Defense Nuclear Facilities Safety Board

27th Annual Report to Congress April 2017

Required by Section 2286e(a) 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."
42 U.S.C. § 2286a(a)

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

April 27, 2017

To the Congress of the United States:

The Defense Nuclear Facilities Safety Board (Board) is pleased to submit to Congress its Twenty-Seventh Annual Report for Calendar Year 2016. 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 the Department of Energy's (DOE) defense nuclear facilities. As required by 42 U.S.C. § 2286e(a), this report describes our current safety initiatives and assesses improvements in the safety of defense nuclear facilities, as well as safety issues yet to be resolved.

Respectfully submitted,

Sean Sullivan
Chairman

c: The Honorable James Richard Perry

Table of Contents

Pantex Plant, Amarillo, TX

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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 facility complex—a complex that has served to design, manufacture, test, maintain, and decommission nuclear weapons, as well as other national security priorities. The Board is statutorily mandated to 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 in providing adequate protection of public health and safety at DOE defense nuclear facilities.

The Board's safety oversight activities are prioritized predominantly on the basis of 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 significant safety oversight initiatives and some high priority safety issues at defense nuclear facilities subject to the Board's oversight during 2016. Foremost among these initiatives and issues were:

- Emergency Preparedness and Response
- Safety of Transuranic Wastes at Los Alamos National Laboratory
- Recovery Actions at the Waste Isolation Pilot Plant
- Safety Posture at the Los Alamos National Laboratory Plutonium Facility
- Defense Nuclear Facility Design and Construction Projects

The Board met its staffing target of 116 at the end of fiscal year (FY) 2016, the number contained in the agency budget request. The agency's staff leadership published new agency-wide requirements including six new Directives and ten new Operating Procedures to reflect changes in law and policy applicable to the agency. The Office of Inspector General's FISMA Report for FY 2016 contained no new findings or recommendations for the agency.

This Annual Report organizes the Board's oversight activities into four strategic areas: nuclear weapon operations; design and construction of new defense nuclear facilities and major modifications to existing facilities; hazardous materials; and safety standards and programs. The status of all Board recommendations open in 2016 is summarized in Appendix A. In addition, the hazards posed by aging defense nuclear facilities are summarized in Appendix B, while DOE's progress in resolving issues in the design of modern replacement facilities is summarized in Appendix C.

Substantive Board Communications to DOE in 2016

TECHNICAL REPORT	
January 20	Plugging and Wear of Process Piping at the Waste Treatment and Immobilization Plant (DNFSB/TECH-40)
LETTERS WITH REPORTING REQUIREMENTS	
February 26	Revised Annual Reporting Requirement on DOE Nuclear Criticality Safety Program
May 12	Los Alamos National Laboratory Plutonium Facility Fire Suppression System Vulnerabilities
June 3	Revision to DOE Implementation Plan for Recommendation 2014-1, *Emergency Preparedness and Response*
July 29	Inappropriately Remediated Nitrate Salt Defense Waste Stored at Commercial Facility
September 2	DOE's Holistic Evaluation of DOE Federal Nuclear Safety Oversight Processes
September 23	DOE's Plan to Implement Policy 226.2, *Policy for Federal Oversight and Contractor Assurance Systems*
December 13	Safety of Operations at the Waste Isolation Pilot Plant
LETTERS FORWARDING STAFF REPORTS	
January 7	Savannah River Site Tritium Extraction Facility Safety Basis Review
March 28	Waste Isolation Pilot Plant Documented Safety Analysis
April 4	Waste Treatment and Immobilization Plant Quality Assurance Review
September 16	Savannah River Site Nuclear Criticality Safety Program
LETTERS ON PRIOR RECOMMENDATIONS AND OTHER SAFETY ISSUES	
January 5	Closure of Issues with Software Code SASSI (A System for the Analysis of Soil-Structure Interaction)
January 7	Preliminary Observations of Weaknesses Associated with Emergency Preparedness and Response at Los Alamos National Laboratory
February 8	Concerns with DOE Implementation of Recommendation 2014-1, *Emergency Preparedness and Response*
February 19	Project Letter on Underground Ventilation System at the Waste Isolation Pilot Plant
September 2	Evaluation of DOE Implementation Plan for Recommendation 2015-1, *Emergency Preparedness and Response at the Pantex Plant*
September 16	Progress in Implementation of Recommendation 2012-2, *Hanford Tank Farms Flammable Gas Safety Strategy*
September 23	Closure of Recommendation 2010-1, *Safety Analysis Requirements for Defining Adequate Protection for the Public and the Workers*
November 18	Project Letter on Plutonium Equipment Installation Subproject at Los Alamos National Laboratory
PUBLIC HEARING	
March 22	Los Alamos National Laboratory Transuranic Waste Management

I. The Board's Statutory Mission

The Board was established in 1988[1] as an independent federal agency within the executive branch of government, answerable to the President and subject to congressional oversight and direction. Five Board members, appointed by the President subject to confirmation by the Senate, are required by law 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 chairman 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 role as operator and regulator of DOE defense nuclear facilities, in providing adequate protection of public health and safety. As noted above, the Board's jurisdiction covers DOE's "defense nuclear facilities" – a term defined in the Atomic Energy Act of 1954, as amended. The Board is only concerned with facilities operated by DOE that are: (1) covered by the Atomic Energy Act; and, (2) have a function related to national defense. The phrase "defense nuclear facilities" thus excludes 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 (NRC). 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 on page 3 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 formal Board recommendation issued to the Secretary. The statute requires the Secretary to either accept or reject the Board's recommendation, and in the case of an acceptance, to write and execute an implementation plan. 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 requires the Board to also 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, if necessary), conduct investigations, obtain information and documents from DOE and its contractors needed for the Board's work, and review and comment on DOE requirements and standards affecting safety at defense nuclear facilities. DOE is required by law to grant the Board "ready 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 NRC) and from organizations outside the government (such as the National Academy of Sciences), as needed.

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[1] For more historical information on the factors that caused Congress to establish the Board, see the Board's 5th Annual Report to Congress, available at: http://www.dnfsb.gov/sites/default/files/Board%20Activities/Reports/Reports%20to%20Congress/1995/ar_1995216_1301.pdf

Major Sites Subject to Board Jurisdiction

Site	Location	Operations	Website
Hanford Site	Richland, Washington	Management and treatment of radioactive wastes; facility decommissioning	http://www.hanford.gov
Idaho National Laboratory	45 miles west of Idaho Falls, Idaho	Storage and processing of radioactive waste	http://www.inl.gov
Lawrence Livermore National Laboratory	Livermore, California	Research to support the nuclear weapons arsenal	https://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	http://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	http://www.nnss.gov
Oak Ridge National Laboratory	Oak Ridge, Tennessee	Energy research; treatment and disposal of radioactive wastes	http://www.ornl.gov
Pantex Plant	17 miles northeast of Amarillo, Texas	Maintenance of the U.S. nuclear stockpile	http://www.pantex.com
Sandia National Laboratories	Albuquerque, New Mexico	Nuclear research; support for the weapons stockpile maintenance program	http://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	http://www.srs.gov
Waste Isolation Pilot Plant	26 miles east of Carlsbad, New Mexico	Safe disposal of transuranic waste in underground repository	http://www.wipp.energy.gov/
Y-12 National Security Complex	Oak Ridge, Tennessee	Manufacturing and surveillance of nuclear weapons components; processing of weapons-grade uranium	http://www.y12.doe.gov/

II. Nuclear Weapon Operations

Los Alamos National Laboratory (LANL)

Nuclear Criticality Safety

The Board's 25th and 26th Annual Reports to Congress summarized deficiencies in the nuclear criticality safety program at the LANL Plutonium Facility. During 2016, LANL made progress in addressing long-standing deficiencies in the criticality safety program and resuming operations that had been paused at the Plutonium Facility. The Laboratory Director's formal restart project to address the pause in programmatic activities was completed in September 2016. LANL plans to restart the next significant activity in the Plutonium Facility, aqueous chloride and americium oxide operations, by September 2017. The Board's staff plans to perform a follow-up assessment of the criticality safety program during 2017.

Plutonium Facility Safety Posture

Since 2009, the Board has sent multiple communications to DOE regarding the safety posture of the Plutonium Facility at LANL.[2] The Board correspondence identified seismic vulnerabilities with the Plutonium Facility structure; deficiencies with the Plutonium Facility safety basis and fire suppression system; and opportunities for risk reduction by reducing the quantity of radioactive material on the first floor of the Plutonium Facility. The Board's 25th and 26th Annual Reports to Congress provide more information and summarize the Board's role in identifying these deficiencies.

Seismic Vulnerabilities—The LANL contractor undertook a series of actions to characterize and address seismic vulnerabilities in the Plutonium Facility. These actions included efforts to strengthen the structure of the building and to reduce the likelihood and severity of a post-seismic fire. While LANL was pursuing these efforts, structural analyses based on an updated sitewide seismic hazard analysis raised further questions regarding the possibility of severe damage to the Plutonium Facility in a design basis earthquake, including a potential facility collapse. To answer these questions, LANL personnel are developing a request for a proposal to identify contractors to model the Plutonium Facility's performance during an earthquake.

Risk Reduction—LANL is reducing the quantity of material-at-risk within the Plutonium Facility. Specifically, in 2016 LANL personnel reduced the material-at-risk by 127 kilograms by moving nuclear material stored outside gloveboxes on the first floor to more robust storage locations and by improving the utilization of certified containers.

[2] Key Board correspondence includes Recommendation 2009-02*, Los Alamos National Laboratory Plutonium Facility Seismic Safety*; letters dated June 18, 2012, and May 12, 2016, providing staff reports on the facility's safety basis and the seismic performance of the facility fire suppression system; and Technical Report 39, *Opportunities for Risk Reduction at the Los Alamos National Laboratory Plutonium Facility through the Minimization of Material-at-Risk.*

Material-at-Risk Storage on the First Floor of the LANL Plutonium Facility

Fire Suppression System—The Board issued a letter to the National Nuclear Security Administration (NNSA) on May 12, 2016, identifying seismic vulnerabilities of the fire suppression system at the Plutonium Facility. In response, NNSA directed its Los Alamos field office to correct these deficiencies. LANL personnel are in the process of testing fire suppression system components to support formulation of an appropriate path forward.

Safety System Upgrades—LANL has developed a Project Execution Strategy for upgrading the Plutonium Facility to help mitigate risk and address known deficiencies. The plan includes resolving issues regarding cast iron fittings in the fire suppression system; identifying equipment and components needed to seismically qualify the confinement ventilation system; and completing seismic evaluations for safety-significant systems, structures, and components to identify the totality of seismic vulnerabilities.

Inappropriately Remediated Nitrate Salt Waste

DOE attributed the February 14, 2014, radiological release event at the Waste Isolation Pilot Plant to LANL transuranic waste drums containing what is now termed "inappropriately remediated nitrate salt (RNS) waste." LANL currently has 60 RNS waste containers located in Dome 375 at Area G. The Board conducted a public hearing in Santa Fe, New Mexico on March 22, 2016, to obtain information from DOE and NNSA officials and the LANL contractor on hazards posed to the public and workers by the RNS waste and their plans to address these hazards. Over the course of 2016, the Board's staff reviewed LANL's safety basis for treatment of the RNS waste and performed an independent assessment of LANL's modeling of wildland fires that could impact the RNS waste. Members of the Board and the Board's staff performed multiple walkdowns of Area G and the Waste Characterization, Reduction, and Repackaging Facility (WCRRF)—the facility that will treat the RNS waste—to assess controls for safe RNS waste storage and LANL's preparations to treat the RNS waste.

By the end of 2016, LANL had completed key actions toward addressing the risk associated with the RNS waste, including:

- Installing pressure relief devices with an enhanced-capacity vent pathway on RNS waste containers to minimize the potential for a spontaneous thermal runaway event.
- Improving engineering and maintenance practices to strengthen the reliability of the confinement ventilation system and temperature controls in the Dome 375 Perma-Con® to restrict the chemical kinetics of the RNS waste.

- Completing sophisticated modeling to understand the threat posed to the RNS waste by a wildland fire, and took prudent actions to create a new fire break and significantly reduce vegetation fuel loads near Dome 375.
- Revising the safety basis documents for Area G, WCRRF, and on-site transportation to support treatment of the 60 containers of RNS waste into a safe form.
- Completing upgrades to WCRRF including ceiling and roof repairs, replacing roll-up doors, and addressing an issue with the fire drain.

