proposed and ongoing actions for improving safety at the Savannah River Tritium Facilities
June 25	The hazard categorization of the Low-Activity Waste Facility at the Hanford Site
July 1	Board report, *Report to Congress—DNFSB Access to Information*, for the six-month period ending June 30, 2020
July 10	Implementation of the potential inadequacy of the safety analysis process across the DOE defense nuclear complex
July 15	Closure of Recommendation 2012-2, *Hanford Tank Farms Flammable Gas Safety Strategy*
August 4	Request for a meeting on development of a memorandum of understanding with DOE
August 6	Identification and control of safety basis and quality assurance requirements for construction projects at the Pantex Plant
August 7	Fire protection program at the Savannah River Site
September 16	Revised DOE Implementation Plan for Recommendation 2019-1, *Uncontrolled Hazard Scenarios and 10 CFR 830 Implementation at the Pantex Plant*
September 25	DOE's response to Recommendation 2020-1, *Nuclear Safety Requirements*
September 29	DOE's approval of Critical Decision-4 and authorization to operate the Salt Waste Processing Facility at Savannah River Site
October 14	Resolution of issues related to erosion and corrosion of piping, process vessels, and pulse-jet mixers for the Waste Treatment and Immobilization Plant at the Hanford Site
October 21	Revised safety basis for the Transuranic Waste Facility at Los Alamos National Laboratory
October 22	Joint DOE and DNFSB Memorandum of Understanding Working Group Charter
October 29	Management of high efficiency particulate air filters in the safety bases
December 8	Draft safety basis for the Hazard Category 3 upgrade to the Radiological Laboratory Utility Office Building at Los Alamos National Laboratory
December 23	Revised DOE Implementation Plan for Recommendation 2012-1, *Savannah River Site Building 235-F Safety*
January 19, 2021	DOE Standard 1027, *Hazard Categorization of DOE Nuclear Facilities*

Technical Reports	
August 7	*Violations of the Nuclear Safety Basis* (DNFSB/TECH-45)
September 24	*Potential Energetic Chemical Reaction Events Involving Transuranic Waste at Los Alamos National Laboratory* (DNFSB/TECH-46)
Public Meeting	
December 4	Board Recommendation 2020-1, *Nuclear Safety Requirements*
Recommendation	
February 21	Board Recommendation 2020-1, *Nuclear Safety Requirements*

In 2020, the Board's correspondence was accessed more than 7,000 times via its public website. The Board held one public and six closed meetings, which were accessed 1,738 times. In particular, the December 4, 2020, public meeting was accessed 410 times. Besides the 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 2020.

Access of Board Publications via Public Web Site in 2020

Type of Publication	Number of Times Documents Were Accessed
Resident Inspector Weekly Reports, Hanford Site	2,584
Resident Inspector Weekly Reports, Savannah River Site	2,875
Resident Inspector Weekly Reports, Los Alamos National Laboratory	3,144
Resident Inspector Weekly Reports, Y-12 National Nuclear Complex and Oak Ridge National Laboratory	2,260
Resident Inspector Weekly Reports, Pantex Plant	2,061
Letters, Technical Reports, Recommendations, and others	7,037

This annual report organizes the Board's oversight activities into four strategic areas: nuclear weapon operations; defense nuclear waste operations; design and construction of new defense nuclear facilities and major modifications to existing facilities; and safety standards and programs. Appendix A summarizes the status of all Board recommendations open in 2020.

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I. The Board's Statutory Mission

Congress established the Defense Nuclear Facilities Safety Board (Board) in 1988 as an independent federal agency within the executive branch of the government, subject to congressional oversight and direction. Five Board members, appointed by the President and subject to confirmation by the Senate, 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 his or her role as operator and regulator of Department of Energy (DOE) defense nuclear facilities, in 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 facilities operated by DOE that: have a function related to national defense; or 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. The table at the end of this section lists the major sites that the Board oversees.

The Board's oversight mission covers all phases in the life 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 statute 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 all takes place on the public record. In cases involving an "imminent or severe threat" to the public health and safety, the statute also requires the Board to send its recommendation to the President, who makes the final decision on actions to be taken.

In addition to recommendations, the Board is empowered to hold public hearings (and subpoena witnesses or documents, if necessary), conduct investigations, obtain information and documents needed for the Board's work from DOE and its contractors, and review and comment on DOE requirements and standards affecting safety at defense nuclear facilities. DOE is required by law to grant the Board prompt and unfettered access to such facilities, personnel, and information as the Board considers necessary to carry out its responsibilities. Finally, the statute authorizes the Board to seek assistance from other federal agencies (such as

the Nuclear Regulatory Commission) and from organizations outside the government (such as the National Academy of Sciences), as needed.

Congressional Directives

Since its creation in 1988, the Board has received directives from Congress related to internal management, its relationship with DOE, and specific safety issues at defense nuclear facilities. Recently, the Board has received multiple instructions from Congress via authorizations, appropriations, and related congressional reports. These instructions, and the status of the Board's responses, are summarized below.

Minimum Staffing Level

On multiple recent occasions, Congress has directed the Board to maintain adequate staffing levels to ensure the Board can carry out its important mission. Specifically, in the National Defense Authorization Act (NDAA) for Fiscal Year 2020, Congress directed the Board to maintain at least 100 full-time employees for Fiscal Year 2020. Additionally, in the Joint Explanatory Statement accompanying the Consolidated Appropriations Act, 2021, Congress directed the Board to ensure a minimum of 110 full-time employees. The Board is committed to maintaining adequate staffing to ensure robust oversight of DOE, consistent with Congress' direction. To that end, the Board has been aggressively recruiting for new members of the technical and administrative staff. At the beginning of Calendar Year 2020, the Board had 91 positions encumbered. By December 31, 2020, the Board had hired 17 employees, that when adjusted for attrition, resulted in a net gain of seven employees, a 7.7 percent increase to 98 positions. The Board also received employment commitments from an additional six employees before December 31, 2020. As a result, the Board added a total of 13 employees, increasing its staffing level by 14 percent to 104 positions. At 104 positions, the Board meets 94.5 percent of its hiring mandate.

Executive Director of Operations

In addition to the instruction regarding the Board's overall number of employees, the 2020 NDAA created a new senior management position at the Board. The Board recently hired a new executive director of operations. The executive director of operations supervises all technical and administrative employees of the Board, and performs other duties formerly carried out exclusively by the Chair.

Other Directives

On multiple occasions in the past year, Congress directed the Board to work with DOE to develop a bilateral memorandum of understanding to address the ongoing interface issues between the two agencies. The need for a memorandum of understanding was highlighted by the 2018 National Academy of Public Administration report, *Defense Nuclear Facilities Safety Board Organizational Assessment*. Both the Board and DOE have committed to developing a

memorandum of understanding and have recently commenced productive discussions to this end. More detail regarding this process and early results are in Section II of this report.

Draft Recommendation Process

Overview

The 2013 NDAA included the most substantial revision to the Board's recommendation process since the agency's creation in 1988. Under these revisions, the Board is required to provide the Secretary of Energy a copy of all draft recommendations at least 30 days prior to final issuance. This draft process is intended to ensure that the Secretary is adequately informed of a formal recommendation and to give the Secretary an opportunity to provide input to the Board before the recommendation is finalized. After the 30-day review and comment period, the Board considers any comments submitted by the Secretary and may subsequently issue a final recommendation, which the Secretary must publicly accept or reject.

Successes and Pitfalls

Since passage of the 2013 NDAA, when the draft recommendation process was added to its statute, the Board has issued several draft recommendations. The Board provided these draft recommendations and, when approved, final recommendations to DOE in conformance with the 2013 NDAA recommendation process. The Secretary provided comments on all draft recommendations, which generally resulted in minor Board revisions in the final recommendations, while the main thrust of the Board recommendations remained unchanged. Thus, the new recommendation process succeeded in giving the Secretary early notice and an opportunity to provide additional information and comments prior to Board issuance of the final recommendations, but had no substantial impact on the content of final recommendations.

Since the creation of the draft recommendation process in 2013, the Secretary has wholly rejected Recommendation 2019-2, *Safety of the Savannah River Tritium Facilities*, the first time the Secretary rejected a recommendation in the Board's history. The Secretary also rejected most of Recommendation 2020-1, *Nuclear Safety Requirements*. Although the Secretary accepted Recommendation 2019-1, *Uncontrolled Hazard Scenarios and 10 CFR 830 Implementation at the Pantex Plant*, the Board noted in its response to DOE's first implementation plan that "the language and terms of the Implementation Plan in fact reject significant parts of the Recommendation" (this issue was remedied in a revision to the implementation plan provided by DOE in 2020).

According to the Conference Report for the 2013 NDAA, the purpose of the draft recommendation process was to "improve collaboration" between the Board and DOE. Regarding the three most recent draft Recommendations 2019-1, 2019-2, and 2020-1, the Secretary's response to the draft recommendations did not offer additional technical information or comments to persuade the Board to re-perform any of its technical analyses, but instead focused on either procedural issues or the Board's evaluation of adequate protection.

The draft recommendation process did not assist the parties in coming to a shared safety understanding. Recent rejections and reaffirmations between the Board and DOE reflect divergent judgments that have persisted through the draft recommendation process. The Board is concerned that the draft recommendation process is not improving collaboration with DOE while causing delays in addressing safety issues.

The best way to ensure adequate protection and increase public confidence in the safety of the nuclear weapons and waste management programs is to maintain an independent safety oversight and recommendation process. The Board will endeavor to engage DOE with a dialogue about the best use of the draft recommendation process to come to a common understanding of safety issues.

Revision of the Strategic Plan

Following review of the National Academy of Public Administration's report of November 2018, the Board revised its strategic plan in November 2019. The revised strategic plan followed a reassessment of the Board's goals and objectives with an eye to improving interactions among staff, management, and the governing Board. The Board developed the revised strategic plan with an iterative process that engaged a broad swath of its employees, in addition to obtaining valuable input from the National Academy of Public Administration. The revised strategic plan has helped, and will continue to help, the Board emphasize technical excellence and improvement.

Revision of Board Policies and Directives

The Board has developed a plan to review and update its internal polices in light of various developments over the last few years, such as the creation of the executive director of operations position, various congressional directions, interface issues with DOE, and the National Academy of Public Administration's report. This plan commenced in 2020 with issuance of two new policy statements.

The first policy statement established the Board's expectations of collegiality for individual Board members in terms of policy setting and execution, maintenance of a quorum, and decision-making on delegations of authorities assigned to the Board. This policy statement was responsive to several recommendations in the National Academy of Public Administration's report regarding Board member relationships and collegiality.

The second policy statement established the Board's expectations with regard to access to DOE facilities, personnel, and information to carry out its statutory responsibilities. This policy statement also helps implement statutory changes in the 2020 NDAA and anticipates a new memorandum of understanding that will establish agreed-upon procedures to guide information access with DOE.

Major Sites Subject to the Board's Jurisdiction

Site	Location	Operations	Website
Hanford Site	Richland, Washington	Management and treatment of radioactive wastes; facility decommissioning	www.hanford.gov
Idaho National Laboratory	45 miles west of Idaho Falls, Idaho	Storage and processing of radioactive waste	www.inl.gov
Lawrence Livermore National Laboratory	Livermore, California	Research to support the nuclear weapons arsenal	www.llnl.gov
Los Alamos National Laboratory	Los Alamos, New Mexico	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, Nevada	Disposition of damaged nuclear weapons; critical and subcritical experiments; waste management	www.nnss.gov
Oak Ridge National Laboratory	Oak Ridge, Tennessee	Energy research; treatment and disposal of radioactive wastes	www.ornl.gov
Pantex Plant	17 miles northeast of Amarillo, Texas	Maintenance of the nuclear weapons stockpile	pantex.energy.gov
Sandia National Laboratories	Albuquerque, New Mexico	Nuclear research; support for the weapons stockpile maintenance program	www.sandia.gov
Savannah River Site	Aiken, South Carolina	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, New Mexico	Disposal of transuranic waste in underground repository	wipp.energy.gov
Y-12 National Security Complex	Oak Ridge, Tennessee	Manufacturing and surveillance of nuclear weapons components; processing of weapons-grade uranium	www.y12.doe.gov

II. Interface with DOE

In the *30th Annual Report to Congress*, the Board noted a decline in its historically strong and constructive relationship with DOE. This decline included DOE's publication of DOE Order 140.1, *Interface with the Defense Nuclear Facilities Safety Board*, which was issued in May 2018 without formal input from the Board. The order codified a major policy shift and introduced significant changes to DOE's interface with the Board, including restrictions placed on the Board's access to information that diminished the Board's ability to effectively perform its statutory mandate.

The NDAA for Fiscal Year 2020 amended the Atomic Energy Act of 1954 to clarify the Board's jurisdiction and DOE's responsibilities for granting the Board access to information, facilities, and personnel. This revision to the Atomic Energy Act resolved many of the problems that DOE's implementation of DOE Order 140.1 had on the ability of the Board to perform its mission.

In 2020, the Board and DOE took several actions to improve their relationship and address communication challenges. These actions are described below:

- *Interagency Communications*—Throughout 2020, the Board increased communications with DOE across all organizational levels through a series of ongoing and routine meetings. Specifically, the Board has periodic meetings with the Deputy Secretary and various under-secretaries, the Board's technical director and deputy technical director have weekly meetings with the departmental representative to the Board, and the Board's associate technical directors meet with DOE senior staff on a frequent basis. These meetings have proven to be invaluable at increasing transparency and communication between the Board and DOE.

