



## **Defense Nuclear Facilities Safety Board**

### **26<sup>th</sup> Annual Report to Congress March 2016**

**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)**

Joyce L. Connery, Chairman  
Jessie H. Roberson, Vice Chairman  
Sean Sullivan  
Daniel J. Santos  
Bruce Hamilton

**DEFENSE NUCLEAR FACILITIES  
SAFETY BOARD**

Washington, DC 20004-2901



March 30, 2016

To the Congress of the United States:

The Defense Nuclear Facilities Safety Board (Board) is pleased to submit to Congress its Twenty-Sixth Annual Report for Calendar Year 2015. 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 problems yet to be resolved. Two reports formerly submitted separately to Congress—the periodic report on the status of significant unresolved safety issues with DOE's design and construction projects and the annual report on significant safety-related infrastructure issues at DOE defense nuclear facilities—are included as Appendix C and Appendix D, respectively. The Board will continue to include these reports as appendices to future Annual Reports.

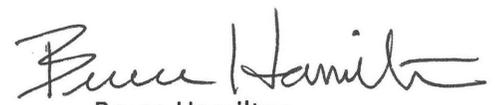
Respectfully submitted,

  
Joyce L. Connery  
Chairman

Jessie H. Roberson  
Vice Chairman

  
Sean Sullivan  
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## EX. Executive Summary

Under the Atomic Energy Act, as amended, the Defense Nuclear Facilities Safety Board (Board) is responsible for independent oversight of all programs and activities impacting public health and safety within 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 that the Board determines have adversely affected, or may adversely affect, public health and safety. Board oversight is centered on nuclear safety at 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 the Board's most significant safety oversight initiatives and the highest priority safety issues at defense nuclear facilities subject to the Board's oversight during 2015. Foremost among these issues are:

- Emergency Preparedness and Response
- Safety Basis for Transuranic Waste Operations at Los Alamos Area G
- Recovery Actions at the Waste Isolation Pilot Plant
- Nuclear Criticality Safety at the Los Alamos National Laboratory Plutonium Facility
- Seismic Vulnerability at the Los Alamos National Laboratory Plutonium Facility
- Early Integration of Safety in Design

This Annual Report begins with a description of the Board's statutory mission, followed by a summary of the issues listed above. The report next discusses the Board's Recommendation 2015-1, *Emergency Preparedness and Response at Pantex*, issued on November 24, 2015, and then provides the status of Board's Recommendations from prior years which remain open. The report next summarizes the Board's most significant oversight activities in four strategic areas: nuclear weapon operations, design and construction, hazardous materials, and safety standards and programs. Lastly, the report summarizes the Board's efforts to inform the public about its work, and then reviews funding and human resources at the Board.

In addition, in order to keep the Congress informed regarding the hazards posed by aging defense nuclear facilities and DOE's progress in resolving issues in the design of modern replacement facilities, this Annual Report includes two annual summaries as appendices: the first of these summarizes significant unresolved safety issues with DOE's design and construction projects; the second summarizes the status of significant safety issues related to aging infrastructure in the DOE defense nuclear complex.

## **I. The Board's Statutory Mission**

### **Mission, Jurisdiction, and Powers**

The Board was established in 1988<sup>1</sup> 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. While informal exchanges between Board and DOE technical professionals may add safety margin to defense nuclear facilities, formal recommendations made on the public record specifically address adequate protection concerns to the Secretary of Energy. Safety measures may pertain to specific DOE facilities and activities or may be directed at the safety requirements and guides employed to regulate nuclear activities.

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. In order to carry out its mission, Congress granted the Board an effective suite of statutory tools. 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

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<sup>1</sup> 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](http://www.dnfsb.gov/sites/default/files/Board%20Activities/Reports/Reports%20to%20Congress/1995/ar_1995216_1301.pdf)

hearings (and subpoena witnesses, if necessary), conduct investigations, demand 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).