Mockup of Glovebox for Treatment of RNS Waste

At the end of 2016, LANL was preparing for readiness reviews to conduct treatment activities. LANL intends to complete the treatment before the start of the 2017 wildland fire season.

Pantex Plant

Nuclear Explosive Bay and Cell Structures and Systems

In March 2016, the Board's staff conducted structural walkdowns of the Pantex Plant's nuclear material staging facilities and nuclear explosive facilities. The Board's staff identified two concerns that are being addressed by corrective actions: (1) water intrusion and cracking in a nuclear explosive bay and (2) faulty reinforced concrete repairs in two nuclear explosive cells.

Water Intrusion and Cracking—The staff observed vertical cracks in the walls and water intrusion damage to the electrostatic dissipative flooring in one nuclear explosive bay. The Pantex contractor found a break in the lead-in from the high pressure fire loop that may have caused the water intrusion. The Pantex contractor plans to remove the electrostatic dissipative surface, which will allow the structural condition of the floor to be assessed.

Faulty Concrete Repairs—The Board's staff found that the Pantex contractor had made faulty repairs after opening 25-square-foot holes in the structural slabs of two nuclear explosive cells to gain access to fire system piping below the floor. In planning repairs to the floors, the contractor did not recognize that the floor was credited as a safety class feature for structural integrity of the cells. As a result, appropriate quality and rigor were not applied during the repair effort, which included connecting reinforcing steel to in-place rebar with mechanical splices and placing new concrete. In addition, the repairs were made using rapid set concrete, rather than the originally specified mixture, to facilitate an accelerated repair timeline. The resulting repairs did not meet nuclear quality assurance and structural code requirements. Subsequent strength tests of concrete cores from the repairs found strengths 30 percent weaker than the minimum specification. Operations will not resume in the two cells until the repairs are redone.

Fire Protection System—During a March 2014 review, the Board's staff identified a potential vulnerability associated with latent undetected failure modes with the aging fire detection systems at Pantex. Specifically, the deluge system surveillance test procedures did not assure that all possible logic combinations of flame detectors were tested. During 2016, the Pantex contractor successfully tested the flame detectors and confirmed that no issues or anomalies exist.

"Falling Man" Scenarios

In a letter dated June 2, 2014, the Board identified that NNSA and the Pantex contractor had not demonstrated that special tooling used in nuclear explosive operations at Pantex adequately protects the public and workers from the potential consequences of a worker falling into the special tooling or nuclear explosive. Subsequently, NNSA and the contractor undertook mitigation efforts, including revised cell layouts and process changes to reduce tripping hazards, workstand height changes to reduce impact forces, and administrative controls (e.g., standoff zones and signage). Additionally, the contractor commissioned a multi-year series of academic studies to characterize the falling man accident scenario, including experiments to simulate a human falling into a workstand with special tooling. The contractor also evaluated special tooling for the bounding event (i.e., 100th percentile weight man). Where the required safety factor was not met, the contractor either redesigned the tooling, instituted additional controls (e.g., process changes to remove the hazard), or determined that the risk was acceptable.

In 2016, NNSA's Weapons Complex Falling Man Committee continued to work to develop a standard falling man model for the DOE nuclear weapons complex. The Board's staff provided feedback during bi-weekly teleconferences and onsite meetings of the committee to help ensure the model will be conservative and bounding. The model is expected to be finalized in early 2017.

Maintenance

In November 2015, the Board transmitted a letter to NNSA detailing deficiencies in several elements of the maintenance program at Pantex. The letter provided examples of deficiencies and opportunities for improvement in areas such as the quality of procedures,

formality of operations, work planning and authorization, pre-job briefings, use of predictive maintenance, design of performance measures, labeling, and system engineering support. The Board's letter noted that initial actions had been taken by the NNSA Production Office (NPO) to direct improvements in these areas. In 2015 and 2016, NPO and the Pantex contractor developed a corrective action plan to drive improvements in several areas identified as deficient in the Board's letter. Many of these corrective actions have been completed and implemented, including new procedure place-keeping requirements, component labeling on newly installed fire system equipment, and development of a pilot program for predictive maintenance. Improvement actions have not yet been identified for work authorization and the design of performance measures. At the end of 2016, the Board's staff had identified specific maintenance issues for follow-up review in 2017, notably maintenance of ceiling-mounted equipment such as hoists.

Nuclear Explosive Safety

Throughout 2016, the Board's staff provided oversight of nuclear explosive operations at Pantex and NNSA's efforts to implement revised nuclear explosives safety directives at the design agencies and production plants. The Board's staff observed the evaluations of nuclear explosive safety for the W87, W84, and B83 programs, as well as variants of the B61 program. Additionally, the Board's staff evaluated improved special tooling implemented by Pantex contractor for W78 operations. The Board's staff also evaluated a new electrical tester featuring optical isolation that the Pantex contractor is implementing to replace a tester that has the potential to apply electrical energy to a nuclear explosive.

Federal Safety Oversight of Pantex and Y-12 National Security Complex

NNSA merged its Pantex and Y-12 Site Offices in 2012 to create NPO to manage a consolidated management and operating contract for the two sites. In 2016, the Board's staff reviewed the effectiveness of NPO's safety oversight of the Pantex/Y-12 contractor. The staff's review identified concerns related to NPO's training and qualification program, evaluation of contractor programs, issues management, self-assessments, and staff engagement. NPO management reached several similar conclusions in a self-assessment of its oversight procedures and practices. Based on these findings, NPO senior management made several changes to its organizational structure and internal procedures and practices to strengthen its safety oversight. NPO plans to finish implementing the improvements in 2017.

Y-12 National Security Complex

Aging Infrastructure

Since 2005, the Board has been monitoring DOE's efforts to address the safety vulnerabilities of aging defense nuclear facilities at Y-12. Of particular concern is the vulnerability of certain enriched uranium production facilities to damage in an earthquake. In October 2016, DOE fulfilled an annual reporting requirement on the safety of continued operations and briefed the Board regarding the condition of the 9212 Complex. Key

accomplishments in 2016 included continued reductions in the material-at-risk in the facility. DOE also initiated focused maintenance outages to improve the operational safety and reliability of process systems important for continued risk reduction. Continued programmatic work in Y-12's aging defense nuclear facilities requires a high level of operational rigor to compensate for the lack of modern safety structures, systems, and components; observations during 2016 indicate that this area warrants continued monitoring in 2017.

Enriched Uranium Facilities

NNSA has developed an enriched uranium mission transformation strategy intended to improve operational safety while maintaining key mission capabilities. Significant elements of the strategy include ceasing enriched uranium programmatic operations in the 9212 Complex by 2025, while sustaining mission capabilities in Building 9204-2E and the 9215 Complex through at least 2040. Installation of a rotary calciner in the 9212 Complex and an electrorefining capability in the 9215 Complex will enable NNSA to shut down certain aged and hazardous process systems in the 9212 Complex.

Consistent with its mission transformation strategy, NNSA has developed an Extended Life Program to help maintain safe operations in Building 9204-2E and the 9215 Complex through at least 2040. The Board's staff reviewed the Y-12 contractor's recommendations for the Extended Life Program, as well as the safety strategy that will guide the evolution of the safety bases for these two facilities. The review team shared observations with NNSA related to structural performance, nuclear criticality safety, confinement, and nuclear safety regulatory gaps. The observations are being factored in to refinement of the program safety strategy.

Savannah River Tritium Enterprise

Tritium Extraction Facility Safety Basis

The Board identified three safety issues regarding the Tritium Extraction Facility in a letter to NNSA dated January 7, 2016: (1) new controls may be needed to protect collocated workers for some accident scenarios; (2) the tritium control rooms have no remote indication of the tank level for the fire suppression system water supply; and (3) the Tritium Extraction Facility safety basis inappropriately credits safety management programs for specific risk reductions in the hazard analysis. In January 2017, facility personnel installed and tested engineered systems to address the issue with tank level indication. The facility contractor plans to provide the NNSA field office with updates to the safety basis correcting issues with the hazard analysis and controls by June 2017. In the interim, the contractors is using administrative controls, including reducing material-at-risk by at least 50 percent in several areas of the facility, to mitigate the hazard without impacting operations.

III. Design and Construction

New Facilities

The Atomic Energy Act of 1954, as amended, requires that the Board review the design and construction of new defense nuclear facilities to ensure the adequate protection of the public health and safety during eventual operation. The Board carries out this function through activities including detailed reviews by the Board's technical staff, public hearings, requests for information, and visits by Board members to construction sites. The Board is currently overseeing the design and construction of over a dozen new defense nuclear facilities with a combined projected cost exceeding $20 billion. In addition, the Board maintains cognizance of several other DOE projects that are on hold or have been deferred. The table below lists DOE's design and construction projects, the status of each project, and the status of the Board's review.

Design and Construction Projects under Review in 2016

Project Name	Location	Status of Project	Status of Board Review
Waste Treatment and Immobilization Plant	Hanford Site, Richland, WA	Concurrent design and construction	Ongoing- multiple open safety issues
K-Basin Closure Sludge Treatment Project	Hanford Site, Richland, WA	Phase 1: Construction Phase 2: Conceptual design	Ongoing-open safety issue
Low Activity Waste Pretreatment System	Hanford Site, Richland, WA	Preliminary design	Ongoing- project letter issued 5/14/2015
Tank Waste Characterization and Staging Capability	Hanford Site, Richland, WA	Conceptual design	Ongoing- no current safety issues
Idaho Calcine Disposition Project	Idaho National Laboratory, Idaho Falls, ID	Conceptual design	Ongoing- no current safety issues
Transuranic Waste Facility Project	Los Alamos National Laboratory, Los Alamos, NM	Construction complete	Ongoing- open safety issue
Plutonium Equipment Installation Subproject Phase 1	Los Alamos National Laboratory, Los Alamos, NM	Construction	Ongoing- project letter issued 11/18/2016

Project Name	Location	Status of Project	Status of Board Review
Transuranic Waste Processing Center Sludge Processing Facility Buildouts Project	Oak Ridge National Laboratory, Oak Ridge, TN	Preliminary design	Ongoing- no current safety issues
Material Staging Facility	Pantex Plant, Amarillo, TX	Conceptual design	Ongoing- no current safety issues
K-Area Complex Purification Area Vault Project	Savannah River Site, Aiken, SC	Construction complete	Complete- project letter issued 6/22/2015
Saltstone Disposal Unit #6	Savannah River Site, Aiken, SC	Construction	Ongoing- no current safety issues
Salt Waste Processing Facility	Savannah River Site, Aiken, SC	Construction complete	Ongoing- reviewing facility startup
Waste Solidification Building	Savannah River Site, Aiken, SC	Construction complete	Complete- project letter issued 5/13/2015
Underground Permanent Ventilation System	Waste Isolation Pilot Plant, Carlsbad, NM	Preliminary design	Ongoing- no current safety issues
Uranium Processing Facility	Y-12 National Security Complex, Oak Ridge, TN	Preliminary design	Ongoing- no current safety issues
Electrorefining Project	Y-12 National Security Complex, Oak Ridge, TN	Preliminary design	Ongoing- project letter issued 10/29/2015

Appendix B summarizes the status of significant unresolved safety issues concerning the design and construction of DOE's defense nuclear facilities. Select projects are summarized below:

Hanford Site, Hanford Tank Waste Clean-up

Background

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 (WTP) intended to immobilize

the Hanford tank waste. WTP is a radiochemical processing plant consisting of four primary facilities: the Analytical Laboratory, Low-Activity Waste (LAW), High-Level Waste (HLW), and Pretreatment (PT) Facilities. As initially designed, all waste would be processed first through the PT Facility, where it would be separated into two streams—low activity waste and high-level waste. The two waste streams would then be solidified into glass in stainless steel containers at the LAW and HLW Facilities. DOE will dispose of the low activity waste glass onsite and will ship the high-level waste glass offsite for permanent disposal once a national repository is available.

In 2012, DOE restricted engineering, procurement, and construction work on the PT and HLW Facilities because of unresolved technical and safety issues and misalignment between the design and the nuclear safety basis. DOE directed its contractor to address open issues before DOE would authorize resuming engineering, procurement, and construction work for these facilities. On August 19, 2014, DOE authorized the contractor to resume engineering work to finalize the design of the HLW Facility, with limited procurement and construction. However, a considerable amount of work still remains to resolve the open issues.