  Additionally, on January 16, 2020, the Board issued a letter to the Secretary of Energy requesting a meeting to discuss key challenges facing the defense nuclear weapons complex. This meeting was delayed due to the coronavirus disease 2019 (COVID-19) pandemic. In an August 4, 2020, letter to the Secretary of Energy, the Board requested another meeting to focus on the development of a memorandum of understanding between the Board and DOE. The Board met with the Deputy Secretary of Energy on October 2, 2020, and on January 14, 2021.

- *DOE Order 140.1 Revision*—On June 15, 2020, DOE revised Order 140.1 to address the Board's interface concerns and to comply with the changes made in the NDAA. DOE solicited Board's input while revising the order, and the Board noted its satisfaction with a draft version in a February 28, 2020, letter to the Secretary of Energy. The Board and DOE also gave a joint briefing to staff members from the Senate and House Armed Services Committees on DOE Order 140.1 and its implementation, consistent with the request in *the Senate Armed Services Committee Report to Accompany the Fiscal Year 2021 National Defense Authorization Act.*

- *Memorandum of Understanding*—On October 22, 2020, the Board's staff and DOE signed a charter that established a working group to develop a memorandum of understanding that will provide the foundation to improve communication and transparency between the two agencies. The development of a memorandum of understanding was directed by Congress on numerous occasions, most recently in the *2021 NDAA Conference Report and Joint Explanatory Statement* accompanying the Consolidated Appropriations Act, 2021, and was also recommended by an October 2020 Government Accountability Office report, GAO-21-141, *DOE and the Safety Board Should Collaborate to Develop a Written Agreement to Enhance Oversight.*

- *Access to Information*—On February 11, and July 1, 2020, the Board issued its semi-annual reports to Congress documenting Board information requests denied by DOE. These reports were also provided to the Secretary of Energy and noted that the Board experienced a number of delays in access to information and identified two outright denials related to observing Pantex nuclear explosive safety deliberations.

  The Board provided the Secretary of Energy more detail on this denial in an April 16, 2020, letter. On April 23, 2020, the Administrator of the National Nuclear Security Administration (NNSA) responded that DOE would grant the Board's staff access to these safety deliberations. The Board issued a final reply on June 3, 2020, thanking the Secretary of Energy for affirming Board oversight of nuclear explosive safety evaluations.

Overall, the Board continues to work with DOE to improve communications and to resolve interface challenges. While the Board is encouraged by DOE's revision to Order 140.1 and the progress made on the joint memorandum of understanding, more work is needed to fully restore the Board's long-standing productive relationship with DOE.

III. Oversight during the COVID-19 Pandemic

In 2020, the Board continued to fulfill its public health and safety mission while addressing the challenges with the COVID-19 pandemic. As an expertise-based safety oversight agency, the Board's ability to perform its mission is dependent on its ability to ensure the safety and well-being of its workforce.

On March 13, 2020, the Board's Chair activated the *DNFSB Continuity of Operations Plan*, which encouraged, and later required, most employees to telework and curtailed official travel. On-site resident inspectors were directed to follow DOE's guidance for their respective sites. Subsequently, on September 15, 2020, the Board approved the *DNFSB Pandemic Response and Recovery Plan* (i.e., pandemic response plan). The plan implemented additional risk-reduction controls and best practices in accordance with the *National Guidelines for Opening up America Again*, Office of Personnel Management Memorandum M-20-23, and the Occupational Safety and Health Administration Guidance on Returning to Work. The agency is currently in Phase 1—*Minimum On-site Staffing* (i.e., remote operations, or maximum telework) of its pandemic response plan, with no specified date for the start of Phase 2—*Reduced On-site Staffing* (i.e., intermediate operations, or mixed telework and on-site work). Actions to contain the spread of COVID-19 among its workforce during Phase 1 include the implementation of maximum telework, workplace flexibilities, a self-screening checklist, facial coverings and social distancing requirements, and a contact-tracing program. In February 2021, the Office of the Inspector General at the Nuclear Regulatory Commission reviewed and verified that the Board has implemented the procedures and guidance as outlined in the *DNFSB Pandemic Response and Recovery Plan*. Subsequently, the Office of the Inspector General closed its congressionally directed pandemic plan review and recommendation.

The Board has proven its effectiveness while in maximum telework posture, despite the unexpected challenges of adapting work practices to remote work situations. Staff meetings and processes were modified to use the existing virtual private network, Skype, and teleconference capabilities, while new software capabilities such as Webex were subsequently acquired and deployed. The Board recently demonstrated these capabilities in its December 4, 2020, virtual open meeting, which it considers as an option for conducting future public hearings and meetings. Also, in 2020, the Board hired 13 new employees and provided them with comprehensive virtual orientations and training curricula.

While the COVID-19 pandemic resulted in delays to some planned and ongoing activities and reviews, the Board's staff was able to refocus efforts on technical reviews that could be completed via remote interactions, while resident inspectors conducted oversight in the field. In its *Fiscal Year 2021 Technical Review Plan*, the Board identified that 67 percent of its planned technical review activities can be completed without the need for official travel, while the remaining activities would resume when local and field conditions can support them again. The Board plans to resume routine travel during the second or third quarter of Calendar Year 2021 to begin work that has been temporarily delayed.

The Board closely monitored DOE's pandemic response actions. The Board's resident inspectors stationed at Hanford Site, Los Alamos National Laboratory, Savannah River Site, Pantex Plant, and Y-12 National Security Complex have continued to safely conduct on-site oversight throughout the pandemic. Dedicated members of the Board's headquarters staff—cognizant engineers—have upheld routine communications with Idaho National Laboratory, Lawrence Livermore National Laboratory, Nevada National Security Site, Sandia National Laboratories, and the Waste Isolation Pilot Plant. To maintain situational awareness, the Board instituted and began receiving weekly pandemic status briefings from resident inspectors and cognizant engineers responsible for oversight of DOE defense nuclear facilities. The Board's staff documented observed impacts of the pandemic on DOE in resident inspector weekly reports, and site cognizant engineer monthly reports, which are available on the Board's public website.

In March 2020, DOE began ramping down operations at its defense nuclear facilities while maintaining work activities that supported primary mission essential functions. In response, the Board's staff established routine remote interactions with DOE program and field offices to gather information on and discuss DOE's rapidly evolving pandemic response actions. These interactions with DOE were focused initially on how the pandemic affected the safety of nuclear operations at defense nuclear facilities, particularly facilities that continued to perform operations in support of primary mission essential functions. The interactions and status briefings formed the basis for a case study of DOE's pandemic response actions.

In its case study conducted through July 2020, the Board's staff identified several opportunities for improvement and best practices that could help DOE improve its pandemic response actions in the areas listed below. The Board communicated this information to DOE leadership on October 13, 2020.

- Potential safety impacts due to a rapid on-site staffing reduction
- Nuclear safety oversight commensurate with work activities and ongoing operations
- Regulatory relief and worker qualifications in a maximum telework environment
- Implementation of controls for protecting on-site personnel
- Guidance and processes for pandemic action decision-makers
- Implementation of safety equipment surveillances

As the pandemic extends into 2021, the Board continues to assess its own internal response actions and DOE's response actions to evolving conditions. The Board will continue to study and adopt best practices aimed at minimizing the risk of COVID-19 to its employees. At DOE defense nuclear facilities, the Board will continue to closely monitor for potential impacts on nuclear safety including training and qualifications; emergency response capability;

equipment surveillances per technical safety requirements; and potential staffing impacts on facility operations, maintenance, engineering, and DOE oversight.

IV. Nuclear Weapon Operations

In 2020, 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. For Los Alamos National Laboratory, the Pantex Plant, the Savannah River Tritium Enterprise, and the Y-12 National Security Complex, the Board maintained full-time resident inspectors to monitor operations. Cognizant engineers on the Board's headquarters staff are dedicated to monitoring Lawrence Livermore National Laboratory, Nevada National Security Site, and Sandia National Laboratories.

Pantex Plant

Revised Implementation Plan for Recommendation 2019-1

DOE accepted Recommendation 2019-1, *Uncontrolled Hazard Scenarios and 10 CFR 830 Implementation at the Pantex Plant*, on April 16, 2019, and transmitted its implementation plan to the Board on July 16, 2019. For additional background on Recommendation 2019-1, see the associated entry in Appendix A of this report. The Board found that the language and terms of the implementation plan rejected significant parts of the recommendation, and reaffirmed Recommendation 2019-1 in a letter to the Secretary of Energy dated August 22, 2019. The Board held a public meeting in December 2019 to receive briefings from NNSA on the deficient implementation plan and planned improvement activities. At the meeting, 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 allow elimination of both hand lifts of tools and swing arms in tooling. The Board and its staff will continue to review actions and deliverables associated with the revised implementation plan in 2021.

Design Agency Weapon Response Technical Bases

During 2020, the Board and its staff continued oversight of weapon response technical basis information developed by NNSA's nuclear weapon design agencies. The design agencies use this information in generating weapon response summary documents for incorporation into the safety bases for nuclear explosive operations at the Pantex Plant. The Board and its staff evaluated the adequacy of the design agency documentation; design agency processes for

generating and reviewing the documents; implementation of the revised DOE Standard 3016, *Hazard Analysis Reports for Nuclear Explosive Operations*; and NNSA oversight of the process.

In a June 23, 2020, letter to the Secretary of Energy, the Board communicated findings regarding the weapon response development process and resulting technical basis documentation for the W88 weapon program at Los Alamos National Laboratory, including an evaluation of the impacts of the revisions to DOE Standard 3016. The Board identified opportunities to bolster the technical underpinnings of the Pantex safety basis and noted the lack of independent federal review of the weapon response process and documentation used in developing the safety bases for Pantex nuclear explosive operations. DOE directives do not define expectations for such federal oversight, and the Board encouraged DOE to consider establishing requirements for federal oversight of the weapon response process. The W88 program represented the first application of new accident consequence categories for weapon response analysis outlined in the revised DOE Standard 3016—the Board found the revised consequence definitions and their application in developing the W88 weapon response documentation to be technically justified. However, the Board noted that the conservatism of weapon response information developed for weapon programs whose characteristics differ from the W88 will depend on how the responsible design agency applies the revised consequence definitions.

The Board and its staff continued a review of the weapon response process and resulting technical bases for the B61, W80, and W88 programs at Sandia National Laboratories. Observations from this review are similar to the observations from the review at Los Alamos National Laboratory (e.g., opportunities to improve the weapon response development process and underlying data, as well as the lack of federal oversight of the weapon response process). The Board and its staff plan to continue these reviews in 2021.

Nuclear Explosive Safety

During 2020, the Board and its staff provided oversight of a broad range of nuclear explosive operations at the Pantex Plant. The Board's staff assessed NNSA's operational safety review (a periodic evaluation of nuclear explosive safety for ongoing operations at Pantex) for the W78 program and evaluated proposed changes to the suite of controls that mitigates lightning hazards. In addition, the Board and its staff reviewed and commented on DOE directives governing nuclear explosive safety. During NNSA's revision of DOE Order 452.2, *Nuclear Explosive Safety*, and NNSA Supplemental Directive 452.2*, Nuclear Explosive Safety Evaluation Processes*, the Board's staff provided comments to improve these directives, which NNSA generally accepted.

In early 2020—as noted in the Board's April 16, 2020, letter to the Secretary of Energy—NNSA continued to deny the Board and its staff access to the deliberation phase of its nuclear explosive safety evaluations. However, after further correspondence, the NNSA Administrator agreed to restore this access for the Board and its staff (see the Board's June 3, 2020, letter to the Secretary of Energy). For additional detail on access to nuclear explosive safety deliberations, see Section II, *Interface with DOE*.

Quality Assurance of Structural Repairs

On August 6, 2020, the Board issued a letter to the Secretary of Energy delineating deficiencies in the identification and control of safety basis and quality assurance requirements for Pantex construction projects. The Board had previously identified deficient quality assurance for reinforced concrete construction during the replacement of the high-pressure fire loop lead-ins for the 12-98 cells at Pantex in 2016. The Pantex contractor subsequently determined the concrete placed during that work to be understrength, demolished it, and replaced it using appropriate quality assurance measures. In 2019–2020, the Board reviewed lead-in replacement for the 12-96 cell. The Board found improved quality assurance compared to the 12-98 lead-in replacement but observed that Pantex had not fully implemented the lessons learned from the 12-98 project, particularly related to identification and control of system requirements.

Construction for High-Pressure Fire Loop Lead-In Replacement

In response to the deficiencies in the 12-98 lead-in replacement project, the Pantex contractor created a new process to identify properly the system and quality requirements early in a construction project. However, the Pantex contractor did not implement this process for the 12-96 project, and several key construction documents again failed to identify the facility structure as safety class. The Board concluded the Pantex contractor could further improve and formalize the process for controlling safety basis and quality assurance requirements on construction projects. The Board also identified opportunities for improvement related to commercial grade dedication of procured items such as rebar splices used in structures credited to perform safety functions. On December 16, 2020, NNSA transmitted a letter to the Board, agreeing with the Board's concerns and identifying corrective actions to resolve them.