### Major Sites Subject to Board Jurisdiction

Site	Location	Operations	Website
Hanford Site	Richland, Washington	Management and treatment of radioactive wastes; facility decommissioning	<a href="http://www.hanford.gov">http://www.hanford.gov</a>
Idaho National Laboratory	45 miles west of Idaho Falls, Idaho	Storage and processing of radioactive waste	<a href="http://www.inl.gov">http://www.inl.gov</a>
Lawrence Livermore National Laboratory	Livermore, California	Research to support the nuclear weapons arsenal	<a href="https://www.llnl.gov">https://www.llnl.gov</a>
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	<a href="http://www.lanl.gov">http://www.lanl.gov</a>
Nevada National Security Site	65 miles northwest of Las Vegas, Nevada	Disposition of damaged nuclear weapons; nuclear fission and subcritical experiments; waste management	<a href="http://www.nv.energy.gov">http://www.nv.energy.gov</a>
Oak Ridge National Laboratory	Oak Ridge, Tennessee	Energy research; treatment and disposal of radioactive wastes	<a href="http://www.ornl.gov">http://www.ornl.gov</a>
Pantex Plant	17 miles northeast of Amarillo, Texas	Maintenance of the U.S. nuclear stockpile	<a href="http://www.pantex.com">http://www.pantex.com</a>
Sandia National Laboratories	Albuquerque, New Mexico	Nuclear research; support for the weapons stockpile maintenance program	<a href="http://www.sandia.gov">http://www.sandia.gov</a>
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	<a href="http://www.srs.gov">http://www.srs.gov</a>
Waste Isolation Pilot Plant	26 miles east of Carlsbad, New Mexico	Safe disposal of transuranic waste in underground repository	<a href="http://www.wipp.energy.gov/">http://www.wipp.energy.gov/</a>
Y-12 National Security Complex	Oak Ridge, Tennessee	Manufacturing and surveillance of nuclear weapons components; processing of weapons-grade uranium	<a href="http://www.y12.doe.gov/">http://www.y12.doe.gov/</a>

## **II. Highest-Priorities**

### **Emergency Preparedness and Response**

#### Board Actions

On September 3, 2014, the Board issued Recommendation 2014-1, *Emergency Preparedness and Response*, to address deficiencies with DOE's promulgation of emergency management requirements and oversight of compliance with those requirements. The Board focused reviews in 2015 on the assessment of implementation of these requirements at defense nuclear facilities. These assessments included site-specific reviews at the Pantex Plant and Savannah River Site, as well as observation of drills and exercises at the Y-12 National Security Complex, Los Alamos National Laboratory, Lawrence Livermore National Laboratory, Sandia National Laboratories, the Pantex Plant, the Savannah River Site, and the Hanford Site.

The review at the Pantex Plant led to the identification of significant issues that warranted near-term resolution. As a result, on November 24, 2015, the Board issued Recommendation 2015-1, *Emergency Preparedness and Response at Pantex*, to address the identified deficiencies. Section III of this report discusses the details of the Board's Recommendation.

Similarly, the Board noted weaknesses in emergency preparation and response programs at LANL in 2015, and issued a letter to the Secretary of Energy on January 7, 2016, to alert him to the problem. The Board's letter reported that the laboratory contractor had self-identified that it had failed to implement a training and drills program consistent with the requirements of DOE Order 151.1C, *Comprehensive Emergency Management System*. It also provided the Board's preliminary observations of weaknesses associated with emergency preparedness and response at LANL. The Board's letter suggested that the Secretary consider whether additional requirements or oversight were needed.

#### DOE Response

Despite the Board's emphasis on the need to improve emergency preparedness and response programs across the DOE defense nuclear complex, DOE's actions in response to Recommendation 2014-1 have not met the schedule defined in the Secretary's Implementation Plan for the Recommendation. By the end of 2015, six deliverables for the plan were past due, including key items such as the draft Criteria and Review Approach Document for DOE oversight of emergency preparedness and response programs.