Waste Treatment and Immobilization Plant, Hanford Site

Progress in 2016

In 2016, DOE developed resolution strategies for three longstanding technical issues which address four of the Board's fifteen open safety issues: generation and accumulation of hydrogen in process vessels; heat transfer analyses for process vessels; criticality in process vessels; and hydrogen in pipes and ancillary vessels. The strategies include the development of a standard vessel design with demonstrated mixing performance to handle slurries with high solids content in the PT Facility. DOE initiated full-scale testing of the vessel design in December 2016.

To mitigate delays from technical and safety issues with the HLW and PT Facilities, DOE is developing a strategy to feed the liquid portion of the Hanford tank waste to the LAW Facility without first processing it in the PT Facility. This approach includes a new project—the Low-Activity Waste Pretreatment System (LAWPS)—which will pretreat and deliver waste to the LAW Facility. This strategy would enable the LAW Facility to begin vitrifying waste before completion of the PT Facility. In 2016, DOE continued to make progress on the design of LAWPS.

In 2016, the Board's staff focused on evaluating LAWPS, the LAW Facility, and DOE's work to resolve open Board safety issues. The staff initiated reviews of the LAW Facility ventilation systems and worked with DOE in resolving concerns identified in the Board's May 14, 2015, project letter on LAWPS.

In a January 20, 2016, letter, the Board provided a Technical Report, *Plugging and Wear of Process Piping at the Waste Treatment and Immobilization Plant*, to DOE for information and use as it works to resolve issues associated with pipeline plugging and sliding beds of solids in WTP transfer systems. The report provided a number of actions for DOE's consideration to address the hazards associated with process piping and pump failures. As a result of the Board's technical report, the WTP contractor plans to mitigate potential wear due to sliding beds of solids by increasing the pipe schedule. In addition, the WTP contractor plans to address the hazards of centrifugal pump explosions in future safety basis reconstitution efforts. Accordingly, the Board is removing this concern from the list of significant unresolved issues presented in Appendix B.

In an April 4, 2016, letter to DOE, the Board identified several quality assurance deficiencies related to storage of safety-related structures, systems, and components at WTP. The Board communicated that failure to adhere to quality assurance requirements for material control and storage could reduce the reliability of safety systems. The Board's letter noted that the Board was encouraged that DOE had resumed quality assurance program assessments at WTP, and that the Board would continue to follow DOE's efforts in this area. As a result of the Board's letter, the WTP contractor made improvements to storage conditions and associated procedures. These improvements will help ensure the reliability of safety-related components.

In 2016, the Board's staff continued to work closely with DOE to oversee resolution of the 15 previously identified technical and safety issues for WTP (listed below). The Board's staff reviewed DOE's issue resolution strategies for the first four issues listed.

- Generation and accumulation of hydrogen in process vessels;
- Heat transfer analyses for process vessels;
- Criticality in process vessels;
- Hydrogen in pipes and ancillary vessels;
- Pulse jet mixer control;
- The ability to obtain representative samples;
- Modeling of spray leak accidents;
- Safety controls for ammonia hazards;

- Erosion and corrosion of process systems;
- Design and construction of the electrical distribution system;
- Plugging and wear of process piping (closed this year);
- Volcanic ashfall hazard;
- Potential melter accidents in the HLW Facility;
- Hydrogen control strategy in the HLW Facility; and
- Seismic categorization of safety controls in the HLW Facility.

Appendix B provides additional information on these safety issues.

Y-12 National Security Complex, Uranium Processing Facility

Enriched uranium processing and fabrication are vital to maintaining the Nation's nuclear weapons stockpile and supplying fuel for the United States Navy's nuclear-powered warships. NNSA's current modernization strategy calls for replacing certain capabilities from the aging 9212 Complex at Y-12 by 2025. Under the Uranium Processing Facility (UPF) Project, these capabilities will be installed in multiple facilities segregated by safety risk and security requirements.

Artist's Rendering of the Uranium Processing Facility, Y-12 National Security Complex

In 2016, NNSA authorized early site preparation work and construction of a concrete batch plant for the UPF Project. In addition, in December 2016, NNSA approved the UPF contractor's revised Preliminary Safety Design Report, which identifies key facility and process-

level controls and describes the function of major processes. The Board's staff conducted a review of the Preliminary Safety Design Report in November 2016 and expects the preliminary design package to be available for review in 2017.

Los Alamos National Laboratory, Chemistry and Metallurgy Research Replacement, PF-4 Equipment Installation Project Phase 1 (PEI-1)

To facilitate the exit from the aging Chemistry and Metallurgy Research Building, 2,800 square feet of operational space at Plutonium Facility (PF-4) will be reconfigured to accommodate analytical chemistry and material characterization equipment. NNSA currently plans to complete equipment installation and infrastructure improvements associated with this project by 2022.

In 2016, the Board's staff reviewed the design package for Critical Decision (CD)-2/3, Approve Performance Baseline/Approve Start of Construction, and identified no safety issues. NNSA approved CD-2/3 for the project in October 2016. NNSA is currently procuring gloveboxes and making facility modifications to accommodate equipment installation.

Los Alamos National Laboratory, Transuranic Waste Facility

NNSA recently finished constructing a new Transuranic Waste Facility to replace the transuranic waste storage facilities in Area G. The new facility will be capable of staging and storing up to 1,240 drums of waste created by the enduring missions at Los Alamos National Laboratory. In addition, its characterization function will certify waste containers to meet the acceptance requirements for shipment to and disposal at WIPP.

Transuranic Waste Facility, Los Alamos National Laboratory

The Board has closed three of the five safety issues identified in the Board's August 7, 2014, project letter:

- The risk of sealed sources undergoing a pressurized release due to fire—the use of a fire watch when sources are not secured in a credited safe is considered sufficient based on the limited duration for which sources could be exposed to fire conditions;
- Site-specific deposition velocity—the values for this parameter used in the safety analysis are appropriate; and

- Safety classification of noncombustible roofs—this has been adequately captured in the current revision of the Documented Safety Analysis.

NNSA is nearing approval of CD-4, *Start of Operations*, with the completion of its Safety Evaluation Report and the beginning of facility startup activities.

Waste Isolation Pilot Plant, Permanent Ventilation System

After a nearly three-year hiatus following the March 2014 fire and radiation release accidents, the Waste Isolation Pilot Plant resumed transuranic waste disposal operations in January 2017. However, because of the radioactive contamination in the waste disposal area, air exhausted from the underground must now be filtered to remove contaminated particulates. The present underground ventilation system cannot provide sufficient filtered airflow to support concurrent mining, maintenance, and waste emplacement activities. Accordingly, DOE is pursuing the Permanent Ventilation System Project to remove this constraint by greatly expanding the air filtering capabilities to 540,000 cubic feet per minute. This system will also add an unfiltered exhaust shaft which will service mining operations in uncontaminated areas separately from the filtered airstreams.

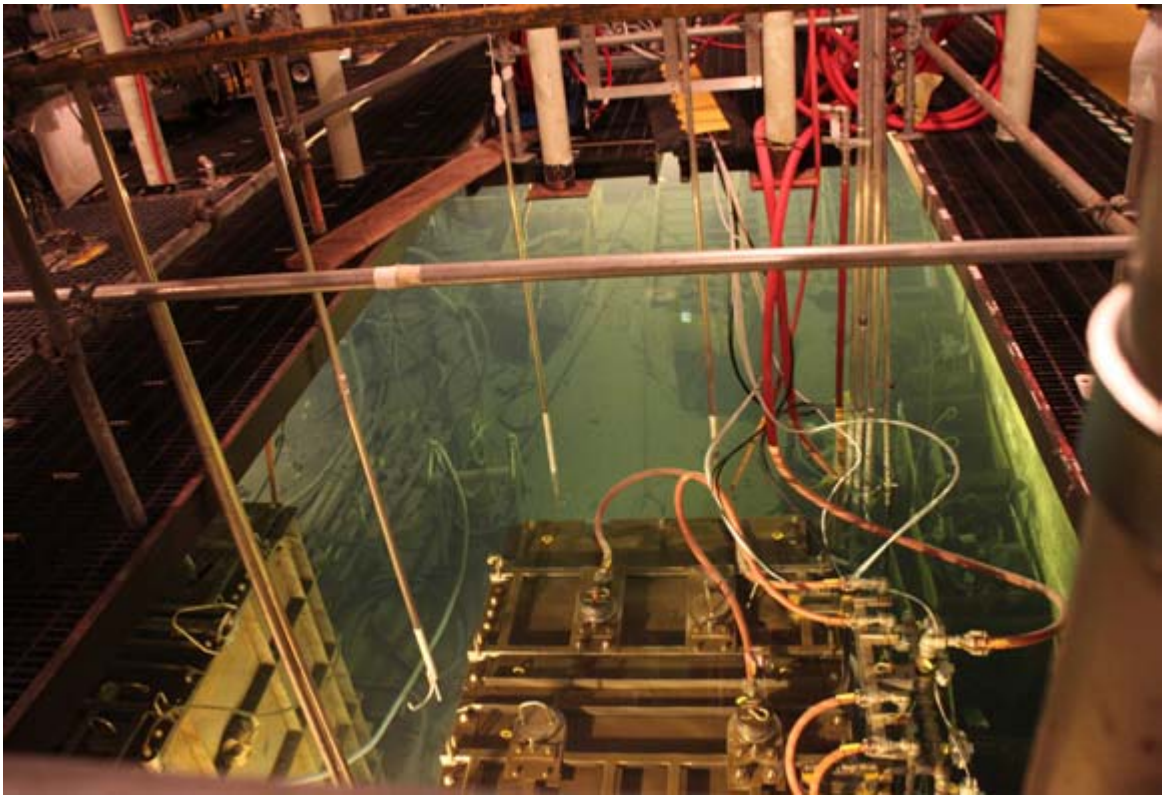
The Board issued a project letter to DOE in February 19, 2016, documenting its staff's evaluation at the CD-1, *Approve Alternative Selection and Cost* Range, phase of the project. The letter noted that the Board's staff review team identified potential reliability problems which project personnel plan to evaluate early in the next phase of the system's design.

By the end of 2016, this project had passed the 60% design stage of its New Filter Building. The Board's staff has continued to follow its progression closely.

Hanford Site, Sludge Treatment Project (STP)

The STP is a subproject of the K Basins Closure Project which will dispose of approximately 7000 gallons of radioactive sludge stored underwater in six engineered containers within the 105 K West Basin. The sludge is a combination of corrosion products from metallic spent nuclear fuel (particulates of uranium oxides and uranium metal), debris from fuel storage racks and containers, windblown dust, and spallation products from the basin's concrete walls and floors.

Phase I of the STP, referred to as the Engineered Container Retrieval and Transfer System (ECRTS), will transfer the sludge in multiple batches as slurry through a hose-in-hose transfer system into containers located in the sludge loading bay of the K West Basin Annex. The K West Basin Annex is located approximately 40 feet north of the K West Basin and approximately 1700 feet from the Columbia River. Trucks will transport the loaded containers in casks to T-Plant for interim storage until the sludge is treated and sent to the Waste Isolation Pilot Plant.



Engineered Storage Containers Containing Sludge in the K West Basin

In 2016, the project completed a number of key activities toward CD-4, *Start of Operations*, notably:

- Obtained DOE approval of Revision 2 of the Preliminary Documented Safety Analysis for ECRTS. This revision resolves the three conditions of approval specified by DOE in its Safety Evaluation Report for Revision 1 of the document.
- Completed preoperational acceptance testing at the Maintenance and Storage Facility. The testing confirmed system functionality and operability and resulted in several improvements to system components and associated procedures.
- Installed important equipment, including sludge retrieval booster pumps, a sand filter and filter shield, and the ingress/egress assembly.

IV. Hazardous Materials

Waste Isolation Pilot Plant (WIPP)

Operations at WIPP were suspended in February 2014 as a result of a fire involving an underground vehicle and a radiological release event caused by a chemical reaction in a waste drum emplaced in the underground. Resumption of waste disposal operations at WIPP is essential to eliminate the risks posed by transuranic waste stored across the DOE defense nuclear complex. DOE oversaw the completion of extensive recovery actions at WIPP during 2016 and provided its approval to the WIPP contractor to resume waste disposal operations in December 2016. Waste disposal resumed in January 2017.

The Board increased its safety oversight to verify that the recovery actions were sufficient and that waste disposal could be safely resumed. Members of the Board's staff regularly traveled to WIPP to monitor DOE's recovery actions throughout 2016. The Board's staff evaluated revisions to WIPP's safety basis to ensure that workers and the public would be adequately protected during recovery activities and resumption of waste disposal operations. The Board issued a letter on March 28, 2016, to the Secretary of Energy conveying the results of its staff's analysis for DOE's information and use in finalizing the revised Documented Safety Analysis for WIPP. The new Documented Safety Analysis relies on development and implementation of new Waste Acceptance Criteria (WAC) to prevent a repeat radiological release event. The Board's staff is monitoring DOE's development and implementation of the WAC.