Conduct of Operations and Training & Qualification

Over the past year, the Pantex Plant has experienced various events and safety issues related to conduct of operations. Based on these events and experiences shared by Pantex employees, the Board began an evaluation of conduct of operations and the training and qualification programs at the Pantex Plant in 2020. As part of this review, the Board's staff assessed program documentation and discussed resulting questions with the NNSA field office and Pantex contractor personnel. Additionally, the Board's staff conducted on-site and remote interviews with more than 30 Pantex employees, gathering feedback on these programs and discussing areas for improvements. The Board plans to complete this review in 2021.

Los Alamos National Laboratory

Weapon Response Development

During 2020, the Board and its staff continued oversight of Los Alamos National Laboratory's weapon response development. For additional information, see the Pantex Plant entry, *Design Agency Weapon Response Technical Bases*, earlier in this section of this report.

Transuranic Waste Facility

During 2020, the Board's staff completed a review of the revised safety basis for the Transuranic Waste Facility at Los Alamos National Laboratory. The review assessed the adequacy of the facility's hazard analysis and control set and evaluated whether DOE addressed safety items documented in previously issued Board correspondence. In an October 21, 2020, letter to the Secretary of Energy, the Board concluded that: (1) all previously identified safety items regarding the Transuranic Waste Facility safety basis could be closed, and (2) the current safety basis did not adequately analyze the hazards associated with energetic chemical reactions involving transuranic waste. Energetic chemical reaction hazards in transuranic waste at Los Alamos National Laboratory are the subject of Technical Report 46, which is described further in the entry *Safety of Solid Nuclear Waste*, in Section V of this report.

Radiological Laboratory Utility Office Building

To support NNSA pit production goals, Los Alamos National Laboratory is upgrading the Radiological Laboratory Utility Office Building from a radiological facility to a Hazard Category 3 facility to be termed Plutonium Facility, Building 400 (i.e., PF-400). During 2020, the Board's staff completed a review of the draft safety basis and shared observations with Los Alamos National Laboratory personnel. In a December 8, 2020, letter, the Board noted that given the low proposed radiological inventory for the facility, it did not identify any safety issues related to the control strategy for radiological hazards. In the letter, the Board also highlighted important staff observations. These included the need to identify appropriate current codes and standards for the facility to address any gaps between the facility construction and current safety requirements, and the need to address self-identified deficiencies with the fire protection system relied upon for life safety expeditiously. The Board and its staff will continue following

Los Alamos National Laboratory's progress in addressing these observations as the laboratory undertakes readiness activities to support Hazard Category 3 operations.

Transuranic Waste Facility

Radiological Laboratory Utility Office Building

Review of Credited Safety Systems in Defense Nuclear Facilities

During 2020, the Board's staff began a review of 10 selected safety systems from three defense nuclear facilities at Los Alamos National Laboratory: the Weapons Engineering Tritium Facility; the Plutonium Facility, Building 4 (i.e., PF-4); and the Transuranic Waste Facility. The primary objective of the staff's review was to ensure the selected systems can perform their credited safety functions reliably. In addition, the staff used the data from this review to analyze

the effectiveness of the cognizant system engineer program at Los Alamos National Laboratory and safety system oversight by the NNSA Los Alamos Field Office. The staff completed interactions with Los Alamos National Laboratory's personnel in 2020 and will finalize the results of its review in 2021.

Plutonium Facility Seismic Performance

Los Alamos National Laboratory is conducting a seismic performance reassessment project for the Plutonium Facility, Building 4, to address a seismic expert panel's prior recommendations. The goal of the project is to evaluate the performance of the facility's structure during an earthquake to ensure it can maintain confinement and remain operable. The Board's staff has followed the progress of the reassessment, attended workshops, and discussed its questions and comments with project personnel. The project team recently completed the first phase and is currently calculating an interim seismic risk for the facility.

Plutonium Facility Column Capital Testing at the University of Nevada

One of the efforts under the seismic performance reassessment project is to conduct column capital testing to determine, via full-scale testing, the seismic vulnerability of column-

capital-slab assemblies that support the laboratory floor of the Plutonium Facility. Los Alamos National Laboratory conducted limited laboratory testing of column capitals representative of those found in the Plutonium Facility to determine the actual extent of damage that would occur in a seismic design basis event. The Board's staff reviewed the testing program, which has been successfully completed. Results indicate that the Plutonium Facility's column capitals will perform as designed during an earthquake. NNSA expects to complete the entire seismic performance reassessment project in 2022.

Public Outreach

On October 1, 2020, one of the Board's resident inspectors assigned to Los Alamos National Laboratory participated in a workshop conducted by the Princeton Program on Science and Global Security and the Los Alamos Study Group. The workshop centered on issues regarding production of plutonium pits and was well attended by federal and state government officials. The resident inspector presented on the state of nuclear safety at Los Alamos National Laboratory.

Y-12 National Security Complex

Reactive Hazards of Materials Stored at the Highly Enriched Uranium Materials Facility

The Board's staff completed a review focused on the safety of special nuclear materials at the Highly Enriched Uranium Materials Facility at the Y-12 National Security Complex. In 2018, Y-12 personnel discovered that certain materials in the facility were not authorized for long-term storage per safety basis documents in place when the materials were discovered. As a result, NNSA approved changes to the safety basis to allow continued storage of the materials. The Board's staff evaluated the rationale for the safety basis changes and reviewed a Y-12 strategy to reduce risk site-wide by transferring nuclear materials from aging Y-12 facilities to the Highly Enriched Uranium Materials Facility.

In a June 1, 2020, letter to the Secretary of Energy, the Board communicated that materials discovered in the Highly Enriched Uranium Materials Facility that were not authorized in the safety basis and materials transferred to the facility as part of the Y-12 risk reduction strategy have neither been fully characterized nor confirmed to be chemically stable. While the Highly Enriched Uranium Materials Facility is more robust than alternative storage facilities at Y-12, the Board could not conclude, based on the available knowledge, whether the risk from potential energetic events was acceptable. The Board requested that NNSA provide a briefing on the strategies to protect the facility worker from energetic events initiated inside storage containers, actions to ensure materials received and already stored at the facility are suitable for prolonged storage, and the disposition path of materials determined unsuitable for storage at the Highly Enriched Uranium Materials Facility.

On August 25, 2020, NNSA briefed the Board on its strategy for the safe storage of materials at the Highly Enriched Uranium Materials Facility. The briefing addressed the actions taken by NNSA to date and NNSA's planned disposition strategy. The Board's staff continues to

monitor NNSA's progress on the disposition of unsuitable materials currently stored at the Highly Enriched Uranium Materials Facility.

Highly Enriched Uranium Materials Facility

Nuclear Criticality Safety Program

The Board has expressed concern to the Secretary of Energy regarding nuclear criticality safety at the Y-12 National Security Complex. This included issuing a letter on July 25, 2019, that detailed deficiencies in the performance of the contractor's nuclear criticality safety program, continuing discoveries of unexpected uranium accumulation in equipment and process areas, and insufficient oversight of nuclear criticality safety by the NNSA Production Office. In October 2019, because of the Board's concerns, the full Board conducted its first trip in several years to receive on-site briefings and to conduct field observations. Since then, the Board has observed improvement in the areas that most directly contributed to the uranium accumulation problems; however, the Y-12 contractor continues to experience challenges with implementing and maintaining all of the elements necessary for a healthy nuclear criticality safety program. The Board's resident inspectors have documented events that highlight such challenges in their weekly reports.

The Board is continuing to monitor actions by the NNSA Production Office and the Y-12 contractor to address areas for improvement. During 2020, the Board's staff initiated follow-up reviews of the overall Y-12 nuclear criticality safety program, including an assessment of efforts by the Y-12 contractor and the NNSA Production Office to address the issues identified in the Board's July 25, 2019, letter and an evaluation of fissile material holdup in out-of-service equipment in Y-12's uranium facilities. These reviews are planned to be completed in 2021. Additionally, the Board's staff completed a review of the Y-12 contractor's use of "technical deviations" to manage minor issues related to compliance with nuclear criticality safety requirements. The Board's staff found no safety issues during this review. The Y-12 contractor

instituted new guidance for approval of such non-compliances in 2019 and initiated dispositioning legacy technical deviations that do not meet the new guidance.

Savannah River Site

Savannah River Tritium Facilities

The Board remains concerned with the risk to workers and the public associated with the Savannah River Tritium Facilities. On June 24, 2020, the Board transmitted a letter to the Secretary of Energy providing its evaluation of NNSA's proposed and ongoing actions related to Recommendation 2019-2, *Safety of the Savannah River Tritium Facilities*. For additional background on Recommendation 2019-2, see the associated entry in Appendix A of this report. NNSA had cited a new safety basis as part of its rationale for rejecting the recommendation; however, the contractor's projected implementation date for the new safety basis is in 2025. In addition, the new safety basis presents calculated dose consequences to co-located workers from multiple accident scenarios that are still nearly 100 times higher than DOE's guideline.

NNSA directed the contractor to develop a risk reduction strategy for co-located workers. The contractor's proposed actions are focused on refining accident analysis parameters or crediting existing structures to reduce the calculated dose consequences in the safety basis and do not include implementing new engineered controls. Furthermore, the contractor does not expect to complete all the actions until 2025. The Board's staff will continue evaluating DOE's progress on its proposed actions.

NNSA points to the proposed Tritium Finishing Facility as its primary long-term solution for improving safety at the Savannah River Tritium Facilities. The Board's staff is currently conducting a review of the conceptual design of the new facility. The Board notes that the Tritium Finishing Facility will not replace the facilities that contain the largest fraction of readily dispersible tritium and is not projected to begin operations until sometime between the fourth quarter of Fiscal Year 2029 and the fourth quarter of Fiscal Year 2031. For additional information, see the Tritium Finishing Facility entry in Section VI of this report.

Nevada National Security Site

U1h Hoist Control System at the U1a Complex

The Board's staff completed a review of the U1h hoist control system for the U1a Complex at Nevada National Security Site. The U1h hoist control system is credited to safely lower a subcritical experiment package into the underground U1a Complex. In a letter dated May 13, 2020, the Board communicated to the Secretary of Energy its concerns with the design and qualification of the system, adding to a software quality assurance concern related to the system that the Board communicated to the Secretary of Energy on December 19, 2018. These issues exist because the current system was not designed for a nuclear safety function and was recently upgraded in safety classification. The Board communicated these concerns to aid an evaluation being undertaken by NNSA and its contractor to identify and execute needed safety

improvements for the hoist systems at the U1a Complex. The Board's staff plans to review the evaluation and determine whether NNSA addresses the Board's concerns.

U1h Hoist at the Nevada National Security Site U1a Complex

Sandia National Laboratories

Weapon Response Development

During 2020, the Board and its staff continued oversight of weapon response development at Sandia National Laboratories. For additional information, see the Pantex Plant entry, *Design Agency Weapon Response Technical Bases*, earlier in this section of this report.

Lawrence Livermore National Laboratory

Transuranic Waste Shipping Campaign

In late 2019, as part of the overall efforts to restart transuranic waste shipping, Lawrence Livermore National Laboratory's staff completed a readiness assessment for loading transuranic waste into Transuranic Package Transporter Model II (i.e., TRUPACT-II) shipping containers. The readiness assessment encompassed all aspects of the shipping container loading activities and demonstrated that the radioactive and hazardous waste management staff could successfully complete the loading operation. The Board's staff provided close oversight of this readiness assessment. On March 27, 2020, the NNSA Livermore Field Office completed its readiness assessment for the loading operations and authorized re-start. Transuranic waste shipping activities began in mid-September 2020. Lawrence Livermore National Laboratory shipped 624 drums and 13 standard waste boxes of transuranic waste for permanent disposal. The eighteenth, and final, shipment of the 2020 campaign departed on October 30, 2020. The laboratory plans another shipping campaign in early 2021. The Board's staff plans to follow these activities.

Transuranic Waste Shipment Departing Livermore on October 30, 2020

V. Defense Nuclear Waste Operations

In 2020, 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. For the Hanford and Savannah River sites, the Board maintained full-time resident inspectors to monitor operations. In addition, from August through December, the Board stationed an interim resident inspector at the Hanford Site, as the first step toward increasing resident inspector manning to three permanent staff members at the Hanford and Savannah River sites, and Los Alamos National Laboratory.[1] For selected sites at which Environmental Management operations are not the primary activity, such as Oak Ridge National Laboratory and Los Alamos National Laboratory, the Board maintained coverage using resident inspectors assigned nearby and dedicated members of the Board's headquarters staff. Cognizant engineers on the Board's headquarters staff are dedicated to monitoring Idaho National Laboratory and the Waste Isolation Pilot Plant.

Safety of Solid Nuclear Waste

DOE has experienced two significant waste events in the past decade—one in February 2014 at the Waste Isolation Pilot Plant and another in April 2018 at Idaho National Laboratory—in which waste drums released radiological materials due to energetic chemical reactions involving the waste. As a result, the Board has been evaluating how DOE analyzes hazards and implements controls at facilities that generate, process, and store radioactive waste. Since the event at the Waste Isolation Pilot Plant, the Board has communicated several safety issues and deficiencies to DOE through a variety of correspondence and public hearings (see the *30th Annual Report to Congress* for more information). These Board initiatives identified common themes, including the need for:

- Chemical compatibility evaluations for waste containers stored at waste generator sites that have not yet been certified for shipment to the Waste Isolation Pilot Plant;
- Development of a technically defensible release fraction for energetic chemical reaction events based on the observed amount of material released in recent radiological release events;
- Improvements to control strategies to protect against energetic chemical reactions; and
- Revision of DOE Standard 5506, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities*, to address these deficiencies.