### **Safety Basis for Transuranic Waste Operations at Los Alamos Area G**

#### DOE Activities

Since 2014, the Los Alamos contractor has declared four Potential Inadequacies of the Safety Analysis (PISA) at Area G, all of which remained unresolved at year's end. These

unresolved PISAs included the potential for a release event similar to the one that occurred at the Waste Isolation Pilot Plant (WIPP) on February 14, 2014. All concerns addressed in the PISAs are magnified in the event of a wildfire of type to which Los Alamos has been historically susceptible.

Area G provides Los Alamos National Laboratory's (LANL) current capability for storing and certifying defense-related transuranic (TRU) waste prior to permanent disposal at WIPP. The LANL contractor largely curtailed operations at Area G following initial indications that a drum of TRU waste generated at LANL was involved in the February 2014 radiological release event at WIPP. LANL will not be able to resume shipping waste to WIPP until DOE completes extensive corrective actions at WIPP. Today's aboveground TRU waste inventory at Area G includes about 3,500 containers, of which about 2,000 require further remediation to achieve compliance with WIPP acceptance criteria. This includes 60 drums that contain waste similar to the drum identified by DOE as the source of the release at WIPP. LANL requires a functioning waste management system to enable programmatic work, as well as important risk reduction activities in the Plutonium Facility (PF-4), Chemistry and Metallurgy Research building, and Weapons Engineering Tritium Facility. Additionally, with LANL resuming plutonium activities, the National Nuclear Security Administration (NNSA) will be generating additional TRU waste that will need to be stored. See the item on "Nitrate Salt-Bearing TRU Waste" in Section V for additional information on the issues at Area G.



**Aerial View of Area G**

#### *Board Staff Activities*

The Board's staff has reviewed and provided feedback to the Los Alamos contractor and NNSA Field Office personnel on multiple safety basis changes designed to address some of the identified inadequacies. The Board's staff also observed and provided feedback to NNSA personnel during waste container thermal testing at Sandia National Laboratories (SNL), which will be utilized to support the Area G safety basis.

#### *Board Action*

The Board has voted to hold a public hearing in early 2016 to discuss safety issues at Area G and NNSA and DOE's plans to address and mitigate hazards.

## **Recovery Actions at the Waste Isolation Pilot Plant**

Resumption of waste disposal operations at WIPP is essential to eliminate the risks posed by TRU waste stored across the DOE defense nuclear complex. Completing the extensive recovery actions needed to resume operations at WIPP in a timely manner while adequately protecting workers and the public is a challenging task. The Board has increased safety oversight of WIPP commensurate with its importance and challenge.

### *DOE Activities*

WIPP has not conducted TRU waste operations since early February 2014 as the result of a fire involving an underground vehicle and a second event that involved the release of radioactive material. The radioactive release event contaminated a portion of the underground and released a small amount of radioactive contamination into the environment. DOE issued its final investigation report on the vehicle fire in March 2014 and its final investigation report on the release event in April 2015. The investigations identified more than 200 corrective actions required to ensure future WIPP operations can be safely performed. During 2015, DOE completed interim closure of underground areas containing waste similar to that involved in the radioactive release. This action greatly reduced the potential consequences of a repeat radioactive release event while the corrective actions are being put in place. Elimination of the hazards posed by storage of TRU waste at DOE's other defense nuclear facilities continued to be on hold throughout 2015 due to the halt in WIPP operations.

### *Board Staff Activities*

Members of the Board's staff regularly traveled to WIPP to closely monitor DOE's recovery actions throughout 2015, and prioritized oversight of DOE's efforts to revise the safety basis for waste disposal operations at WIPP to ensure that workers and the public are adequately protected both during recovery operations and after resumption of waste disposal operations.

### *Board Action*

The Board held a public hearing and meeting in Carlsbad, New Mexico on April 29, 2015, to assess progress at WIPP. See the item on "Recovery and Resumption of Operations at WIPP" in Section IX for a summary of the hearing and meeting.