To evaluate DOE's ability to sustain safe operations at WIPP, the Board issued a letter to DOE on December 13, 2016, requesting a briefing from DOE on the safety of operations, formal resolution of conclusions and judgements of need identified by the Accident Investigation Board, and verification of readiness to restart WIPP, including the findings from the recent operational readiness reviews observed by the Board's staff.

Hanford Site

Deactivation and Decommissioning of the Plutonium Finishing Plant (PFP)

In 2016, the Board's staff focused oversight on DOE's preparations to begin demolition of the heavily contaminated PFP structure. The Board's staff reviewed safety basis changes, planning documents, contractor work packages, and air dispersion models relevant to predicting potential releases of radioactive contamination. The Board's staff provided close oversight of DOE's readiness assessment for demolition as well as subsequent actions to correct pre-start findings from the assessment. DOE's contractor began demolition of the Plutonium Reclamation Facility, a heavily contaminated structure within PFP, on November 1, 2016. As part of ongoing corrective actions from negative safety trends during earlier deactivation and decommissioning activities at PFP, DOE implemented an oversight watch bill to provide a high level of scrutiny to the demolition work.

Demolition of the Hanford Plutonium Reclamation Facility

Longevity and Continued Operations of Hanford's High Level Waste Storage Systems

DOE stores more than 50 million gallons of high-level radioactive waste in 177 underground tanks at the Hanford site. In 2012, DOE identified a slow but continuing leak from the primary (inner) tank of double-shell tank AY-102. During 2016, DOE's Tank Farms contractor retrieved most of the waste from AY-102 and moved it to an intact double-shell tank. The Board anticipates that DOE will complete retrieval of waste from AY-102 in 2017.

As part of the long-term waste cleanup strategy for Hanford, DOE is identifying improved methods to inspect the integrity of double-shell tanks. Such inspections may improve DOE's service life estimates for the remaining double-shell tanks and provide valuable input to DOE's overall waste retrieval and treatment strategy.

Savannah River Site

Criticality Safety

In a September 16, 2016, letter to DOE, the Board communicated the conclusions of a staff review of the nuclear criticality safety program at the Savannah River Site. The letter emphasized the importance of identifying and protecting an adequate safety margin during operations involving fissionable materials. The Board's letter highlighted four significant operational issues related to criticality controls that occurred at the site in 2015 and 2016. The Board's letter noted that fissionable material operations at the site relied heavily on administrative and often non-independent controls and advised that identifying and protecting safety margin could produce a system more tolerant of control failures.

Defense Waste Processing Facility (DWPF

In 2016, the Board's staff reviewed DOE's actions to address safety issues regarding flammable gas controls at DWPF that the Board identified in an August 3, 2015, letter to DOE. DOE has prepared a revision to the DWPF Final Safety Analysis Report that identifies a new control strategy for flammable gas hazards to support the resumption of bubbled melter operations in 2017. Additionally, DOE began a testing program to collect data on the retention of flammable gases in wastes processed in DWPF and began working on a new DWPF flowsheet using an alternative reductant (glycolic acid). The new reductant is expected to significantly reduce flammable gas generation in DWPF process vessels.

H-Canyon

In a December 16, 2015, letter to DOE, the Board expressed concern that structural degradation the H-Canyon Exhaust Tunnel may render it unable to perform its safety function following a design basis earthquake. In 2016, DOE began taking core samples of the tunnel's concrete structure. The sampling program will help determine the effect of the tunnel's harsh exhaust environment on the structural capacity of the concrete, and whether changes are required to the structural analyses relied upon to demonstrate that the tunnel will perform its safety function in the event of a design basis earthquake.

The Board's staff completed a review of the safety basis for a new mission in H-Canyon to process highly enriched uranium target residue material solutions from Canadian Nuclear Laboratories. The staff identified and shared with DOE several opportunities to improve the development, identification, and implementation of safety controls for the processing campaign.

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V. Safety Standards and Programs

Department of Energy Directives

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.

On September 23, 2016, the Board issued a letter to the Secretary of Energy noting that two commitments DOE made in response to Recommendation 2004-1, *Oversight of Complex, High-Hazard Nuclear Operations*, were not included in DOE Policy 226.2. The Board's letter asked DOE to brief the Board on its plans to implement Policy 226.2, including the means by which DOE will verify that its contractors develop and maintain highly effective contractor assurance systems at defense nuclear facilities, as well as any planned changes in DOE's approach to safety oversight of complex, high-hazard defense nuclear facility operations. Representatives of DOE and NNSA briefed the Board on December 2, 2016, informing the Board that the new policy will not affect DOE's existing directives on contractor assurance systems and safety oversight.

Emergency Preparedness, Response, and Recovery

On September 3, 2014, the Board issued Recommendation 2014-1*, Emergency Preparedness and Response*, to address deficiencies in emergency management programs at defense nuclear facilities by strengthening DOE's emergency management requirements and DOE's oversight of compliance with those requirements. The Board followed up on November 24, 2015, by issuing Recommendation 2015-1, *Emergency Preparedness and Response at Pantex*, to address significant safety issues specific to Pantex. The status of these recommendations is summarized in Appendix A. The Board further noted weaknesses in emergency preparedness and response programs at Los Alamos National Laboratory in a letter to the Secretary of Energy on January 7, 2016.

Throughout 2016, the Board and its staff observed and conducted targeted reviews of emergency response drills and exercises at Idaho National Laboratory, Y-12 National Security Complex, Pantex, Savannah River Site, Waste Isolation Pilot Plant, Nevada National Security Site, and Hanford to evaluate the current competencies and capabilities of emergency response at the defense nuclear facilities.

Quality Assurance/Software Quality Assurance

During the past year, the Board's staff completed a number of reviews and observations of quality assurance and software quality assurance involving the DOE Office of Environmental Management and NNSA. The Board's staff followed up on issues identified in two letters sent to DOE by the Board in 2015 regarding deficiencies in federal oversight and in a contractor's compliance with DOE's safety software quality assurance requirements in the development,

use, and maintenance of the computer program RadCalc. RadCalc is a custom-developed, web-based computer program used to determine the classification of packages for transport of radioactive materials, including radioactive waste, based on the isotopic content. DOE alerted users to suspend use of the noncompliant software, audited the responsible vendor, issued a stop work order based on the audit's results, and initiated an extent of condition review for similar software. DOE evaluated the contractor's quality assurance/software quality assurance program in early 2016 to ensure requirements were being met.

Conduct of Operations and Maintenance

In 2016, members of the Board's staff continued to perform assessments of the conduct of maintenance and operations at DOE's defense nuclear facilities. The Board's staff assessed maintenance programs at WIPP and Sandia National Laboratories. The review at Sandia National Laboratories followed up on issues documented in a May 12, 2014, Board letter to the NNSA Administrator. The three reviews at WIPP followed up on maintenance issues identified in a 2012 Board letter to DOE and actions taken to address maintenance issues noted in the DOE Accident Investigation Board reports issued following the underground vehicle fire and radioactive material release event in February 2014. The staff's shared its observations with federal and contractor personnel at the WIPP for consideration as they prepared for the safe restart of waste disposal activities.

Members of the Board's staff also evaluated conduct of operations at Los Alamos National Laboratory and Sandia National Laboratories. The staff's review at Sandia National Laboratories followed up on issues documented in the May 12, 2014, Board letter to the NNSA Administrator. The Board's staff provided feedback on opportunities for program improvements to personnel at both sites, including areas such as documentation and implementation of requirements from DOE Order 422.1, *Conduct of Operations*, and DOE Order 426.2, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities*.

Appendix A: Board Recommendations

Recommendations Open in 2016

Recommendation 2015-1, *Emergency Preparedness and Response at the Pantex Plant*

The Board issued Recommendation 2015-1 in November 2015 after a series of interactions with NNSA and the Pantex contractor, including on-site reviews, exercise observations, and a Board public hearing, led the Board to determine that there were significant weaknesses in specific elements of emergency response at Pantex. The Secretary of Energy accepted the recommendation in a letter dated January 13, 2016, and transmitted the DOE Implementation Plan to the Board on June 15, 2016. DOE's plan forecasts completion of actions to implement the Board's recommendation by June 15, 2017. Many of the early deliverables in the Implementation Plan provide the foundation for improvements, including updating and approving technical planning documents, and DOE has already taken promising steps towards accomplishing these improvements. In particular, the site's new five-year exercise schedule is an improvement over previously issued documents. DOE plans to (1) conduct three exercises in 2017 and subsequent years, in contrast to the one exercise per year that was conducted previously; (2) drill the Emergency Response Organization every quarter; and (3) conduct an exercise within a nuclear explosive cell during fiscal year 2017.

Recommendation 2014-1, *Emergency Preparedness and Response*

Recommendation 2014-1 recommended that DOE standardize and improve its criteria and review approach for oversight to improve emergency management at the defense nuclear facilities and update the emergency management directive. On February 8, 2016, the Board issued a letter to the Secretary of Energy identifying concerns with DOE's implementation of the recommendation, including weaknesses in the DOE Implementation Plan and deliverables that were past due. In response, the Secretary of Energy provided an improved plan to the Board on July 20, 2016. In accordance with the Implementation Plan, DOE issued a revised and strengthened directive to govern emergency preparedness and response throughout its enterprise (DOE Order 151.1D, *Comprehensive Emergency Management System*) on August 11, 2016. DOE remains committed to issuing a new risk-based oversight approach to ensure oversight is properly applied to emergency management programs at each defense nuclear facility. DOE is revising its Criteria and Review Approach Documents to align with the revised DOE Order 151.1D. Also in response to the Board's recommendation, DOE transmitted a report on its view of the current status of emergency preparedness and response programs at defense nuclear facilities on July 14, 2016.

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 a number of other systems necessary to provide accurate and reliable indications of abnormal conditions associated with flammable gas events. In 2016, the Board evaluated DOE's proposed approach to rely on portable ventilation units if the primary ventilation is unavailable and found it to be adequate.

DOE is now treating the double-shell tank primary ventilation system as a safety-significant control in the safety basis. In March 2016, DOE submitted a revised Implementation Plan to the Board. Per this revised plan, DOE is pursuing design and implementation of two additional safety-related systems in the double-shell tanks: ventilation airflow monitors, and annulus waste level indicators. The Board expects DOE to complete these improvements within the next two years.

Recommendation 2012-1, *Savannah River Site Building 235-F Safety*

Recommendation 2012-1 identified the need to take actions to reduce the risk to collocated workers at Building 235-F. These actions include removing or immobilizing the residual contamination within Building 235-F, taking near-term actions to improve the safety posture of the facility, and ensuring the emergency response to a radiological release from Building 235-F is adequate.

The Secretary of Energy provided an Implementation Plan in response to Recommendation 2012-1 in December 2012 and an updated schedule to the Implementation Plan in March 2015. The new overall completion date for mitigating the residual contamination hazard at Building 235-F is May 31, 2021. During 2016, DOE completed restoring the cell infrastructure in the lowest-hazard cells of the Plutonium Fuel Form Facility (cells 6-9) to support deactivation activities and began removing waste from cell 6. DOE also made progress in identifying the amount and location of the remaining contamination through enhanced characterization measurements of the cells.

Recommendation 2011-1, *Safety Culture at the Waste Treatment and Immobilization Plant*

The Board issued Recommendation 2011-1 following an investigation into the safety culture of the Waste Treatment and Immobilization Plant Project at the Hanford Site. During 2016, the Board monitored efforts by DOE and its contractors to implement safety culture improvement plans, including the DOE-wide Safety Culture Improvement Panel and improvement actions at the Waste Treatment and Immobilization Plant. DOE site offices and contractors have continued to implement the safety culture sustainment plans started in 2014. The DOE-wide Safety Culture Improvement Panel, established in 2015, continues to prepare guidance and training material for safety culture improvement within DOE. In establishing these activities, DOE completed all but one of the actions in its Implementation Plan for the recommendation. The remaining commitment involves changing the Waste Treatment and Immobilization Plant contract to address balanced priorities and include safety culture elements. The Board anticipates that DOE will report completion of this action in 2017.