[1] On September 24, 2019, the Board voted to increase the resident inspector staffing from 10 to 13 full time positions. The COVID-19 pandemic delayed staffing of additional resident inspector positions. The Board has advertised the openings, received applications, and will conduct interviews to fill the positions in Fiscal Year 2021.

DOE began the process of revising DOE Standard 5506 in 2019. On January 29, 2020, the Board issued a letter to the Secretary of Energy highlighting specific areas of concern that DOE should address during the revision process. Selected topics included:

- *Chemical Compatibility Evaluations*—The 2007 version of DOE Standard 5506 does not require a chemical compatibility evaluation to identify potential undesired chemical reactions. Waste generator sites may generate, process, and store wastes indefinitely without performing such an evaluation. The Board concluded that the revision to DOE Standard 5506 would be enhanced by including requirements, methods, and criteria for a chemical compatibility evaluation that is documented, comprehensive, and performed at the generator sites.

- *Defensible Release Fractions*—The Board advised DOE to incorporate information about the release fractions from both the 2014 event at the Waste Isolation Pilot Plant and the 2018 event at Idaho National Laboratory into the revised standard.

- *Controls for Chemical Reaction Events*—The Board noted that the revised standard should address controls for chemical reaction events. Also, application of the defense-in-depth approach would help reduce the risks involved in managing wastes of uncertain composition. Presently, DOE often stores waste in locations without confinement ventilation, and sometimes without the capability for timely detection of release events that workers have not directly observed.

- *Flammable Gas Hazards*—The Board advised that the revised standard discusses deflagrations in vented containers. Considerations include how quickly flammable gases are generated and vented, measurement of flammable gas concentrations, controls to minimize ignition potential, and controls to mitigate the consequences of deflagrations.

- *Container Performance*—The Board noted that the assumptions in the standard about how waste containers perform in fire and deflagration scenarios should be revised to have a conservative and defensible technical basis reflecting available data.

- *Implementation of the Standard*—Given the potential major changes in the revised standard, and the information gathered from the two recent events, the Board concluded that an urgent approach to implementation of the revised DOE Standard 5506 is warranted.

Over the course of 2020, the Board's staff has worked with the DOE team that is revising DOE Standard 5506 to resolve the concerns highlighted in the letter, as well as additional concerns that the Board's staff provided via the DOE review, comment, and approval system in July 2020. The Board will evaluate how DOE proposes to resolve these concerns in early 2021.

In a related action, on September 24, 2020, the Board issued Technical Report 46, *Potential Energetic Chemical Reaction Events involving Transuranic Waste at Los Alamos National Laboratory*, to the Secretary of Energy. This report built upon previous Board efforts and provided a site-specific case study on how the safety bases for several different facilities at Los Alamos National Laboratory treat the hazards posed by energetic chemical reactions. In the report, the Board determined that these safety bases do not consistently or appropriately consider a potential energetic chemical reaction involving transuranic waste. Examples include:

- Hazard analyses lack systematic evaluations of the chemical compatibility of transuranic waste streams. These analyses are needed to fully identify potential chemical reaction hazards associated with waste constituents.

- Accident analyses are not bounding, assume inappropriate initial conditions, and do not defensibly estimate the quantity of radioactive material that may be released due to an energetic chemical reaction. As such, additional credited safety controls may be necessary to protect workers and the public.

- Some facilities store transuranic waste without any engineered controls beyond the waste container. The radiological release events that occurred at the Waste Isolation Pilot Plant and Idaho National Laboratory have demonstrated the importance of incorporating multiple layers of protection to reduce the consequences of an accident.

The Board requested that DOE provide a report in response to Technical Report 46 that describes whether the hazards associated with the current transuranic waste container population at Los Alamos National Laboratory are consistently and adequately controlled, and whether the revision to DOE Standard 5506 will address the broader implications of Technical Report 46, as the concerns are applicable to other DOE sites. At year's end, DOE was determining its response to the Board's request. The response due date has now been set to March 19, 2021.

Savannah River Site

In 2020, the Board worked closely with DOE personnel as they continued actions identified in response to Recommendation 2012-1, *Savannah River Site Building 235-F Safety*. Recommendation 2012-1 identified the need for DOE to take actions to reduce the risk to co-located workers near Building 235-F. For additional background on Recommendation 2012-1, see the associated entry in Appendix A of this report. The Board also continued to provide oversight of the commissioning of the Salt Waste Processing Facility, which achieved Critical Decision-4, *Approve Start of Operations or Project Completion*, this past year. For additional information, see the Salt Waste Processing Facility entry in Section VI of this report.

In the *30th Annual Report to Congress*, the Board articulated its plan to hold a public hearing at Savannah River Site in 2020 to discuss with DOE actions to improve safety. The public hearing was scheduled for March 19, 2020, and the agenda included three topics: the

risk to co-located workers near Building 235-F; federal oversight and technical staffing needs; and the significant safety risk to workers due to high-consequence accident scenarios at the Savannah River Tritium Facilities. The Board and DOE struggled with the availability of proposed witnesses for the hearing, and that, coupled with the COVID-19 pandemic, necessitated a postponement. In 2021, the Board will determine whether specific agenda topics still warrant a public hearing at Savannah River Site.

Review of Savannah River Site Fire Protection Program

In a letter to the Secretary of Energy dated August 7, 2020, the Board informed DOE that it had completed a review of the Savannah River Site fire protection program, and found that expected elements of the program had been developed, implemented, and were functioning adequately. The Board also communicated five program-related items that DOE should consider for improvement:

- The current arrangement of mobile compact shelving in the Savannah River National Laboratory classified document vault presents a special fire hazard that has not been properly analyzed.

- The new A-Area water supply is not completely safety-significant and does not have sufficient technical safety requirement surveillances, which may prevent the safety-significant automatic sprinkler system at the Savannah River National Laboratory from meeting its safety function.

- Some fire protection records were inconsistent with requirements and standards, or contained inaccuracies, potentially leading to missed problems, missed trends, difficulties in problem resolution, and lack of confidence in operations.

- The Savannah River Site fire department has had issues with excessive turnout time, a high number of nuisance alarm responses, lack of analysis in the annual fire department report, and radio communications.

- Formal, site-wide evaluation of fire protection metric data is limited to impairments, fire protection system uptime, staffing, corrective action tracking, and fire extinguisher inspections. This limitation could lead to missed site-wide issues for other fire protection topics such as fire prevention, life safety, combustible controls, fire watches, hot work, fire barrier inspection, and fire suppression inspection and testing, which are only evaluated on a facility or area basis.

Since the publication of the August 2020 Board letter, the Board's staff has discussed the status of the A-Area water supply with the Office of Environmental Management and is awaiting a more in-depth response from DOE on this topic.

Hanford Site

At the Hanford Site, the Board continued to provide oversight of several design and construction projects intended to support the disposition of radioactive waste stored in 177 underground tanks, including multiple components of the Waste Treatment and Immobilization Plant. For additional information on these design and construction projects, see the Waste Treatment and Immobilization Plant entry in Section VI of this report. The Board also focused on oversight of important deactivation and decommissioning efforts in progress at several locations across the site. Additionally, the Board remains involved in overseeing the continued safe storage of solid and liquid waste on site pending its ultimate disposition.

In 2020, the Board closed Recommendation 2012-2, *Hanford Tank Farms Flammable Gas Safety Strategy*. Recommendation 2012-2 identified the need for safety-related ventilation systems to aid in preventing flammable gas events in the double-shell tanks at the Hanford Tank Farms. The recommendation also identified the need to upgrade several other systems necessary to provide accurate and reliable indications of abnormal conditions associated with flammable gas events. For additional background on Recommendation 2012-2, see the associated entry in Appendix A of this report.

Double-Shell Tank Safety Significant Air Flow Monitoring Equipment

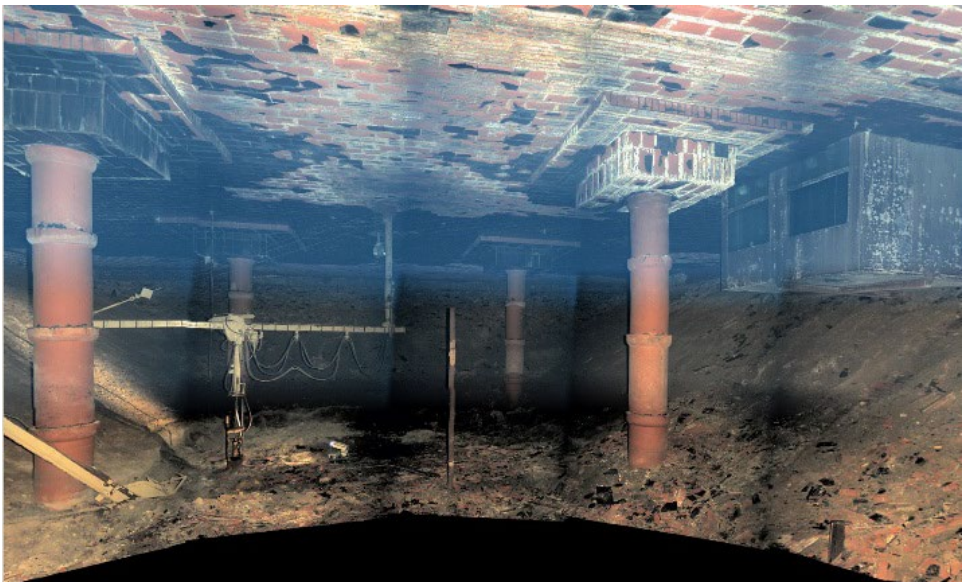
Deactivation and Decommissioning of the Plutonium Finishing Plant

In 2020, the Board's oversight of the demolition activities of the Plutonium Finishing Plant continued to focus on DOE's control of radioactive contamination and the implementation of corrective actions established to avoid recurrence of the conditions that caused contamination spread events in 2017. It is instructive to observe the effort Hanford Site personnel invested in reframing work processes and controls throughout 2020 to adjust to changing conditions and constraints.

Following the completion of high hazard structural demolition work at the Plutonium Finishing Plant in January 2020, the contractor transitioned to the lower hazard activities of lesscontaminated debris removal and site clean-up. In February 2020, project personnel demonstrated the procedure for retrieval, packaging, and removal of the more highly contaminated debris at the Plutonium Reclamation Facility that had been previously covered by soil and fixative as a contamination control measure. Strong workforce involvement contributed to improved housekeeping, contamination control, and waste management.

In April 2020, productivity slowed due to control measures instituted in response to the COVID-19 pandemic, as well as the need to conserve personal protective equipment that was in short supply because of the pandemic. During the pause in higher hazard work, the contractor continued activities necessary to prevent contamination spreads in the idle demolition area and reconfigured its support buildings to facilitate social distancing during pre-job meetings and other necessary work gatherings.

In July 2020, DOE directed the contractor to stabilize three structurally weak, highly contaminated, underground structures (known as "cribs") located within the work control boundary of the Plutonium Finishing Plant to remove the possibility of a subsidence similar to the 2017 PUREX tunnel collapse. As of December 2020, one of the three underground structures had been partially stabilized. The contractor will complete stabilization of that structure and the other two underground structures before resuming retrieval of the remaining higher hazard debris. Project personnel are also demolishing unused mobile offices that were contaminated in 2017 as part of the broader clean-up mission at the Plutonium Finishing Plant. The Board continues to monitor closely ongoing stabilization and debris removal activities.



216-Z-9 Crib on June 8, 2007

216-Z-9 Crib on December 15, 2020

Building 324 Preparatory Work for Remote Soil Excavation

In November 2009, DOE discovered that radioactive contamination had migrated into the soil underneath the B-Cell of Building 324. DOE paused the in-progress deactivation and decommissioning project until it could remediate the condition and remove the environmental hazard to the Columbia River. In 2019, the contractor began preparatory building stabilization activities that required disturbing the contaminated soil. In November 2019, contractor management stopped all work, except for min-safe operations in Building 324 radiological areas in response to a skin contamination event and a negative trend of increased contamination control incidents. Consequently, DOE directed that work in radiologically contaminated areas within the facility remain paused until the contractor developed corrective actions, briefed DOE, and obtained concurrence on a path forward.

In 2020, the Board's oversight of DOE's ongoing soil retrieval activities focused on the development and implementation of corrective actions to address the contamination control issues. In April 2020, contractor management approved the Building 324 Resumption Team's root cause analysis and corrective action plan to improve radiological control at the facility. The corrective action plan provided a phased approach for returning to high hazard radiological work at the facility.

In September 2020, one of the Board's resident inspectors observed a contractor management review of high contamination area training for Building 324. The training was designed to significantly improve the ability of facility personnel to learn and demonstrate useful radiological skills applicable in high contamination environments, especially related to the use of personal protective equipment. The contractor is implementing the training program under constrained conditions resulting from COVID-19 pandemic controls and limited availability of personal protective equipment. As of December 2020, work in radiologically

contaminated areas remains paused while the contractor continues to implement other corrective actions. Work at the facility will move forward once the full suite of corrective actions is complete and after the execution of an ongoing contract transition.