Recommendation 2010-1, *Safety Analysis Requirements for Defining Adequate Protection for the Public and the Workers*

Recommendation 2010-1 advised DOE to strengthen its regulatory framework for ensuring adequate protection of the public and workers, particularly in cases where Documented Safety Analyses indicate the potential for mitigated offsite consequences

exceeding DOE's Evaluation Guideline of 25 rem Total Effective Dose. In response to Recommendation 2010-1, DOE revised key nuclear safety directives, including DOE Standard 3009, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*, and DOE Standard 1104, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents*. These updated standards contain significantly improved requirements that clarify DOE's expectations for ensuring adequate protection at DOE defense nuclear facilities.

The Board closed this recommendation on September 23, 2016. The Board's letter to the Secretary of Energy closing the recommendation stated that the Board concluded that DOE's previous and planned actions would satisfy the recommendation's intent based on the following considerations: (1) Although there was still an open Implementation Plan commitment for DOE to revise DOE Standard 1189, *Integration of Safety into the Design Process*, the revised standard will no longer include safety analysis requirements. New facilities and major modifications to existing facilities will instead use the enhanced requirements established by Standard 3009-2014; and (2) DOE intends to apply elements of the improved safety standards to the two remaining facilities with mitigated consequences that exceed the Evaluation Guideline. The Board's letter also noted that DOE field elements were currently evaluating existing facility Documented Safety Analyses against new requirements from Standard 3009-2014 that involve protecting the public from radiological hazards, and that the Board would continue to review the execution and results of those evaluations.

Recommendation 2009-2, *Los Alamos National Laboratory Plutonium Facility Seismic Safety*

The Board issued Recommendation 2009-2 to focus the attention of DOE and NNSA leadership on the need to address the danger posed by an earthquake and subsequent fire at the Los Alamos National Laboratory Plutonium Facility. On January 3, 2017, the Board issued a letter to the Secretary of Energy closing this recommendation because the Implementation Plan no longer addressed the current state of safety at the Plutonium Facility. The Board letter noted significant remaining questions regarding the suitability of the Plutonium Facility for long-term operations, including concerns with the adequacy of the fire suppression system and opportunities to further reduce material-at-risk.

During 2016, NNSA continued to implement upgrades to the Plutonium Facility structure and safety systems to improve seismic performance and reduce the consequences of a seismic event. The laboratory contractor has applied carbon fiber wrap to the majority of girders identified as needing reinforcement to improve performance during a seismic event, and expects to complete this effort by the end of fiscal year 2017. NNSA also issued a fiscal year 2017 Project Execution Strategy, which identified 18 planned and ongoing upgrades to the facility. NNSA also continued to make progress on a request for proposal to identify contractors to perform an additional, dynamic non-linear analysis of the facility's performance during an earthquake, and expects to complete this proposal by March 2017. In parallel, laboratory personnel continued work to develop a column capital test program to provide crucial data for the dynamic non-linear analysis.

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Appendix B: Status of Significant Unresolved Issues with DOE's Design and Construction Projects

Since 2007, the Board has provided periodic reports to Congress presenting the status of significant unresolved safety issues concerning the design and construction of DOE's defense nuclear facilities. This report summarizes the status of significant unresolved safety issues through December 2016.

The phrase "unresolved safety issue" does not mean the Board and DOE disagree on resolution. Some of the issues noted in these reports await final resolution through further development of the facility design. The significant unresolved safety issues discussed herein have been formally communicated to DOE. Lesser issues that can be easily resolved and that have an agreed-upon path forward are excluded from this periodic report. The Board will follow these items as part of its normal design review process.

The Board may identify additional issues during future design reviews. For this reporting period one issue was resolved, two new projects have been listed, and the status of two projects changed. No new significant issues were identified during this reporting period. Enclosure B-1 of this report identifies significant unresolved safety issues for current design and construction projects. Enclosure B-2 of this report summarizes significant safety issues that have been resolved by DOE on current design and construction projects.

PROJECT WITH THE MOST SIGNIFICANT UNRESOLVED SAFETY ISSUES

Hanford Site's Waste Treatment and Immobilization Plant (WTP)

Since 2002, the Board has identified a number of significant safety issues with the design of WTP. Many of the unresolved safety issues apply to multiple facilities, with the majority of the issues associated with the Pretreatment (PT) and High-Level Waste (HLW) Facilities. In 2012, DOE restricted engineering, procurement, and construction work at the PT and HLW facilities due to unresolved safety issues and misalignment between the designs and nuclear safety bases. On August 19, 2014, DOE authorized the contractor to resume engineering work to finalize the design of the HLW Facility, with limited procurement and construction.

In 2016, DOE worked to resolve open safety issues with the PT Facility. DOE focused on hydrogen and criticality hazards in process vessels and hydrogen in pipes and ancillary vessels. As part of this effort, DOE began full-scale testing of a standard high-solids vessel design in December 2016. The new vessel design is intended to replace previous high-solids vessel designs in the PT Facility. A considerable amount of work still remains to resolve all open safety issues and finalize the design of both the PT and HLW Facilities.

To mitigate delays due to technical and safety issues with the HLW and PT Facilities, DOE is developing a strategy to feed the liquid portion of the Hanford tank waste to the Low Activity Waste (LAW) Facility without first being processed in the PT Facility. This approach includes a new project—the Low-Activity Waste Pretreatment System (LAWPS)—which will pretreat and

deliver waste to the LAW Facility. This strategy would enable the LAW Facility to begin vitrifying waste before completion of the PT Facility. In 2016, DOE continued to make progress on the design of LAWPS.

During this reporting period, the Board did not identify any new safety issues with the WTP project. The Board closed one safety issue related to plugging and wear of process piping. A description of this issue closure, as well as a complete list of the unresolved safety issues at WTP, can be found below.

The first four safety issues summarized below are associated with inadequate performance of vessel mixing systems. These issues stem from a January 28, 2014, letter to the Secretary of Energy, in which the Board closed Recommendation 2010-2, *Pulse Jet Mixing at the Waste Treatment and Immobilization Plant*, and expressed concern that the underlying safety issues remain unresolved.

Criticality in Process Vessels—Inadequate pulse jet mixing could allow fissile material to accumulate at the bottom of process vessels and potentially lead to criticality. Particles of fissile material could separate from neutron absorbers and reach a critical mass in WTP process vessels. DOE conducted an engineering study on heavy particulate plutonium and evaluated the criticality safety hazards. DOE proposed criticality controls for vessels handling heavy particulate plutonium in the PT Facility.

Generation and Accumulation of Hydrogen in Process Vessels—Inadequate pulse jet mixing could allow solids to accumulate in process vessels, resulting in the generation and accumulation of hydrogen, and could lead to explosions. DOE developed a new hydrogen control strategy for all process vessels in the PT Facility. The strategy for high-solids vessels relies on the new standard high-solids vessel design. The control strategy utilizes both preventive and mitigative controls to ensure adequate protection of the public.

Pulse Jet Mixer Control—The accumulation of solids may interfere with the pulse jet mixer control system, causing frequent overblows (i.e., discharge of air from the pulse jet mixer) that may lead to equipment damage. DOE continues to test prototypic pulse jet mixers to confirm the control system can adequately perform its functions. The final stage of the test program is included in the full-scale testing of the standard high-solids vessel design initiated in December 2016.

Ability to Obtain Representative Samples—Obtaining representative samples is a prerequisite for waste entering WTP from the Hanford Tank Farms to ensure that the safety-related aspects of the WTP Waste Acceptance Criteria (WAC) are met. Waste entering WTP that does not meet the WAC could lead to several safety concerns, including the potential for criticality and hydrogen explosion hazards. Also, waste that does not meet the WAC could produce unacceptable radiation hazards for the public and workers during potential accident scenarios. DOE completed accuracy and precision testing of the waste feed delivery sampling system to verify its performance. Additional work remains to complete the system design and requirements.

The Board's remaining unresolved safety issues with WTP are summarized below:

Hydrogen in Pipes and Ancillary Vessels—Flammable gases generated by the wastes treated in WTP will accumulate in process piping whenever flow is interrupted and in regions that do not experience flow, such as piping dead legs. This hazard, if not properly addressed, may result in explosions and releases of radioactive material within the PT and HLW Facilities. In July 2016, DOE performed an analysis to determine the safety classification of controls for hydrogen explosions in process piping. However, the analysis and control selection for a spray leak initiated by a hydrogen explosion in process piping is not yet complete. Part of DOE's strategy moving forward is to use a quantitative risk analysis model in the design of process piping.

Inadequacies in the Spray Leak Methodology—In an April 5, 2011, letter to DOE, the Board identified safety issues related to DOE's model for estimating radiological consequences to the public from spray leak accidents in the PT and HLW Facilities. WTP recently incorporated test results from the Pacific Northwest National Laboratory spray leak testing program into its accident analyses.

Heat Transfer Analysis for Process Vessels—In an August 3, 2011, letter to DOE, the Board identified safety issues related to the heat transfer calculations used to establish post-accident vessel mixing requirements. These requirements are necessary to prevent explosions in PT Facility process vessels containing waste that develops distinct sludge and supernatant layers if not agitated. DOE is no longer using the heat transfer calculations to establish the mixing requirements in the new PT Facility hydrogen control strategy. Instead, DOE will rely on the waste properties established in the WAC.

Ammonia Controls—In a September 13, 2011, letter to DOE, the Board communicated a concern that the design and safety-related controls for potential releases of large quantities of ammonia at WTP did not adequately protect workers and facilities. In a September 24, 2014, letter, the Board requested DOE's updated plan and schedule to resolve this issue. In its response, DOE committed to perform hazard analyses to identify controls needed to protect the workers and facilities.

Erosion and Corrosion of Piping, Vessels, and Pulse Jet Mixer Nozzles—In a January 20, 2012, letter to DOE, the Board communicated a concern that design information for WTP does not provide confidence that wear allowances are adequate to ensure that piping, vessels, and components located in black cells are capable of confining radioactive waste over the 40-year design life of the facility. The WTP contractor is continuing to perform erosion-corrosion testing to address the concern.

Design and Construction of the Electrical Distribution System—In an April 13, 2012, letter to DOE, the Board identified several issues related to the operability and safety of the electrical distribution system for WTP. Inadequacies in the design and construction of the electrical distribution system would inhibit the safety systems from performing their functions to protect the public and the worker. DOE's response to the letter included a plan to address these issues. DOE has made progress addressing the electrical issues; however, work remains to completely resolve the issue.

Volcanic Ashfall—In an October 23, 2014, letter to DOE, the Board communicated its concern that the WTP design continues to progress without an adequate control strategy to address the volcanic ashfall hazard at the Hanford site. Also, the current WTP design and safety bases do not include the most recent ashfall assessment. Incorporation of the updated assessment will have significant impacts on the structural, ventilation, and emergency power design requirements. DOE is following a phased approach to address the ashfall hazard. As part of the approach, DOE is estimating ashfall consequences and evaluating hazard control alternatives.

The three safety issues listed below are specific to the HLW Facility:

Unanalyzed Melter Accidents—In a December 5, 2014, letter to DOE, the Board communicated its concern that implementation of the nuclear safety control strategy for the melter and associated support systems in the Safety Design Strategy (SDS), could produce a design that is insufficient to protect the public and the workers. The Board identified several melter accident scenarios that were not analyzed in the SDS. As a result, the SDS does not identify nuclear safety controls for these accidents. DOE is evaluating these melter accidents to identify appropriate nuclear safety controls.

HLW Hydrogen Control Strategy—In a January 21, 2015, letter to DOE, the Board communicated its concern that the SDS for the HLW Facility does not define a nuclear safety control strategy for hydrogen explosion hazards following the loss of mixing in the process vessels. This hazard, if not properly addressed, may result in releases of radioactive materials. The Board also expressed concern that the WTP project team plans to rely on evaluations for resolving similar issues in the PT Facility to inform the development of a hydrogen control strategy for the HLW Facility. DOE is evaluating the accident to determine a nuclear safety control strategy.

Seismic Categorization of Safety Controls—In a February 2, 2015, letter to DOE, the Board communicated its concern that the SDS for the HLW Facility did not ensure that the confinement ventilation system, known as "C5V," would be able to perform its credited safety class functions effectively. The SDS proposed downgrading the seismic classification of several key components. Following a seismic design basis accident, these downgrades could result in penetrations through the C5V confinement boundary that compromise safety functions protecting workers and the public. DOE is evaluating the seismic event to validate the seismic classification of safety controls.