Mock-up Facility Configured for Building 324 High Contamination Area Training

The Board's staff completed a review of the structural changes DOE is using to stabilize the hot cells of Building 324 while removing the contaminated soil. The review confirmed the adequacy of the approach but noted potential constructability concerns to inform the Board's oversight activities. The Board will continue to monitor DOE and contractor efforts to improve radiological controls and implement them more effectively.

Los Alamos National Laboratory

Most of the operations at Los Alamos National Laboratory fall under the purview of NNSA and are discussed in Section IV of this report. However, the laboratory has a dedicated Office of Environmental Management field office, and separate management and operations contractor. The Board has continued to focus on a review of transuranic waste generation, processing, and storage operations at Los Alamos National Laboratory, as well as the status of the safety basis associated with the laboratory's Area G.

On September 24, 2020, the Board issued Technical Report 46, *Potential Energetic Chemical Reaction Events involving Transuranic Waste at Los Alamos National Laboratory*, to the Secretary of Energy. This topic is discussed in the entry *Safety of Solid Nuclear Waste*, earlier in this section of this report.

Public Outreach

On November 18, 2020, the Board's technical director presented a briefing to the Northern New Mexico Citizens' Advisory Board on the state of nuclear safety for legacy waste

clean-up operations at Los Alamos National Laboratory, as well as the Board's interface with DOE. This was the Board's first invitation to present to this advisory board, and based upon the positive reception, other presentations may follow.

Transuranic Waste Containers Staged Inside the Plutonium Facility

Oak Ridge Environmental Management

In 2020, the Board followed the Office of Environmental Management's efforts to process and clean up legacy waste. DOE has a small but active portfolio of operations that fall within this scope at Oak Ridge National Laboratory. It ranges from sorting, processing, and shipping activities at the Transuranic Waste Processing Center to removal of uranium-233 stored in Building 3019, which involves associated discrete processing campaigns housed in Building 2026.

Nuclear Criticality Safety for the Building 2026 Oak Ridge Oxide Processing Campaign

The Oak Ridge Oxide Processing campaign is a project in Building 2026 at Oak Ridge National Laboratory designed to extract thorium-229 from selected uranium-233 materials for medical applications. The campaign is one of DOE's projects to treat and transform the inventory of uranium-233 stored at Building 3019 into a low-level waste form suitable for disposition, and, in this case, to obtain a useful material as a beneficial by-product.

In 2019, the Board evaluated the safety basis of the Oak Ridge Oxide Processing campaign including provisions for nuclear criticality safety per the requirements of DOE Order 420.1C, *Facility Safety*, and the American National Standards Institute/American Nuclear Society (ANSI/ANS) 8.1 standard, *Nuclear Criticality Safety in Operations with Fissionable Material Outside Reactors*. In a December 4, 2019, letter to the Secretary of Energy, the Board identified a concern with incomplete criticality safety analysis. In response, DOE and its contractor provided an updated criticality safety evaluation that included important details on

establishing a defensible maximum mass inventory of uranium-233 and a project mass limit that meets the requirements of the ANSI/ANS 8.1 standard. DOE also revised the safety basis to include a new specific administrative control to limit processing to one uranium-233 canister at a time for criticality safety purposes. The Board found the revised safety basis and established criticality safety controls to be an improvement.

Idaho National Laboratory

In 2020, The Board's primary interests at Idaho National Laboratory centered on DOE's efforts to achieve start-up of the Integrated Waste Treatment Unit, and the development and application of lessons to be learned from the 2018 drum over-pressurization event. The latter focus area is discussed in detail in the entry *Safety of Solid Nuclear Waste*, earlier in this section of this report.

Integrated Waste Treatment Unit

The Integrated Waste Treatment Unit is designed to process approximately 900,000 gallons of liquid radioactive sodium-bearing waste, which is now stored at the Idaho Nuclear Technology and Engineering Center tank farm, as well as newly generated liquid waste from the center. In 2020, Integrated Waste Treatment Unit personnel continued to perform system maintenance and modification work activities. Resequencing of planned field activities was necessary due to COVID-19 pandemic constraints, which significantly delayed the planned start of readiness activities and commencement of radiological operations.

Full-Scale Mock-up of Canister Decontamination Testing

Revised DOE schedules call for the start of a contractor readiness assessment in early Calendar Year 2021 to confirm that plant modifications perform as designed. The contractor readiness assessment will be followed by a federal readiness assessment. After a confirmatory simulant run, separate contractor and federal readiness assessments will follow to demonstrate

full plant operability and contractor preparedness for radiological operations. The Board will continue to follow activities leading to the start-up of Integrated Waste Treatment Unit radiological operations.

Waste Isolation Pilot Plant

The Board continued to provide oversight of Waste Isolation Pilot Plant operations, the National Transuranic Program, and construction projects intended to increase underground ventilation, including the Utility Shaft Project and the Safety Significant Confinement Ventilation System Project. These construction projects are discussed in detail in Section VI of this report. In the interim, Waste Isolation Pilot Plant management is preparing to bring the 700-C Fan, an unfiltered exhaust fan, back online under specific operating conditions to improve underground airflow. The Board has observed some improvements in the contractor self-assessed areas but identified the need to continue striving to improve federal oversight.

700-C Exhaust Fan under Preparation for Restart

Review of the Waste Isolation Pilot Plant Safety Basis

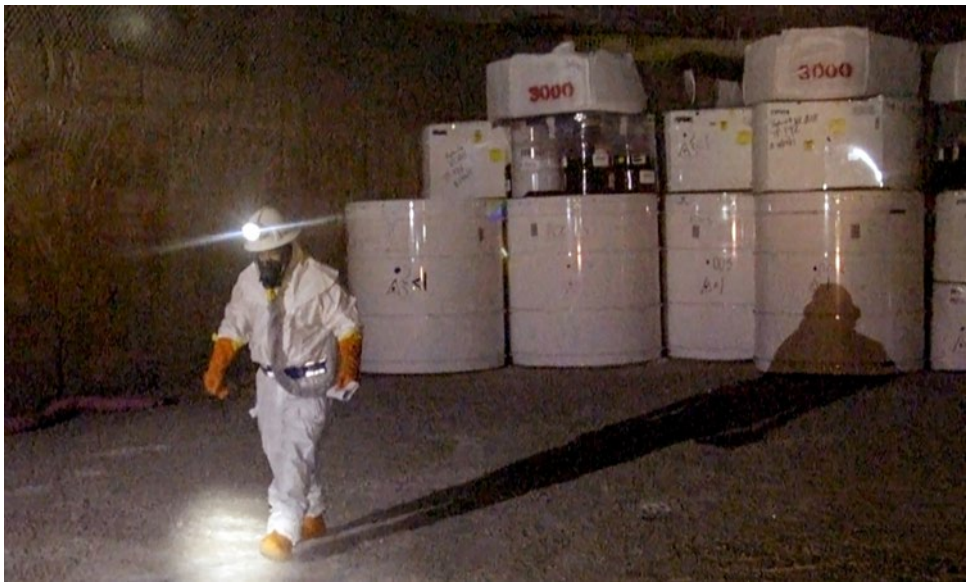
The Waste Isolation Pilot Plant performs a crucial role in dispositioning transuranic waste from sites across the complex. In 2016, DOE upgraded the documented safety analysis of the Waste Isolation Pilot Plant to meet the requirements of DOE Standard 3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*.

On May 29, 2020, the Board issued a letter to the Secretary of Energy summarizing the staff's review of the safety basis and supporting calculations. The Board identified four safety items related to the analysis and control selection for accident scenarios involving a waste shaft pool fire, waste conveyance over-travel, underground roof fall, and repeat energetic exothermic event. The Board also identified concerns with the adequacy of defense-in-depth measures for undesired waste reactions and lack of appropriately trained and qualified

personnel to perform federal oversight of contractor activities associated with the safety basis process. The Board will follow up on DOE actions to resolve these concerns in 2021.

Chemical Compatibility of Waste Mixtures with Nitric Acid and Nitrate Salts

In May 2019, the DOE Carlsbad Field Office sent a letter to the Waste Isolation Pilot Plant certified programs regarding chemical compatibility evaluations for waste mixtures containing nitric acid or nitrate salts and organic materials, i.e., polysaccharides. The letter concluded, based on two reports—*Safety Evaluation of Nitric Acid Reactions with Polysaccharides* and *Safety Evaluation of Remediated Nitrate Salt Waste*—that nitric acid or nitrate salt mixed with polysaccharides will not undergo autocatalytic runaway reactions after a specified latency time and temperature. This waste type was involved in the 2014 radiological release event at the Waste Isolation Pilot Plant, where chemical reactions within the waste led to breach of the drum.



Waste Emplacement at the Waste Isolation Pilot Plant

In late 2019, the Board's staff analyzed the technical basis for DOE's conclusion regarding chemical compatibility and identified several concerns. The DOE letter and associated reports did not adequately demonstrate that an accident cannot occur after the specified aging time. The DOE letter and reports did not provide a clear technical justification for the temperature criterion. The peer-review process may not have adequately resolved all reviewers' comments on the reports. In addition, waste generators were inappropriately citing the reports in local safety basis documents. In January 2020, the Board's staff conducted an initial teleconference with the DOE Carlsbad Field Office, the National Transuranic Program, and Los Alamos National Laboratory-Carlsbad Operations personnel to better understand the technical basis.

The Board's staff ultimately concluded that the DOE letter and associated reports lack sufficient experimental data to discount completely the potential for reactions leading to an autocatalytic runaway reaction. In May 2020, the Board's staff conducted a follow-up teleconference with the DOE Carlsbad Field Office and Office of Environmental Management headquarters personnel. The headquarters personnel agreed that the analysis and conclusions of these reports were not intended to be broadly applied in safety bases for other wastes stored at generator sites across the complex. In June 2020, the Office of Environmental Management released a memorandum stating that future use of the two reports by generator sites needed to be cleared with the chief of nuclear safety on a case-by-case basis.

In a related activity, in July 2020, a DOE sponsored technical review team was assigned to evaluate disposal pathways for inappropriately remediated nitrate salt-bearing wastes stored at the Waste Control Specialists, LLC, facility in Andrews, Texas. This was the same waste type involved in the 2014 radiological release event at the Waste Isolation Pilot Plant. Like the Board's staff, the technical review team determined that there was insufficient technical basis to conclude that the possibility of a thermal runaway reaction could be eliminated by invoking a latency period. In 2021, the Board's staff will continue to monitor the safety implications associated with this waste type and pursue a technical resolution for several remaining concerns with DOE.

VI. Design and Construction

The Board's Policy Statement-6, *Policy Statement on Oversight of Design and Construction of Defense Nuclear Facilities*, established in July 2017, provides the current approach the Board takes to review the design and construction of DOE defense nuclear facilities. The Board evaluates staff analyses, along with other sources of data such as input from resident inspectors, Board member field visits, DOE project status briefings, and Board hearings, to form the basis for identifying any nuclear safety deficiencies to DOE.

Commensurate with the degree to which a deficiency challenges adequate protection of public health and safety, the Board uses its statutory tools to inform DOE and the public. Design and construction projects under the Board's evaluation in 2020 are listed in the following table. The substantive review activities of the design and construction projects performed in 2020 are discussed in detail below.