SAFETY ISSUE RESOLVED DURING THE PERIOD

1. **Project: Hanford Site, Waste Treatment and Immobilization Plant—Pretreatment Facility and High-Level Waste Facility**

   Issue—Plugging and Wear of Process Piping. In an August 8, 2012, letter to DOE, the Board communicated a concern that the design of the WTP slurry pipeline system is susceptible to formation of sliding beds of solids that can increase wear from erosion and the likelihood of pipeline plugging. The Board's letter also identified that prolonged operation of a centrifugal pump with a plugged process line could cause the pump to fail catastrophically, resulting in

the loss of primary confinement of radioactive waste and damage to adjacent structures, systems, and components.

Resolution—On January 20, 2016, the Board provided to DOE a technical report titled *Plugging and Wear of Process Piping at the Waste Treatment and Immobilization Plant*. The report discussed opportunities for improving DOE's path forward to resolve the issues associated with the formation of sliding beds of solids and pipeline plugging. The report also provides a number of actions for DOE's consideration to address the hazards associated with process piping and pump failures. As a result of the Board's technical report, the WTP contractor plans to mitigate potential wear due to sliding beds of solids by increasing the pipe schedule. In addition, the WTP contractor plans to address the hazards of centrifugal pump explosions in future safety basis reconstitution efforts.

NEWLY LISTED PROJECTS

1. Project: Hanford Site, Waste Encapsulation and Storage Facility (WESF) Capsule Dry Storage System

Description—The WESF Capsule Dry Storage System will be designed to transfer capsules of cesium and strontium from the WESF storage pools to dry storage casks. The casks will be placed on an outdoor concrete pad. Removal of the capsules from the WESF pools will support the cleanup of the B Plant Complex at Hanford, including the disposition of B Plant and WESF. The cask storage system will be a modified version of a spent nuclear fuel storage system licensed by the Nuclear Regulatory Commission.

Status of Facility—DOE approved Critical Decision (CD)-0, *Approve Mission Need*, for this project in April 2013. The contract start date was November 1, 2016. DOE selected NAC International as the vendor to design the cask storage system. NAC International supplied cask storage systems for dry storage of vitrified high-level waste at the West Valley Demonstration Plant.

2. Project: Pantex Plant, Material Staging Facility

Description—The Material Staging Facility will provide safe and secure staging of nuclear weapons and nuclear components.

Status of Facility—DOE approved CD-0, *Approve Mission Need*, for this project on November 24, 2015.

CHANGE IN PROJECT STATUS

1. Project: Los Alamos National Laboratory, Chemistry and Metallurgy Research Replacement (CMRR), PF-4 Equipment Installation Project Phase 1 (PEI-1)

In October 2016, NNSA approved CD-2/3, *Approve Performance Baseline/Approve Start of Construction*, for the CMRR PEI-1 project. This approval established the project performance baseline and authorized the start of construction. NNSA is currently procuring gloveboxes

and making facility modifications to accommodate equipment installation. No Board issues have been identified at this time.

2. Project: Waste Isolation Pilot Plant (WIPP) Permanent Ventilation System

On December 23, 2015, DOE approved CD-1, *Approve Alternative Selection and Cost Range*, for the Underground Ventilation System Project at WIPP. Subsequently renamed the Permanent Ventilation System, it will play a critical role in restoring sustainable operations at WIPP. DOE selected a design alternative that provides a new unfiltered exhaust shaft for mining operations and uses the existing exhaust shaft with additional high-efficiency particulate air (HEPA) filtration capacity for waste disposal operations.

The new system will have a much larger capacity for filtering air from the underground waste storage area than the existing ventilation system. Additionally, the design includes an option that allows for unfiltered exhaust from the waste disposal area that automatically switches to HEPA filtration upon detection of airborne radioactive contamination. In a February 19, 2016, project letter to DOE, the Board noted that mechanical components of the system that are exposed to the harsh environment created by the exhaust from the underground are prone to material degradation, as explained in DOE's Accident Investigation Report, *Phase 1, Radiological Release Event at the Waste Isolation Pilot Plant on February 14, 2014*. The enclosure to the Board's letter described potential safety issues with this option due to reliability concerns when the ventilation system is required to change mode to active confinement ventilation for the waste disposal area.

ENCLOSURE B-1

DECEMBER 2016 REPORT SUMMARY OF SIGNIFICANT UNRESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES			
SITE	**FACILITY**	**Critical Decision (CD) Approved**	**ISSUES[1]**
Hanford Site	**Waste Treatment and Immobilization Plant (WTP)[2]**	--	--
	a. WTP Pretreatment Facility	CD-3	1. Hydrogen in pipes and ancillary vessels—**(Jun. 09)** 2. Criticality in process vessels—**(Apr. 10)** 3. Generation and accumulation of hydrogen in process vessels—**(Apr. 10)** 4. Pulse jet mixer control—**(Apr. 10)** 5. Ability to obtain representative samples—**(Apr. 10)** 6. Inadequacies in the spray leak methodology—**(Jun. 11)** 7. Heat transfer analysis for process vessels—**(Sept. 11)** 8. Ammonia controls—**(Mar. 12)** 9. Erosion and corrosion—**(Jun. 12)** 10. Design and construction of electrical distribution system—**(Jun. 12)** 11. Volcanic ashfall hazard—**(Dec. 14)**
	b. WTP High-Level Waste Facility	CD-3	1. Hydrogen in pipes and ancillary vessels—**(Jun. 09)** 2. Pulse jet mixer control—**(Apr. 10)** 3. Inadequacies in the spray leak methodology—**(Jun. 11)** 4. Ammonia controls—**(Mar. 12)** 5. Erosion and corrosion—**(Jun. 12)** 6. Design and construction of electrical distribution system—**(Jun. 12)** 7. Volcanic ashfall hazard—**(Dec. 14)** 8. Unanalyzed melter accidents—**(Dec. 14)** 9. Hydrogen control strategy—**(Dec. 15)** 10. Seismic categorization of safety controls—**(Dec. 15)**
	c. WTP Low-Activity Waste Facility	CD-3	1. Ammonia controls—**(Mar. 12)** 2. Erosion and corrosion—**(Jun. 12)** 3. Design and construction of electrical distribution system—**(Jun. 12)** 4. Volcanic ashfall hazard—**(Dec. 14)**
	d. WTP Analytical Laboratory	CD-3	1. Ammonia controls—**(Mar. 12)** 2. Design and construction of electrical distribution system—**(Jun. 12)** 3. Volcanic ashfall hazard—**(Dec. 14)**

[1] Dates in parentheses indicate the periodic/annual report in which an issue was first identified. The number assigned to each issue indicates the order in which the issue was identified. Issues not listed have been resolved by DOE and are summarized in Enclosure B-2.

[2] DOE no longer treats the WTP Balance of Facilities as a discrete element of the WTP Project. The Balance of Facilities systems have been realigned with the appropriate facilities in the WTP Project.

DECEMBER 2016 REPORT SUMMARY OF SIGNIFICANT UNRESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES			
SITE	**FACILITY**	**Critical Decision (CD) Approved**	**ISSUES**
Hanford Site (continued)	**K-Basin Closure Sludge Treatment Project**	Phase 1: CD-2/3 Phase 2: CD-0	1. Site boundary and Columbia River control—**(Dec. 15)**
	Waste Feed Delivery System	Not formally implementing CD process	No open issues remain.
	Low Activity Waste Pretreatment System	CD-1	No issues identified.
	Tank Waste Characterization and Staging Capability	CD-0	No issues identified.
	Waste Encapsulation and Storage Facility Capsule Dry Storage System	CD-0	No issues identified.
Idaho National Laboratory	**Calcine Disposition Project**	CD-1	No issues identified.
Los Alamos National Laboratory	**Chemistry and Metallurgy Research Replacement, PF-4 Equipment Installation Project Phase 1**	CD-2/3	No issues identified.
	Plutonium Facility (PF-4) Seismic Upgrades	Not formally implementing CD process	1. Inadequate seismic safety posture—**(Jun. 12)**
	Radioactive Liquid Waste Treatment Facility Upgrade Project—Transuranic Liquid Waste Facility	CD-1	No open issues remain.
	Transuranic Waste Facility	Phase A: CD-4 Phase B: CD-3	1. Deficiencies in the Preliminary Documented Safety Analysis**—(Aug. 14)**
Oak Ridge National Laboratory	**Transuranic Waste Processing Center Sludge Project**	CD-1	No issues identified.
Pantex Plant	**Material Staging Facility**	CD-0	No issues identified.
Savannah River Site	**Salt Waste Processing Facility**	CD-3	No open issues remain.
	Saltstone Disposal Unit #6	CD-3	No issues identified.

DECEMBER 2016 REPORT SUMMARY OF SIGNIFICANT UNRESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES			
SITE	**FACILITY**	**Critical Decision (CD) Approved**	**ISSUES**
Waste Isolation Pilot Plant	**Permanent Ventilation System**[3]	CD-1	No issues identified.
Y-12 National Security Complex	**Uranium Processing Facility**	CD-1	No issues identified.
	Metal Purification Process	Electrorefining: CD-1	1. Analysis of safety systems and components—**(Dec. 15)**

[3] Previously titled *Underground Ventilation System.*

ENCLOSURE B-2

DECEMBER 2016 REPORT SUMMARY OF RESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES		
SITE	**FACILITY**	**RESOLVED ISSUES[1]**
Hanford Site[2]	**a. Waste Treatment and Immobilization Plant (WTP) Pretreatment Facility**	1. Seismic ground motion—**resolved Feb. 08.** The initial ground motion for the design basis earthquake was not technically defensible. Geologic work was completed in early 2007. The resulting data were used to develop final seismic ground motion criteria. 2. Structural engineering—**resolved Dec. 09.** The Board found weaknesses in the structural design, including the modeling, the lack of a clear load transfer capability in the structure, and an inadequate finite element analysis. DOE revised the analyses and prepared summary structural reports showing that the reinforced concrete sections of the facility met structural design requirements. 3. Chemical process safety—**resolved Oct. 07.** The Board was concerned about hydrogen accumulation in plant equipment. In response, DOE developed a conservative design criterion. This issue was reopened in the June 22, , periodic report to Congress as "hydrogen gas control" when DOE changed the design approach. 4. Fire safety design for ventilation systems—**resolved Dec. 09.** The Board was concerned about the means of protecting the final exhaust high-efficiency particulate air (HEPA) filters of the confinement ventilation system from fires. DOE developed and approved design changes to provide adequate protection of the filters from fires. 5. Structural steel analysis and design—**resolved Dec. 10.** The Board identified issues related to the adequacy of the structural steel design. The project team subsequently incorporated more realistic composite construction modeling and demonstrated that the design margin was adequate to compensate for the inadequacies of the finite-element model. 6. Deposition velocity—**resolved Mar. 12.** The Board was concerned that a decision by the WTP project team to change the value for deposition velocity from 0 cm/sec to 1 cm/sec was not technically justified. The project team subsequently changed the deposition velocity to an acceptable value. 7. Use of Low-Order Accumulation Model—**resolved Mar. 12.** The Board was concerned about DOE's use of the Low-Order Accumulation Model for design work on the WTP project because the model under-predicted solids accumulation and had no physical basis. DOE subsequently abandoned use of the model for design work on the project.

[1] Dates in bold indicate the periodic report in which an issue was reported as resolved. The number assigned to each issue indicates the order in which the issue was identified. Issues not listed are unresolved and are summarized in Enclosure B-1.

[2] DOE no longer treats the WTP Balance of Facilities as a discrete element of the WTP Project. The Balance of Facilities systems have been realigned with the appropriate facilities in the WTP Project.

DECEMBER 2016 REPORT SUMMARY OF RESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES		
SITE	**FACILITY**	**RESOLVED ISSUES**
Hanford Site[2] (continued)	**a. WTP Pretreatment Facility (continued)**	8. Selection of validation set for computational fluid dynamics model—**resolved July 13**. The Board was concerned that DOE's plans to validate a computational fluid dynamics model to confirm the performance of pulse jet mixing systems were inadequate. The Secretary of Energy subsequently changed the design verification strategy for pulse jet mixing to a full-scale testing program. 9. Plugging and wear of process piping—**resolved Jan. 16.** As a result of the Board's January 2016 Technical Report, *Plugging and Wear of Process Piping at the Waste Treatment and Immobilization Plant*, the WTP contractor plans to mitigate potential wear due to sliding beds of solids by increasing the pipe schedule. The WTP contractor plans to address the hazards of centrifugal pump explosions in future safety basis reconstitution efforts.
	b. WTP High-Level Waste Facility	1. Seismic ground motion—**resolved Feb. 08**. See Item a.1. 2. Structural engineering—**resolved Dec. 09.** See Item a.2. 3. Fire protection—**resolved Jun. 09.** The Board was concerned that DOE lacked an adequate technical bases for not providing fireproof coatings on structural steel members. The project developed a new fire protection strategy. The Board reviewed this strategy and found it to be acceptable. 4. Fire safety design for ventilation systems—**resolved Dec. 09.** See Item a.4. 5. Structural steel analysis and design—**resolved Dec. 10.** See Item a.5. 6. Deposition velocity—**resolved Mar. 12.** See Item a.6. 7. Selection of validation set for computational fluid dynamics model—**resolved July 13.** See Item a.8. 8. Plugging and wear of process piping—**resolved Jan. 16**. See item a.9.
	c. WTP Low-Activity Waste Facility	1. Fire protection—**resolved Jun. 09.** See Item b.3. 2. Structural steel analysis and design—**resolved Dec. 10.** See Item a.5. 3. Instrumentation and control systems design—**resolved Dec. 14.** The Board was concerned that instrumented controls as documented in the safety basis were not adequately controlled. DOE has directed the implementation of DOE Standard 1195-2011, which addresses the Board's concern.
	d. WTP Analytical Laboratory	1. Fire protection—**resolved Jun. 09.** See Item b.3. 2. Instrumentation and control systems design—**resolved Dec. 14.** See Item c.3.
	K-Basin Closure Sludge Treatment Project	1. Completeness of Preliminary Documented Safety Analysis—**resolved Oct. 07.** The Preliminary Documented Safety Analysis was not based on the project design. DOE subsequently re-established the project at the conceptual design stage, with plans to develop a new safety analysis. This action eliminated the issue. 2. Adequacy of project management and engineering—**resolved Sept. 10.** Persistent technical and project management problems delayed the project and resulted in a design that could not meet project requirements. DOE subsequently implemented a formal project management approach in accordance with departmental directives, which led to an acceptable conceptual design.

DECEMBER 2016 REPORT SUMMARY OF RESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES		
SITE	**FACILITY**	**RESOLVED ISSUES**
Hanford Site[2] (continued)	**K-Basin Closure Sludge Treatment Project (continued)**	3. Inadequacies in integration of safety into the design—**resolved Jun. 12**. Design documentation did not contain sufficient information with which to verify the ability of safety systems to perform their safety functions. Through application of a tailoring strategy for project acquisition, the project team had eliminated key safety-in-design deliverables. DOE and the project team subsequently developed the appropriate safety-in-design documents and provided sufficient design detail to verify the adequacy of safety systems. 4. Inadequacies in safety basis development—**resolved Jun. 12.** Safety basis information lacked adequate rigor and conservatism to ensure that DOE had selected the appropriate type and level of controls to protect the public, workers, and the environment from potential hazards. DOE subsequently revised the safety basis using more defensible parameters and identified additional safety controls in the design and operation of the facility to provide the required protection. 5. Non-bounding spray leak consequence analyses—**resolved Nov. 13.** The unmitigated spray leak accident analysis lacked conservatism and improperly relied on active engineered controls and operator actions. The project subsequently revised the accident analysis to produce bounding spray leak accident consequences and no longer credits active engineered controls or operator actions in the unmitigated analysis. 6. Safety-instrumented systems—**resolved Apr. 14.** The safety basis for the preliminary design credited instrumented systems with performing safety-significant safety functions but did not include design requirements or performance criteria for certain key attributes of safety instrumented systems. DOE approved a revised safety basis and final design, which included design criteria for all key attributes of safety instrumented systems.
	Waste Feed Delivery System	1. Design pressure rating of waste transfer system—**resolved Oct. 07.** The analysis performed to determine the pressure rating of the waste transfer system was inadequate. DOE performed additional analyses and conducted sufficient testing and modeling to determine the minimum design pressure accurately.
Idaho National Laboratory	**Integrated Waste Treatment Unit Project**	1. Pilot plant testing—**resolved Feb. 09.** During pilot plant testing, an over-temperature condition developed in the charcoal adsorber bed. DOE investigated the cause of the over-temperature condition and proposed adequate controls to prevent/mitigate such an occurrence in the full-scale facility. 2. Waste characterization—**resolved Feb. 09.** Characterization of the waste to be processed was necessary to ensure that the process would be operated within the bounds of its safety basis. Additional sampling data were compiled and analyzed to show that the control strategy for the facility was adequate. 3. Distributed Control System design—**resolved Feb. 09.** DOE had not demonstrated that the safety-related Distributed Control System was capable of placing the process in a safe configuration, if necessary. DOE changed the design of the control system and added new design requirements to ensure the operational reliability of the safety-related control system.

DECEMBER 2016 REPORT SUMMARY OF RESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES		
SITE	**FACILITY**	**RESOLVED ISSUES**
Los Alamos National Laboratory	**Radioactive Liquid Waste Treatment Facility Upgrade Project**	1. Weak project management and federal project oversight—**resolved Sept. 10.** The federal Integrated Project Team was not well established or providing effective oversight of the design process. NNSA assigned additional personnel to the team and increased the team's involvement in project oversight. 2. Weak integration of safety into the design process—**resolved Sept. 10.** The integration of the safety and design processes for the project was weak. The project team subsequently developed and implemented appropriate tools for tracking and managing key assumptions and design requirements, developed an adequate technical basis for material selection, identified appropriate seismic criteria, and implemented appropriate hazard analysis techniques.
	Transuranic Waste Facility	1. Inadequate integration of safety into the design process—**resolved Sept. 10.** The project team had not developed adequate information and design specificity for its safety systems to demonstrate the integration of safety into the design. NNSA changed the scope of the project such that the Board no longer considered this issue relevant.
Savannah River Site	**Salt Waste Processing Facility (SWPF)**	1. Geotechnical investigation—**resolved Feb. 08.** The geotechnical reports required to support the design of the project were incomplete, precluding the ability to make a final determination of the design basis earthquake and design settlement. The project team completed the reports and finalized the design basis earthquake and design settlement. 2. Structural evaluation—**resolved Dec. 09.** Initial reviews of the structural design documentation for the main processing facility revealed several significant errors and deficiencies in the structural analysis. DOE brought appropriate structural design expertise and oversight to bear on the project, and issued summary structural reports showing that the facility meets the structural design requirements. 3. Quality assurance—**resolved Jun. 07.** Quality assurance requirements were not implemented, as evidenced by inadequate calculations and the project team's failure to report unrealistic predictions by software and use of unapproved software. DOE completed a corrective action program to address these quality assurance issues. 4. Hydrogen generation rate—**resolved Jun. 09.** The SWPF project team failed to adequately consider or quantify in the project safety control strategy the hydrogen generation rate from thermolysis, which can occur when organic solvent material is heated in the presence of radiation. Idaho National Laboratory performed testing that demonstrated the adequacy of the hydrogen generation rate used in the design.

DECEMBER 2016 REPORT SUMMARY OF RESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES		
SITE	**FACILITY**	**RESOLVED ISSUES**
Savannah River Site (continued)	**SWPF (continued)**	5. Flammable gas control—**resolved July 13.** The SWPF project team did not have a defensible strategy for controlling flammable gases generated in piping and vessels. The SWPF strategy was inadequate because it (1) failed to consider heat input from air pulse agitators in determining flammable gas generation rates, (2) failed to include deflagration-to-detonation transitions and reflections due to piping configuration and obstructions when modeling explosions, and (3) allowed plastic deformation of piping in the event of explosions. In response to these issues, DOE (1) accounted for air pulse agitator heat input in determining flammable gas generation rates, (2) included deflagration-to-detonation transition and reflection in the evaluation of flammable gas hazards, and (3) prohibited plastic deformation of piping in the event of an explosion. 6. Fire protection for final HEPA filters—**resolved Sept. 10.** The design of the confinement ventilation system failed to implement all features required by DOE directives to protect the final HEPA filter stage from potential fires or to demonstrate the equivalency of the design to the requirements in DOE directives. The project team implemented design changes and documented the equivalency of the design to the requirements in DOE directives. 7. Operator actions following a seismic event—**resolved Jun. 12.** The design of the facility failed to ensure that all operator actions required to prevent explosions following a seismic event could be accomplished. DOE performed an additional analysis and implemented a number of design changes to ensure that the required actions could be completed. Examples included incorporating seismically qualified connection for a portable air compressor to the air dilution and ventilation systems to maintain operability after a seismic event. 8. Mixing system controls and operational parameters—**resolved Dec. 12.** The SWPF project team's selection of controls and operational parameters for the air pulse agitators did not account for the limitations of mixing tests and modeling. DOE performed additional tests to demonstrate acceptable mixing performance and committed to implementing appropriate process controls during facility operations.
	Waste Solidification Building	1. Structural design—**resolved Jun. 09.** The analysis for the structural design of the roof and the design of the facility with respect to withstanding potential settlement was inadequate. NNSA directed the project team to alter the design of the roof and correct the settlement analysis. The revised settlement analysis identified the need for design changes to structural members; these changes were subsequently incorporated into the facility design. 2. Deficiencies in Preliminary Documented Safety Analysis—**resolved Feb. 09.** The Preliminary Documented Safety Analysis did not include an appropriate analysis of hydrogen explosion scenarios to ensure confinement of material, nor did it include an adequate demonstration of compliance with DOE Standard 1189 with respect to chemical hazards. NNSA directed the project team to revise its hydrogen explosion calculations to ensure confinement and to demonstrate compliance with the standard for chemical hazards.

DECEMBER 2016 REPORT SUMMARY OF RESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES		
SITE	**FACILITY**	**RESOLVED ISSUES**
Multiple Sites	**Multiple Sites**	1. Deficiencies with the System for the Analysis of Soil-Structure Interaction (SASSI) computer program—**resolved Jan. 16.** Technical and quality assurance issues were identified with SASSI and its use in analyzing seismic response of structures around the complex. DOE developed a guidance memo for the use of SASSI which identified the cause of the technical issues. DOE also developed a set of problems that can be used to verify and validate the software.

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Appendix C: Summary of Significant Safety-Related Aging Infrastructure Issues at Defense Nuclear Facilities

This is the Board's seventh annual report on safety issues associated with aging infrastructure at DOE's defense nuclear facilities. DOE relies on several defense nuclear facilities that are at or near the end of their projected design life, but still must carry out national security and legacy waste cleanup missions. Additionally, other defense nuclear facilities that no longer have an operating mission still perform safety functions because they serve to confine legacy radiological materials. Age-related degradation impacts the ability of facilities to perform mission-related work and legacy confinement functions safely.

During the past year, DOE continued work to mitigate the risk posed by aging defense nuclear facilities. Also, the Board and its staff identified new issues and tracked changes in conditions and missions for aging defense nuclear facilities. The tables in Enclosure C of this Appendix provide a summary of the operating defense nuclear facilities with significant safety-related aging infrastructure issues.

ENCLOSURE C: SUMMARY OF SIGNIFICANT SAFETY-RELATED AGING INFRASTRUCTURE ISSUES AT OPERATING DEFENSE NUCLEAR FACILITIES

NATIONAL NUCLEAR SECURITY ADMINISTRATION (NNSA) SITES						
SITE	**FACILITY**	**BEGAN SERVICE**	**REMAINING SERVICE**	**IDENTIFIED CONCERN**	**ASSOCIATED NNSA ACTIONS**	**NNSA ACTIONS SINCE LAST REPORT**
Los Alamos National Laboratory (LANL)	Plutonium Facility (PF-4)	1978	TBD	The potential for earthquake-initiated fire or facility collapse and loss of confinement could result in a high radiological dose to the workers and public following certain seismic events. Key facility-level safety systems (fire suppression system and active confinement ventilation system) are not qualified to survive certain seismic accident scenarios. Additional vulnerabilities to the fire suppression system were identified in late 2015. These vulnerabilities resulted in declaration of a Potential Inadequacy in the Safety Analysis and were documented in a May 12, 2016, Board letter to NNSA. The Board has noted that additional seismic analysis of the facility is needed to demonstrate compliance with DOE standards for confinement integrity following a design basis earthquake.	NNSA is implementing upgrades to the facility structure and selected safety systems to improve seismic performance. Additionally, NNSA is pursuing an alternate seismic analysis to better characterize the likelihood of facility collapse and identify/prioritize structural upgrades.	The LANL contractor is nearly complete with upgrading facility structural members with known seismic vulnerabilities. The contractor also continued seismic upgrades for portions of selected facility safety systems, including the fire suppression system, though the timeline has been extended due to deficiencies identified in the May 12, 2016, Board letter to NNSA. NNSA eliminated from the scope of the TA-55 Reinvestment Project's Phase III upgrading the active confinement ventilation system to safety-class and removing non-seismically qualified loads from the safety class fire water loop. NNSA is developing requests for a proposal to complete a dynamic non-linear analysis and column capital testing based on recommendations of its Seismic Expert Panel.