Design and Construction Projects under Evaluation in 2020

Project Name	Location	Status of Project	Status of Review
Waste Treatment and Immobilization Plant, All Facilities (i.e., overall progress)	Hanford Site, Richland WA	Concurrent design and construction	Ongoing—project letters issued on 10/12/2017, 05/09/2019, 10/07/2019, 11/18/2019, 06/25/2020, 10/14/2020
Waste Treatment and Immobilization Plant, Analytical Laboratory	Hanford Site, Richland WA	Complete, ready for operations	Ongoing
Waste Treatment and Immobilization Plant, Low-Activities Waste Facility	Hanford Site, Richland WA	Construction complete, testing in progress	Ongoing—project letter issued 06/25/2020
Waste Treatment and Immobilization Plant, Effluent Management Facility	Hanford Site, Richland WA	Construction	Ongoing
Waste Treatment and Immobilization Plant, High-Level Waste Facility	Hanford Site, Richland WA	Concurrent design and construction	Ongoing—project letters issued 05/09/2019, 10/14/2020
Waste Treatment and Immobilization Plant, Pretreatment Facility	Hanford Site, Richland WA	On hold, designated technical issues resolved	Ongoing—project letter issued 11/18/2019
Low-Activity Waste Pretreatment System	Hanford Site, Richland WA	Preliminary design complete, on hold	No ongoing review activities—project letter issued on 05/14/2015

Project Name	Location	Status of Project	Status of Review
Tank Side Cesium Removal System	Hanford Site, Richland WA	Construction and testing	Ongoing
Tank Waste Characterization and Staging Capability	Hanford Site, Richland WA	Conceptual design	No ongoing review activities
Waste Encapsulation Storage Facility Dry Capsule Storage	Hanford Site, Richland WA	Construction	Ongoing
Idaho Calcine Disposition Project	Idaho National Laboratory, Idaho Falls, ID	Conceptual design	Monitoring Idaho National Laboratory Calcine Retrieval sub-project
Transuranic Waste Processing Center Sludge Processing Facility Buildouts project	Oak Ridge National Laboratory, Oak Ridge, TN	Preliminary design	Ongoing
Salt Waste Processing Facility	Savannah River Site, Aiken, SC	Complete	Complete—project letter issued on 09/29/2020
Savannah River Plutonium Processing Facility	Savannah River Site, Aiken, SC	Conceptual design	Ongoing
Tritium Finishing Facility	Savannah River Site, Aiken, SC	Conceptual design	Ongoing
Surplus Plutonium Disposition Project	Savannah River Site, Aiken, SC	Conceptual design	Ongoing
Safety Significant Confinement Ventilation System	Waste Isolation Pilot Plant, Carlsbad, NM	Final design	Ongoing—project letters issued on 03/26/2018, 08/27/2019
Uranium Processing Facility	Y-12 National Security Complex, Oak Ridge, TN	Construction	Ongoing—project letter issued on 06/26/2017

Hanford Site, Waste Treatment and Immobilization Plant

The tank farms at the Hanford Site near Richland, Washington, contain 56 million gallons of radioactive and toxic waste stored in 177 underground tanks. In the late 1990s, DOE began work on the Waste Treatment and Immobilization Plant intended to immobilize the Hanford tank waste. This radiochemical processing plant consists of four primary facilities: Pretreatment, Low-Activity Waste, High-Level Waste, and the Analytical Laboratory. As initially designed, all waste first would be processed through the Pretreatment facility, where it would be separated into two streams: low-activity waste and high-level waste. These two waste streams then would be solidified into glass in stainless steel containers at the Low-Activity

Waste and High-Level Waste facilities, respectively. DOE will dispose of the low-activity waste glass on-site 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 Pretreatment and High-Level Waste facilities, many of which DOE now considers to be resolved. DOE has also modified its strategy to focus on bringing the Low-Activity Waste facility on line first, processing feed provided directly from the tank farms, and bypassing the Pretreatment facility.

Wear Allowances

In 2020, the Board completed its review of DOE's declared resolution of concerns related to erosion and corrosion wear allowances for the piping, process vessels, and pulse-jet mixers, as stated in the Office of River Protection's August 30, 2019, letter to the Board. The Board had initially raised these issues as being applicable to the Pretreatment facility, and, to a lesser extent, the High-Level Waste facility, in a January 20, 2012, letter to DOE. In an October 14, 2020, letter to the Secretary of Energy, the Board agreed that DOE had identified acceptable strategies for resolution of these issues and acknowledged that the work performed added significant technical rigor to the designs for erosion and corrosion wear allowances. The Board therefore concurred with DOE's position that these issues were resolved.

Separately from the issues described in DOE's letter, the Board stressed the importance of additional proposed, but not yet fully implemented, Pretreatment facility flowsheet changes. In particular, the Waste Treatment and Immobilization Plant project team had stated that it intended to reduce the maximum allowed temperature within the ultrafiltration feed vessels during caustic leaching. The Board considers this an important change, as the project team's general corrosion allowance for stainless steel process vessels may be non-conservative at higher operating temperatures and caustic concentrations. The proposed reduction in the allowed temperature would resolve any concerns in this area.

Hazard Categorization of the Low-Activity Waste Facility

The Board completed a review of the hazard categorization of the Low-Activity Waste facility. The Title 10, Code of Federal Regulations, Part 830, *Nuclear Safety Management* (CFR 830), requires DOE contractors to categorize their facilities "consistent with" DOE Standard 1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*. The hazard categorization defines the facility's hazard potential, determines which safety-related standards and requirements are applicable to a facility, and helps to define the graded approach for complying with those standards and requirements.

The Board communicated the results of this review to the Secretary of Energy in a June 25, 2020, letter. Contrary to DOE Standard 1027-92, the Board found that the hazard categorization of the Low-Activity Waste facility did not account for all radiological material that

might be processed or present in the facility. The Board also stated that additional integration between the tank farms and the Waste Treatment and Immobilization Plant contractors in maturing the details of feed delivery, sampling analyses, and waste acceptance criteria may be warranted to ensure compliant feed is delivered to the facility.

Savannah River Site, Salt Waste Processing Facility

The mission of the Salt Waste Processing Facility is to pretreat radioactive salt waste solutions from the F- and H-Area Tank Farms at the Savannah River Site. Pretreatment involves removing and concentrating selected actinides, strontium-90, and cesium-137 from the bulk salt waste solution and pumping them to the Defense Waste Processing Facility for vitrification. The remaining decontaminated salt solution is sent to the Saltstone Production Facility for immobilization in a grout mixture.

Salt Waste Processing Facility

In 2020, DOE and the contractor transitioned the Salt Waste Processing Facility to radiological operations. At year's end, the facility is operational. Tank Farms' transfers of high-level waste to the Salt Waste Processing Facility continue. The facility processes the waste and conducts regular transfers to the Defense Waste Processing Facility and the Saltstone Production Facility. Key milestones in 2020 leading to the start-up of radiological operations included the following:

- In January 2020, the Salt Waste Processing Facility contractor certified to DOE that cold commissioning testing, which used non-radioactive waste simulant, was complete. The contractor also completed corrective actions from the contractor operational readiness review following additional demonstrations and declared readiness to proceed with the DOE operational readiness review.

- In February 2020, the DOE operational readiness review team completed its fieldwork and independently confirmed the facility's readiness for safe start-up of radiological operations. The DOE team identified pre-start findings in the areas of radiological protection, fire protection, maintenance and work control, nuclear safety, occupational safety and health, industrial hygiene, and emergency preparedness. Due to the COVID-19 pandemic, a prolonged period was necessary for the contractor to complete corrective actions addressing the pre-start findings identified by the DOE team.

- In August 2020, the Salt Waste Processing Facility contractor completed corrective actions from the DOE operational readiness review to the satisfaction of DOE. DOE approved Critical Decision-4 and issued an authorization to operate. However, maintenance and other issues delayed start-up of radiological operations until October 2020.

Facility's Personnel Demonstrate Replacing a Contactor Prior to Start-up

The Board's staff independently evaluated the conduct of the DOE operational readiness review, the resolution and closure of DOE pre-start findings, emergency exercises, and preparatory operations with non-radioactive waste simulant. In a September 29, 2020, letter to DOE, the Board acknowledged DOE's approval of Critical Decision-4 and the authorization to operate. The Board noted it had reviewed the Salt Waste Processing Facility's activities since completion of construction in 2016, including the contractor and DOE operational readiness reviews, and stated that it had no unresolved safety issues. During and following start-up, the Board's staff closely monitored waste transfers, processing operations, shielding verification surveys, and start-up review boards. The Board and its staff will continue to monitor the Salt Waste Processing Facility as it proceeds through its first full year of operations.

Savannah River Site, Savannah River Plutonium Processing Facility

The 2018 Nuclear Posture Review recommended establishing "the enduring capability and capacity to produce plutonium pits at a rate of no fewer than 80 pits per year by 2030." On May 10, 2018, NNSA recommended to Congress that Building 226-F, constructed for the cancelled Mixed Oxide Fuel Fabrication Facility, be repurposed for a new pit production project. This new project, known as the Savannah River Plutonium Processing Facility, will be designed to produce 50 of the required 80 plutonium pits per year starting in the year 2030. The facility will be designed for a 50-year operating life.

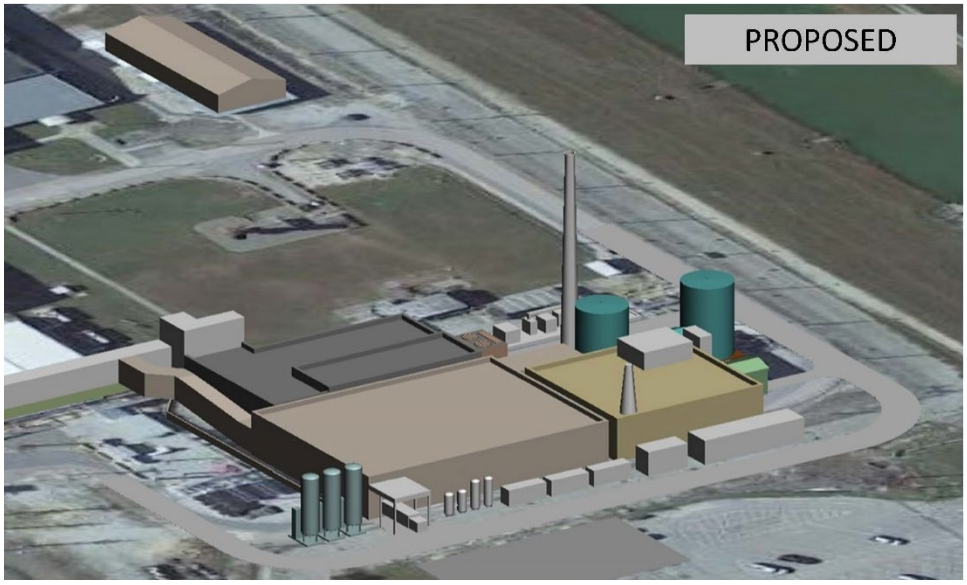
Savannah River Site Building 226-F

In September 2020, NNSA contractors produced a conceptual design of the Savannah River Plutonium Processing Facility. NNSA formed a 70-person review team consisting of contractor and federal personnel and commenced a conceptual design review, as required by DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*. The NNSA review team concluded its review in early October 2020 and submitted comments on the facility design to the NNSA contractors. Currently, the NNSA contractors are revising the conceptual design. NNSA plans to conduct an additional review of the conceptual design as an independent project review and approve Critical Decision-1, *Approve Alternative Selection and Cost Range*, in 2021.

In 2020, the Board's staff closely followed the development of the conceptual design of the Savannah River Plutonium Processing Facility. The Board's staff also observed numerous meetings between NNSA's review team and the NNSA contractors. The Board's staff plans to complete an independent review of the conceptual design in 2021.

Savannah River Site, Tritium Finishing Facility

NNSA plans to construct the Tritium Finishing Facility at the Savannah River Site to replace key capabilities currently located in H-Area Old Manufacturing—a 1950s vintage building that does not fully comply with current industry codes and standards. The capabilities of the Tritium Finishing Facility will include reservoir acceptance, reservoir assessment, assembly, pre-loading, and packaging and shipment. In 2018, NNSA placed the project on hold due to funding constraints. In December 2019, NNSA approved Critical Decision-1 for the Tritium Finishing Facility, marking the completion of the project definition phase and the conceptual design. The Board notes that the Tritium Finishing Facility is currently not projected to begin operations until sometime between the fourth quarter of Fiscal Year 2029 and the fourth quarter of Fiscal Year 2031, and even then it will not replace the facilities that contain the largest fraction of readily dispersible tritium at the Savannah River Site.



Rendering of the Tritium Finishing Facility

In 2020, the Board's staff reviewed the preliminary safety basis and design documents associated with the Critical Decision-1 milestone. The objective of this effort was to understand NNSA's approach to the Tritium Finishing Facility's safety strategy, control selection, and design of key structures, systems, and components, as well as to evaluate NNSA's efforts in early integration of safety into the facility design. The facility design was only 5 percent complete at the Critical Decision-1 milestone and, as such, many aspects of facility safety strategy, control selection, and design were not defined. DOE directives do not prescribe a percentage of the design that must be achieved at the conceptual design phase and acknowledge that a facility design may be anywhere between 0 and 30 percent complete. The Board's staff compiled a list of items to follow up on when the project reaches at least 30 percent design completion. These items include hazard and accident evaluations, confinement strategy, fire protection, design

requirements for the safety-related structures, systems, and components, and software quality assurance.

Savannah River Site, Surplus Plutonium Disposition Project

The Surplus Plutonium Disposition Project, currently in the conceptual design phase, will involve a major modification to Building 105-K in the K-Area Complex of the Savannah River Site, an existing Hazard Category 2 nuclear facility, 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 un-package plutonium oxide, dry blend plutonium oxide with adulterant, perform non-destructive assay and package, and prepare diluted plutonium oxide for shipment.

During 2020, the Board's staff conducted a scoping review of key documents associated with the Surplus Plutonium Disposition Project's Critical Decision-1, including the preliminary project execution plan, the conceptual design report, the facility design description, the safety design strategy, and the preliminary consolidated hazards analysis. The staff identified several areas with potential safety concerns as topics requiring future detailed review, such as fire protection, criticality safety, and radiation dose consequences associated with certain accident scenarios. The Board's staff has begun this more detailed review and expects to complete it in 2021.

Waste Isolation Pilot Plant, Safety Significant Confinement Ventilation System and Utility Shaft

The Board and DOE have been corresponding on various aspects of the overall effort to improve underground ventilation at the Waste Isolation Pilot Plant since the 2014 accident (the release of radiological materials due to energetic chemical reactions in waste drums). The Safety Significant Confinement Ventilation System project is just one component of the plan. It is an exhaust air system that consists of a new filter building, salt reduction building, exterior ductwork, and new exhaust stack. The confinement ventilation system is designed such that it will mitigate design basis accidents with high unmitigated dose consequences to the facility worker and co-located worker. During normal operation, the system directs exhaust air through the salt reduction building before exhausting the airflow through high efficiency particulate air filters. The salt reduction building contains equipment that pulls salt out of the exhaust air to reduce the load on the air filters. Upon detection of an underground radiological release event, the confinement ventilation system is designed to bypass the salt reduction building to prevent an unfiltered release through the salt reduction system.