NATIONAL NUCLEAR SECURITY ADMINISTRATION (NNSA) SITES						
SITE	**FACILITY**	**BEGAN SERVICE**	**REMAINING SERVICE**	**IDENTIFIED CONCERN**	**ASSOCIATED NNSA ACTIONS**	**NNSA ACTIONS SINCE LAST REPORT**
LANL (continued)	Chemistry and Metallurgy Research (CMR) Facility	1952	Capabilities are being transitioned through the CMR Replacement Project. NNSA planned to terminate programmatic operations by 2019. A December 2016 letter from the LANL director to the NNSA Administrator indicates that this timeline is no longer attainable, but NNSA has not endorsed that conclusion.	The facility is vulnerable to collapse and loss of confinement, resulting in a high radiological dose to the workers and public following certain seismic events.	NNSA is limiting material-at-risk in the facility to reduce the public dose consequence following an earthquake to a value below the Evaluation Guideline. Additionally, NNSA is developing alternate strategies to transfer CMR capabilities into existing LANL facilities. NNSA approved a revised Mission Need Statement and Program Requirements document covering new subprojects to repurpose existing space in the Plutonium Facility and the Radiological Laboratory Utility Office Building.	NNSA approved Critical Decision 2/3 for the Plutonium Infrastructure Strategy equipment installation sub-projects and conducted an analysis of alternatives for the Plutonium Modular Approach project. CMR building operators completed cleaning out the fourth of ten confinement vessels stored at TA-55 that have been slated for disposition. Confinement vessel cleanout is a key activity that must be completed before exiting CMR.

NATIONAL NUCLEAR SECURITY ADMINISTRATION (NNSA) SITES						
SITE	**FACILITY**	**BEGAN SERVICE**	**REMAINING SERVICE**	**IDENTIFIED CONCERN**	**ASSOCIATED NNSA ACTIONS**	**NNSA ACTIONS SINCE LAST REPORT**
Nevada National Security Site	Device Assembly Facility (DAF)	1996	TBD	The fire protection system water tank is degrading and lead-in lines are corroding.	In 2009, NNSA completed a reliability assessment of the DAF fire protection system. In 2012, NNSA approved a comprehensive project plan that should address the full scope of deficiencies in the DAF fire protection system by 2019. In 2014 and 2015, NNSA bypassed the three leaking lead-in lines and conducted associated hydrostatic testing.	In 2016, NNSA addressed the lead-in lines for nine buildings. NNSA has also addressed the sprinkler deficiencies for six buildings. NNSA is still considering how to replace the lead-in lines on the south side after discovering that the as-built configuration made access difficult. NNSA is also still considering the path forward for the corroded water supply tank.

NATIONAL NUCLEAR SECURITY ADMINISTRATION (NNSA) SITES						
SITE	**FACILITY**	**BEGAN SERVICE**	**REMAINING SERVICE**	**IDENTIFIED CONCERN**	**ASSOCIATED NNSA ACTIONS**	**NNSA ACTIONS SINCE LAST REPORT**
Pantex Plant	Site-Wide Fire Protection Systems	1950s	TBD	Fire protection lead-ins to numerous facilities and the fire water system's underground pipes that have not been replaced exhibit corrosion-related failures. Aging fire detection system components continue to fail and are no longer being manufactured. During a review, the Board's staff identified a potential vulnerability associated with latent undetected failure modes with the system's flame detectors, which will remain in place for multiple years.	NNSA has made progress installing upgraded fire protection systems and associated components (e.g., sprinkler lead-ins, deluge valves, a diesel fire pump, a water storage tank, fire water mains, and fire detection systems). NNSA completed the start-up of a new diesel fire pump and water storage tank in 2014. NNSA completed the design and testing of a replacement fire detection system.	NNSA continues to replace fire protection lead-ins and underground piping. NNSA installed the replacement fire detection system in two nuclear explosive facilities, and is working to return the facilities to operation. NNSA tested the older system's flame detectors for latent undetected failure modes and identified no resulting issues.

NATIONAL NUCLEAR SECURITY ADMINISTRATION (NNSA) SITES						
SITE	**FACILITY**	**BEGAN SERVICE**	**REMAINING SERVICE**	**IDENTIFIED CONCERN**	**ASSOCIATED NNSA ACTIONS**	**NNSA ACTIONS SINCE LAST REPORT**
Y-12 National Security Complex	9212 Complex (Building 9212 and thirteen collocated buildings)	1951	Capabilities will be relocated or replaced by the Uranium Processing Facility (UPF). Full replacement of 9212 Complex enriched uranium operations is expected in 2025.	The facility is vulnerable to collapse and loss of confinement resulting in high consequences for facility workers following certain seismic and high wind events. The 9212 Complex has reached its end of life. Continued deterioration of systems and components further increases operational safety risk.	NNSA performed Facility Risk Reviews (FRR) in 2006 and 2011 to identify infrastructure investment opportunities and executed the Nuclear Facility Risk Reduction capital project to reduce safety and operational risk. NNSA established the Continued Safe Operability Oversight Team (CSOOT) to maintain awareness of facility conditions and monitor progress toward implementing FRR recommendations. The fiscal year (FY) 2013 charter for this team includes the 9212 and 9215 Complexes and Building 9204-2E. NNSA made significant changes to the UPF project to prioritize replacing functions performed in the 9212 Complex.	NNSA continued to reduce material-at-risk and initiated a series of maintenance outages intended to improve operational safety and reliability of certain 9212 Complex process systems.

NATIONAL NUCLEAR SECURITY ADMINISTRATION (NNSA) SITES						
SITE	**FACILITY**	**BEGAN SERVICE**	**REMAINING SERVICE**	**IDENTIFIED CONCERN**	**ASSOCIATED NNSA ACTIONS**	**NNSA ACTIONS SINCE LAST REPORT**
Y-12 National Security Complex (continued)	Building 9204-2E and the 9215 Complex	Building 9204-2E: Late 1960s 9215 Complex: 1950s	Building 9204-2E: Now planned to serve an enduring mission due to changes in UPF project scope. 9215 Complex: Identified as a bridging facility for selected UPF operational capabilities.	The structural design and performance of Building 9204-2E and the 9215 Complex do not meet modern DOE requirements.	The FY 2013 charter for the CSOOT includes Building 9204-2E and the 9215 Complex. In 2015, NNSA reduced the material-at-risk limits for the 9215 Complex.	In 2014, the CSOOT recommended the development of an Extended Life Program or these facilities. NNSA accepted the recommendation and developed the program in 2016. NNSA continues to reduce material-at-risk in these facilities.

ENVIRONMENTAL MANAGEMENT SITES						
SITE	**FACILITY**	**BEGAN SERVICE**	**REMAINING SERVICE**	**IDENTIFIED CONCERN**	**ASSOCIATED DOE ACTIONS**	**DOE ACTIONS SINCE LAST REPORT**
Hanford Site	Single-Shell and Double-Shell Tank Farms	1943 - 1986	TBD	The single-shell tanks are well beyond their design life, while the double-shell tanks are approaching and will likely exceed their design life before operation of the Waste Treatment and Immobilization Plant.	DOE is transferring waste from single-shell tanks to double-shell tanks for storage. DOE made preparations for removing waste from double-shell tank 241-AY-102, which has a leak in its primary liner.	DOE continues to retrieve waste from single-shell tanks and made significant progress in removing waste from double shell tank 241-AY-102.
	T Plant	1944	TBD	T Plant does not meet minimum building code requirements for structural concrete. While T Plant is suitable for current approved missions (e.g., waste storage, treatment, and packaging operations, including K-Basin sludge storage), it may not be suitable for potential missions such as K-Basin sludge treatment or remote-handled transuranic waste processing.		T Plant is being prepared for receiving, storing, and treating the radioactive sludge that is scheduled to be removed from the K-West Basin by FY 2020.

ENVIRONMENTAL MANAGEMENT SITES						
SITE	**FACILITY**	**BEGAN SERVICE**	**REMAINING SERVICE**	**IDENTIFIED CONCERN**	**ASSOCIATED DOE ACTIONS**	**DOE ACTIONS SINCE LAST REPORT**
Hanford Site (continued)	Waste Encapsulation and Storage Facility (WESF)	1974	TBD	WESF, built in 1973, has significantly exceeded its design life. The strength of concrete in the cells of its underwater pools is indeterminate and may be deteriorating from radiation exposure. This condition could result in water loss from the basin if a severe earthquake occurred. Basin water is used to cool the cesium and strontium capsules and provide radiation shielding.	DOE replaced the K-3 ventilation system as part of actions related to the DOE Implementation Plan for Board Recommendation 2004-2. This upgrade supports future efforts to move the capsules from the pool to dry storage.	DOE and its contractor have issued a contract for the design and fabrication of a long-term dry cask storage system under the Capsule Extended Storage Project. Activities for the design of the Capsule Storage Area and the operational retrieval of the capsules are not included in this contract.
Savannah River Site (SRS)	Building 235-F	1950s	Storage and operation mission complete. Deactivation planned for 2021.	Significant facility and safety system degradation, including seismic and fire vulnerabilities. Board Recommendation 2012-1 identifies the need to execute actions that reduce the hazards associated with residual contamination.	DOE committed to immobilizing or removing Pu-238 contamination, making near-term safety improvements, and improving facility emergency response. DOE has made progress in these commitments by de-energizing electrical circuits, removing unneeded equipment, removing fixed and transient combustibles, and conducting emergency response drills and exercises.	DOE restored infrastructure in cells 6–9 to support deactivation activities. The SRS contractor began decontamination of cell 6. The SRS contractor completed enhanced characterization of cells 6–9 and is analyzing the characterization measurements from cells 3–5.

ENVIRONMENTAL MANAGEMENT SITES						
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SRS (continued)	H-Canyon	1955	TBD	Age-related issues identified at the H-Canyon facility have the potential to impact the safe disposition of spent nuclear fuel and other hazardous materials. The concrete process air exhaust tunnel is more than 60 years old, and recent inspections have revealed that it has significantly degraded.	DOE continues to evaluate and address age-related issues including evaluation of the ventilation system.	DOE began taking concrete core samples from the process air exhaust tunnel to characterize the condition of the tunnel so that a defensible analysis of its structural performance can be completed.
	Tank Farms	1954–1962	TBD	The SRS high-level waste tanks and associated safety equipment have experienced age-related degradation that requires ongoing DOE monitoring and actions, including evaluation of tank and transfer system integrity.	DOE made progress in removing and processing high-level waste from older, degraded tanks. DOE continues to monitor and address tank and safety system issues.	DOE is investigating the cause of a leak in an evaporator needed to process high-level waste. The evaluation will support a repair vs. replacement decision for the evaporator. DOE continues actions to remove and process high-level waste.
	A-Area Fire Protection Water Supply Systems	1950s	TBD	The pumps and water supply that support fire protection systems in A-Area, including the Savannah River National Laboratory, are degraded and no longer code-compliant.	DOE is pursuing actions to replace the fire pumps and water supply tank in A-Area.	DOE repaired a leak in the degraded A-Area fire water supply tank. DOE continues to pursue a project to replace the fire water tank and pumps in A-Area.

ENVIRONMENTAL MANAGEMENT SITES						
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Waste Isolation Pilot Plant (WIPP)	WIPP Surface Structures, Shafts, and Underground Structures	1999 (Construc-ted 1981-1983)	Waste disposal operations planned to continue until at least 2035.	Several issues have been identified related to the WIPP maintenance program. Structures, systems and components (SSCs), such as the confinement ventilation system, have been upgraded and are now classified as safety-significant. These will need to be maintained and protected to guard against further release of radioactive material from the mine.	The vehicle fire and radiological release that occurred in February 2014 prompted DOE to suspend disposal operations. The recovery plan included upgrades to key SSCs.	DOE has upgraded the existing confinement ventilation system to increase its reliability and availability to provide additional airflow for mine stabilization activities and resumption of waste emplacement. DOE approved Critical Decision-1, *Approve Alternative Selection and Cost Range*, on December 23, 2015, for a new safety-significant confinement ventilation system to replace the existing system. Design activities are scheduled to be complete by the end of FY 2017. The project is projected to be completed in FY 2021. Waste emplacement activities resumed in January 2017.

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Index