The Utility Shaft project will complement the Safety Significant Confinement Ventilation System**.** In addition to providing a new air intake source, it will provide supplemental capability for transporting mined salt, equipment, and personnel to and from underground.

In an August 27, 2019, letter to the Secretary of Energy, the Board outlined three safety issues associated with the Safety Significant Confinement Ventilation System. These issues are related to the time required to return the system to a safe (filtered exhaust air) configuration upon detection of an underground radiological release; the interlocks between supply fans in the proposed utility shaft and the confinement ventilation system fans for avoiding inadvertent up-casting of potentially contaminated underground air; and the use of a regulatory framework established by 10 CFR 835, *Occupational Radiation Protection*, as opposed to 10 CFR 830, *Nuclear Safety Management*, to establish performance requirements for the underground continuous air monitors.

Excavation of the New Utility Shaft

On December 20, 2019, DOE provided a written response to the Board's letter. DOE then followed up with a briefing to the Board on February 14, 2020. DOE acknowledged the safety issues outlined in the Board's letter and committed to address them during the procurement and construction phase for the Safety Significant Confinement Ventilation System. DOE further noted that some design details associated with integration with other projects had not been adequately addressed. DOE indicated that it was in the process of performing technical evaluations to assess design and performance requirements for the isolation dampers and continuous air monitor system.

In late May 2020, DOE performed a project peer review of the Safety Significant Confinement Ventilation System and Utility Shaft projects. The project peer review team indicated that the safety issues raised by the Board could drive additional design or safety basis changes related to the isolation dampers, including changes to the isolation damper actuator structural requirements, and noted that these impacts have not been accounted for in the project risk register.

Progress on both the Safety Significant Confinement Ventilation System and Utility Shaft projects has slowed during the latter part of 2020 as DOE works to resolve issues with contractor performance and New Mexico Environment Department permitting requirements.

Y-12 National Security Complex, Uranium Processing Facility

Since construction of the Uranium Processing Facility began in 2018, the project has focused on erecting the structural elements of the overall facility. The three crucial buildings for the project—the Main Processing Building, the Salvage and Accountability Building, and the Mechanical and Electrical Building—are each in different stages of construction.

The non-nuclear portion of the overall project is approximately 85 percent complete and significantly more advanced than the nuclear portion. The Main Processing Building and the Salvage and Accountability Building, which will process nuclear material, are slightly less than 50 percent complete.

Mechanical and Electrical Building

The Board's staff has monitored the progress of construction. The project has reached several major milestones regarding acquisition of safety related structures, systems, and components. This includes starting factory acceptance testing for major nuclear components. The Board's staff plans to evaluate the project's procedures and implementation of factory acceptance testing during 2021.

VII. Safety Standards and Programs

The Board evaluates the content and implementation of DOE directives relating to the design, construction, operation, and decommissioning of DOE's defense nuclear facilities. The Board is required to review these directives, termed as "standards" in the Atomic Energy Act, which include DOE orders, guides, regulations, standards, and handbooks. The Board also evaluates the robustness of the implementation of DOE directives in its review of safety bases and safety programs.

Department of Energy Regulations and Directives

Recommendation 2020-1, Nuclear Safety Requirements

DOE began a revision to 10 CFR 830, *Nuclear Safety Management*, in 2018. This rule provides requirements that DOE relies upon to demonstrate that its nuclear facilities are designed, constructed, operated, and decommissioned in a manner that ensures the adequate protection of the public, workers, and the environment. While agreeing that 10 CFR 830—last revised in 2001—required an update, the Board identified concerns with DOE's proposed updates to the rule. The Board concluded that rather than enhancing safety, DOE's changes to 10 CFR 830 could erode the nuclear safety regulatory framework DOE uses to ensure adequate protection. On October 5, 2018, the Board submitted comments on the rule via the public comment process and transmitted the same comments to DOE via a letter.

The Board received no formal response from DOE about the comments on the rulemaking. After determining portions of the rule needed to be modified to continue to ensure adequate protection, the Board issued Recommendation 2020-1, *Nuclear Safety Requirements*, on February 21, 2020. The recommendation is intended to strengthen DOE's nuclear safety regulatory framework, such that it provides sufficient structure that both aging and new defense nuclear facilities continue to provide adequate protection. Specifically, the Board made recommendations in the following areas:

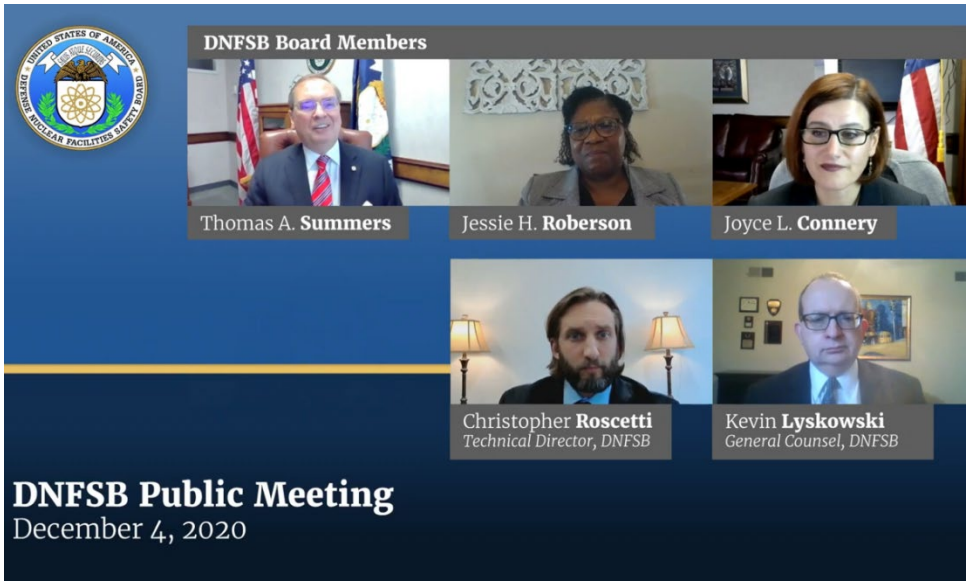
- *Aging Infrastructure*—DOE lacks a formal, complex-wide regulatory structure for identifying, prioritizing, and performing upgrades necessary for the adequate protection of public and workers. The Board recommended that DOE develop requirements for aging management, including a formal process for identifying and performing infrastructure upgrades that are necessary to ensure facilities and structures, systems, and components can perform their safety functions.

- *Hazard Categories*—DOE's proposed changes to 10 CFR 830 could have undermined the hazard categorization process, which determines what safety basis requirements are applicable to a facility. The Board recommended that DOE modify or revert changes it made to the rule concerning nuclear facility hazard categorization to ensure nuclear facility safety bases are prepared with appropriate detail and rigor to ensure adequate protection.

- *DOE Approvals*—The Board and DOE have both noted issues with execution of safety basis submittal and review processes at defense nuclear facilities. Instead of evaluating and addressing the quality and timeliness issues with documented safety analyses, DOE proposed revising 10 CFR 830 to abandon DOE's annual review and approval of safety basis documents. The Board recommended that DOE retain and enhance requirements for annual federal approval of safety basis submittals and conduct a causal analysis to identify underlying issues preventing the approval process from working efficiently.

- *Safety Basis Process and Requirements*—DOE's revision to 10 CFR 830 did not incorporate key requirements for nuclear safety processes and important lessons learned from the past 20 years of facility operation. The Board recommended that DOE establish requirements for these areas, and further recommended that DOE investigate issues preventing contractors from developing and submitting high-quality safety bases on the required annual periodicity.

On June 11, 2020, DOE rejected most of the Board's recommendations for reasons related to the ongoing rulemaking for 10 CFR 830, rather than on substantive technical grounds. In the cases where DOE indicated that it partially accepted the Board's recommendations, DOE neither engaged with the Board's technical arguments nor made clear its proposed actions would address the Board's concerns. The Board sent a letter to DOE on September 25, 2020, expressing that it is well within the Board's jurisdiction to make recommendations related to DOE regulations, and that the Board expects DOE to accept or reject Board recommendations based on technical substance. The Board further noted that the Administrative Procedure Act and other laws do not prohibit a technical response to the Board Recommendation regarding 10 CFR 830.



December 4, 2020, Virtual Public Meeting on Recommendation 2020-1

The Board is continuing to evaluate DOE's response to the recommendation, as well as the final version of the revised 10 CFR 830, which DOE published on October 19, 2020. To that end, the Board conducted a virtual public meeting on December 4, 2020, during which members of the Board's technical staff presented information regarding the status of issues in Recommendation 2020-1. During the meeting, Board members expressed continued support for the importance of those issues and the need for DOE to improve its nuclear safety regulatory framework. The Board is currently considering whether or not to reaffirm the recommendation.

DOE Standard 5506, Preparation of Safety Basis Documents for Transuranic Waste Facilities

On January 29, 2020, the Board transmitted a letter highlighting specific areas of concern for DOE Standard 5506, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities*. The Board's interactions with DOE and concerns with this standard are discussed in detail in the entry *Safety of Solid Nuclear Waste*, in Section V of this report.

DOE Standard 1027, Hazard Categorization of DOE Nuclear Facilities

Per 10 CFR 830, DOE contractors are required to perform hazard categorization "consistent with DOE-STD-1027-92 [Change Notice 1]." DOE interprets this phrase as meaning that documents other than DOE Standard 1027-92, Change Notice 1, *Hazard Categorization of DOE Nuclear Facilities,* can be used for facility hazard categorization if the methodology stays the same. As a result, DOE allows its contractors to use the following standards for facility hazard categorization: DOE Standard 1027-92 Change Notice 1; NNSA Supplemental Directive 1027 Administrative Change 1, *Guidance on Using Release Fraction and Modern Dosimetric Information Consistently with DOE-STD-1027-92*; and DOE Standard 1027-2018 Change Notice 1, *Hazard Categorization of DOE Nuclear Facilities*.

The Board evaluated DOE's three hazard categorization standards and issued a letter and report to the Secretary of Energy on January 19, 2021. The Board advised the Secretary to discontinue the use of NNSA Supplemental Directive 1027 because its methodology is not technically justified and is superseded by DOE Standard 1027-2018; update DOE Standard 1027-2018 to address the multiple deficiencies described in the letter's enclosure; and ensure that changes in methodology introduced in DOE Standard 1027-2018 and NNSA Supplemental Directive 1027 have not caused the under-categorization of existing DOE facilities. The Board's staff will follow any DOE actions that result from this effort.

DOE Standard 1228, Preparation of Documented Safety Analysis for Hazard Category 3 DOE Nuclear Facilities

In 2019, DOE issued DOE Standard 1228, *Preparation of Documented Safety Analysis for Hazard Category 3 DOE Nuclear Facilities*, to provide an acceptable methodology for the preparation of documented safety analyses for Hazard Category 3 nuclear facilities. In 2020, the Board's staff reviewed the standard for compliance with 10 CFR 830. The Board's staff also

compared DOE Standard 1228-2019 to DOE Standard 3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, to ensure consistency with that approved safe harbor standard. The staff's review found that the new standard contains inconsistencies with DOE Standard 3009-2014 that could lead to development of documented safety analyses that lack appropriate rigor, and that do not identify complete control sets for the protection of the public and workers. The staff also found that DOE Standard 1228-2019 is inconsistent with 10 CFR 830 in its use of the graded approach to develop a documented safety analysis. The Board and its staff are continuing to evaluate DOE Standard 1228-2019.

Review and Comment on Draft DOE Directives

In 2020, the Board's staff conducted several reviews of DOE directives that were being developed or revised in DOE's online review, comment, and approval process. The Board's staff reviewed the development of DOE Standard 1234, *Nuclear Material Packaging*, and provided substantial comments on safety protocols that DOE plans to incorporate when the directive is issued. In addition, the Board's staff reviewed the revision of DOE Standard 1195, *Design of Safety Significant Safety Instrumented Systems Used at DOE Nonreactor Nuclear Facilities*; the development of new DOE Standard 1269, *Air Cleaning Systems in DOE Nuclear Facilities*; and the related revision of DOE Handbook 1169, *Handbook for Use with DOE-STD-1269*. The Board's staff provided comments to DOE that would enhance the safety programs and will continue the effort in 2021.

Planned Reviews in 2021

In 2021, the Board plans to evaluate some DOE directives that have complex-wide effects and those that establish controls for high-hazard activities. These include DOE Handbook 3010-94, *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*, and DOE Guide 424.1-1B, *Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements*, which may be revised in 2021.

Because DOE has indicated that it plans to revise several other safety-related directives in 2021, the Board intends to review revisions to DOE Handbook 1224, *Hazard and Accident Analysis Handbook*; DOE Order 425.1, *Verification of Readiness to Start Up or Restart Nuclear Facilities*; DOE Standard 1020, *Natural Phenomena Hazards Analysis and Design Criteria for DOE Facilities*; and DOE Standard 1066, *Fire Protection*. DOE is replacing EH-0545, *Seismic Evaluation Procedure for Equipment in U.S. Department of Energy Facilities*, with a handbook that the Board's staff plans to evaluate in 2021. The Board may elect to add reviews of DOE directives as it deems appropriate.

Safety Basis and Safety Program

Technical Safety Requirements Implementation

The Board's staff completed a cross-cutting review of the implementation of technical safety requirements at defense nuclear facilities throughout the DOE complex. The review was

focused on the site procedures and practices for declaration and reporting of technical safety requirement violations. The Board's staff evaluated DOE and contractor implementation of DOE directives related to technical safety requirements, violation criteria, and reportability of violations in DOE's occurrence reporting and processing system. The Board's staff analyzed the collected data to assess the adequacy of applicable DOE directives in supporting safe operation of defense nuclear facilities.

The Board's staff review found differing interpretations across the complex by DOE and contractor personnel on what constitutes a violation of technical safety requirements, and more generally, found that what constitutes a violation of the nuclear safety basis is often not recognized. A violation occurs when a facility is not operating in compliance with its safety basis, and therefore is operating outside of the risk envelope approved by DOE. Declaration and reporting of all such violations are important for understanding the operational risk incurred and for ensuring proper determination of causes and corrective actions. Overall, the Board's staff review identified the following concerns:

- DOE directives do not define violations of the nuclear safety basis to include all situations that are not consistent with the DOE-approved safety basis;
- DOE lacks specific requirements related to violations of the nuclear safety basis;
- DOE lacks guidance in DOE directives in areas such as operability determinations, time of discovery, and treatment of design features; and
- Reporting criteria in DOE's occurrence reporting and processing system do not address all violations of the nuclear safety basis and other issues related to implementation of the approved safety basis.

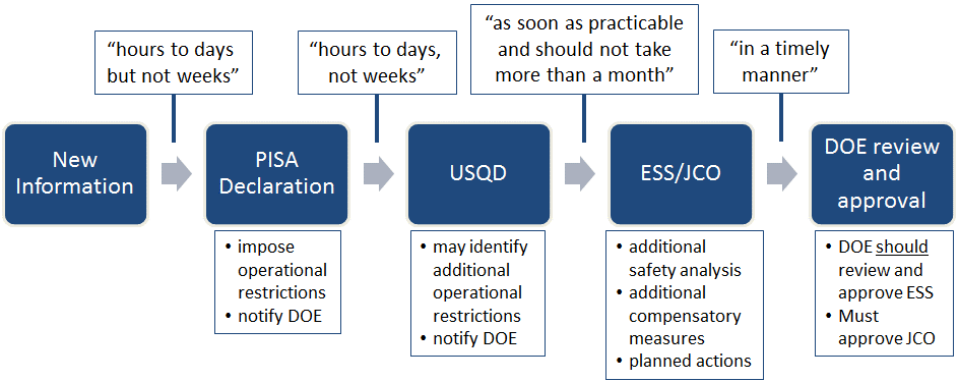
Because of these concerns, the Board sent Technical Report 45, *Violations of the Nuclear Safety Basis*, to the Secretary of Energy in a letter dated August 7, 2020. The report presents results of the Board's staff review and outlines potential areas for DOE improvements that would address the concerns discussed above. Additionally, the Board considers that the information in the report can be useful to DOE's efforts to address parts of Recommendation 2020-1 regarding elevating key guidance on technical safety requirements to clearly identified requirements. The Board will continue to follow DOE actions responding to Recommendation 2020-1 and to Technical Report 45.

Implementation of the Potential Inadequacy of the Safety Analysis Process

The Potential Inadequacy of the Safety Analysis process is a key element of DOE's overall Unreviewed Safety Question process invoked by 10 CFR 830. The Potential Inadequacy of the Safety Analysis process ensures that a DOE site contractor takes proper action when it becomes aware that its documented safety analysis for a nuclear facility may not be adequate. DOE Guide 424.1-1B, *Implementation Guide for Use in Addressing Unreviewed Safety Question*

Requirements, provides guidance for implementing the Potential Inadequacy of the Safety Analysis process.

On July 10, 2020, the Board provided the Secretary of Energy with results of its staff's review on the implementation of the Potential Inadequacy of the Safety Analysis process across the DOE complex. The Board's staff reviewed site Unreviewed Safety Question procedures, evaluated implementation data, and held discussions with DOE field offices and site contractors. The Board's staff found that site contractors inconsistently implement the Potential Inadequacy of the Safety Analysis process, particularly related to timeliness in declaring inadequacies and in executing follow-on Unreviewed Safety Question process steps. This is due to a lack of specific requirements and clear guidance on the Potential Inadequacy of the Safety Analysis process in DOE directives. The Board's staff also found that since DOE removed a requirement to report these potential inadequacies in DOE's occurrence reporting system in 2017, DOE has not established a formal mechanism for sites to notify DOE headquarters of these declarations. Such lack of notification will impede DOE headquarters' awareness and oversight of Potential Inadequacy of the Safety Analysis declarations and follow-on Unreviewed Safety Question determinations.



Board's Staff Illustration of Current DOE Guidance for Meeting 10 CFR 830 Requirements in Executing the Potential Inadequacy of the Safety Analysis Process[2]

Management of High Efficiency Particulate Air Filters in the Safety Bases

During reviews of the confinement ventilation systems and their implementation in safety bases, the Board's staff identified instances where safety bases did not set surveillance testing criteria consistent with the guidance in DOE directives. In addition, at some facilities the high-efficiency particulate air filters were treated as design features, which is not consistent with the definition of design features being permanently installed features that require infrequent inspection. High-efficiency particulate air filters typically require frequent pressure monitoring, annual or biannual efficiency testing, and replacement when certain criteria are met, e.g., loading and age. The Board reviewed the safety bases for defense nuclear facilities where the high efficiency particulate air filtration is identified as a safety system to determine

[2] PISA is a potential inadequacy of the safety analysis; USQD is an unreviewed safety question determination; ESS is an evaluation of the safety of the situation; and JCO is a justification for continued operation.

the extent of condition of the concerns. The Board documented the results of the review and transmitted the information in a letter to DOE dated October 29, 2020, for its consideration in updating guidance on management of high efficiency particulate air filters in DOE directives.

Federal Oversight

In 2019, the Board's staff began a review of DOE's safety oversight across the defense nuclear complex, including DOE's methods to evaluate the effectiveness of its oversight activities. In 2020, the Board's staff gathered information and conducted interactions with multiple DOE headquarters organizations and field offices, including the Office of Enterprise Assessments, the Office of Environmental Management, NNSA, the Production Office at the Y-12 National Security Complex, and the Carlsbad Field Office. In addition, the Board's staff interviewed personnel from each of the organizations to gain insight on day-to-day oversight responsibilities.

The purpose of these interactions was to better understand the current DOE oversight framework and practices for implementing DOE oversight requirements. Within each of the organizations, the Board's staff focused on integrated safety management, issues management systems, performance measures, oversight activity planning, and workforce staffing. The Board's staff also evaluated how DOE organizations interact and leverage assessment information. In 2021, the Board's staff will continue to consolidate and evaluate the data gained in the interactions, draw conclusions, and present the findings to the Board for its consideration.

Appendix A: Board Recommendations

Recommendations Open in 2020

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

The Board issued Recommendation 2020-1, *Nuclear Safety Requirements*, on February 21, 2020. The recommendation is intended to strengthen DOE's nuclear safety regulatory framework, such that it provides sufficient structure that both aging and new defense nuclear facilities continue to provide adequate protection. Specifically, the Board recommended that DOE (1) develop requirements for management of its aging infrastructure, (2) modify or revert changes it made to the rule concerning nuclear facility hazard categorization, (3) retain and augment requirements for DOE approval of safety basis documentation, and (4) establish requirements for key nuclear safety basis processes and concepts.

On June 11, 2020, DOE rejected most of the Board's sub-recommendations for reasons related to the ongoing rulemaking for 10 CFR 830, rather than on substantive technical grounds. In the cases where DOE indicated that it partially accepted the Board's sub-recommendations, DOE did not, for the most part, engage with the Board's technical arguments or make clear that its proposed path forward would address the Board's concerns. The Board is continuing to evaluate DOE's response to the recommendation and is exploring potential paths forward.

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

Recommendation 2019-2 identified the need for DOE to take actions to ensure adequate protection of public health and safety at the Savannah River Tritium Facilities by (1) identifying and implementing near-term compensatory measures and long-term controls to prevent or mitigate potentially high radiological dose consequences, and (2) evaluating the adequacy of emergency preparedness programs and upgrading them as necessary. The NNSA Administrator rejected the recommendation in a September 10, 2019, letter to the Board. Following a public meeting on October 28, 2019, the Board transmitted a letter to the Secretary of Energy on December 5, 2019, reaffirming Recommendation 2019-2.

On January 3, 2020, the NNSA Administrator transmitted a letter to the Board restating that DOE/NNSA's basis for not accepting the recommendation "is rooted in our conclusion that the Savannah River Tritium Enterprise provides adequate protection of the public and worker safety" and that "focused ongoing actions at the Tritium Facilities at [Savannah River Site] adequately address DNFSB concerns discussed in the Recommendation and make the need for additional response actions unnecessarily duplicative of our effort." The Board and DOE differ on the perception of the risk to workers and the public associated with the Tritium Facilities. The Board planned on holding a public hearing at Savannah River Site that would address safety of the Tritium Facilities in March 2020, but the hearing has been postponed. On June 24, 2020, the Board transmitted a letter to the Secretary of Energy providing its evaluation of NNSA's

proposed and ongoing actions for improving safety. The Board remains concerned that NNSA's plans will not result in sufficient improvement to the safety posture at the Savannah River Tritium Enterprise.

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

On February 20, 2019, the Board issued Recommendation 2019-1*, Uncontrolled Hazard Scenarios and 10 CFR 830 Implementation at the Pantex Plant*. The recommendation 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.

Recommendation 2012-2, *Hanford Tank Farms Flammable Gas Safety Strategy (CLOSED IN 2020)*

Recommendation 2012-2, *Hanford Tank Farms Flammable Gas Safety Strategy*, identified the need for safety-related ventilation systems to aid in preventing flammable gas events in the double-shell tanks at the Hanford Tank Farms. The recommendation also identified the need to upgrade several other systems necessary to provide accurate and reliable indications of abnormal conditions associated with flammable gas events.

DOE has addressed all of the items outlined in its implementation plan. The primary ventilation system itself is now protected as a safety-significant control in the safety basis for the Hanford Tank Farms. DOE has also installed and implemented safety-significant real-time airflow monitors in the ventilation systems of the active double-shell tanks in the Hanford tank farms. Furthermore, DOE has included a planned improvement in the safety basis that will provide safety-significant portable exhaust units, equipped with self-contained generator units, which the tank farms contractor will maintain in an available, on-demand condition. The timing of this planned improvement will support installation of mixer pumps in double-shell tanks, should DOE decide the mixer pumps are necessary to support waste feed delivery to the High-Level Waste Facility of the Waste Treatment and Immobilization Plant.

These actions have resulted in tangible safety improvements that provide adequate protection of the public and workers at the Hanford site. Based on these improvements, the Board closed Recommendation 2012-2 in a letter to the Secretary dated July 15, 2020.

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

The Board issued Recommendation 2012-1, *Savannah River Site Building 235-F Safety*, on May 12, 2012. The recommendation identified the need for actions to reduce the hazards associated with the material-at-risk that remained as residual contamination within Building 235-F. DOE issued its original implementation plan on December 5, 2012, which it subsequently updated on November 28, 2014. In May 2020, DOE submitted a revised implementation plan under this recommendation, outlining significant changes to the overall strategy that it would use to address the hazards. On June 22, 2020, DOE sent a letter to the Board, stating that DOE "has completed all actions identified in the Department's May 2020, revised Implementation Plan in response to the DNFSB Recommendation 2012-1."

The Board reviewed DOE's revised implementation plan per the Board's Policy Statement 1, *Criteria for Judging the Adequacy of DOE Responses and Implementation Plans for Board Recommendations*, and the revised safety basis, submitting its findings to DOE in a letter dated December 23, 2020. The Board recognizes that DOE has taken positive steps to reduce the risks posed by the hazards in Building 235-F. However, the Board notes that the revised implementation plan focuses on reducing the risk posed by facility hazards by preventing fires, whereas the original remediation strategy reduced risk by removing the material-at-risk from Building 235-F. The Board is concerned that the revised implementation plan does not ensure that DOE will maintain Building 235-F in a safe condition as the facility awaits its final end-state. Specifically, under the revised approach, DOE downgraded an existing safety control and ceased material-at-risk removal activities due to the anticipated limited effectiveness of additional removal efforts. The Board requested a response from DOE within 60 days of receipt of its letter regarding DOE's intentions to address the issues raised by the Board.

The Board's December 23, 2020, letter to DOE contained an enclosure that identified potential issues that might warrant further consideration as DOE moves forward to revise the implementation plan and complete the deactivation of Building 235-F. These issues included (1) safety basis deficiencies associated with source term, hazards analysis, and controls;

(2) inadequate confinement strategy; (3) fires impacting enclosure material-at-risk;
(4) unprotected assumptions in independent fire evaluations and fire hazards analysis;
(5) heavy reliance on safety management programs; and (6) unclear deactivation end points for Building 235-F.