## **Nuclear Criticality Safety at the Los Alamos National Laboratory Plutonium Facility**

### *DOE Activities*

Since 2005, NNSA has recognized that LANL's nuclear criticality safety program does not fully comply with applicable requirements. In 2013, a severe staffing shortage in LANL's nuclear criticality safety group inhibited progress in correcting the deficiencies in this program. On June 27, 2013, the Laboratory Director paused all programmatic activities at PF-4. During 2015, LANL

achieved substantial progress in resuming operations at PF-4 following corrective actions to address long-standing criticality safety program deficiencies.

### Board Actions

The Board's 24th and 25th Annual Reports to Congress, dated March 2014 and March 2015 respectively, summarize the Board's role in identifying new deficiencies and bringing the state of LANL's nuclear criticality safety program to the attention of the laboratory contractor's management and the Secretary of Energy.

### DOE Response

NNSA has executed a number of corrective actions, resumed PF-4 operations that pose a lower criticality safety risk, and completed readiness assessments for four of eight higher-risk operations at PF-4. NNSA plans to conduct the remaining PF-4 readiness assessments in 2016.

### Board Staff Activities

The Board's staff observed the majority of the contractor and federal readiness assessments for these higher-risk operations and found them to be appropriately rigorous. The Board's staff also reviewed the implementation of corrective actions to ensure that they effectively addressed the deficiencies identified in nuclear criticality safety and conduct of operations. The Board's staff will evaluate the adequacy of the readiness assessments scheduled in 2016 for the remaining higher-risk operations at PF-4.



**Downdraft Table Operations: Readiness Assessment completed in 2015**

## **Seismic Vulnerability at the Los Alamos National Laboratory Plutonium Facility**

The risk posed by an earthquake at LANL remains a significant safety concern. NNSA has funded several upgrades to the facility in recent years and plans further upgrades. Still, NNSA and the Board have yet to reach consensus on the issue of whether existing seismic analyses provide sufficient assurance that the facility can withstand a design basis earthquake. Additionally, the Board continues to suggest that NNSA reduce the risk to the public health and safety by reducing the amount of radioactive material in the facility and improving storage conditions for the material that remains in the facility.

### Board Action

In 2009, the Board found that the safety documentation for PF-4 approved by NNSA in December 2008 indicated that the radiation dose consequence to the public following an earthquake and resulting fire could exceed DOE's allowed levels by several orders of magnitude. As a result, on October 26, 2009, the Board issued Recommendation 2009-2, *Los*

*Alamos National Laboratory Plutonium Facility Seismic Safety*, to focus the attention of DOE and NNSA leadership on the need to address the danger posed by an earthquake and subsequent fire at PF-4.

### DOE Response

In response, the LANL contractor undertook a series of actions to improve the safety posture of this facility. These actions included efforts to strengthen the structure of the building and to reduce the likelihood and severity of a post-seismic fire. At the same time that NNSA was pursuing these efforts, additional structural analyses performed using an updated probabilistic seismic hazard analysis for the Los Alamos site raised further questions regarding the possibility of severe damage to PF-4, including a potential facility collapse, following a design basis earthquake.

To resolve these questions, the Deputy Secretary of Energy directed NNSA in September 2012 to evaluate the seismic vulnerability of PF-4 using a new alternate modeling approach. The engineering firm conducting this alternate analysis completed the first phase in 2014; however, NNSA paused further work and chartered a Seismic Expert Panel made up of prior peer reviewers of PF-4 structural analyses to review the results of the first phase of the alternate analysis as well as a previously completed contractor analysis. The Seismic Expert Panel provided its report to NNSA on March 31, 2015, and subsequently briefed senior NNSA personnel to discuss potential paths forward. The panel recommended continuing structural upgrades to PF-4 girders, conducting limited physical testing of column capitals, inspecting the tops of columns and sliding joints, and instituting administrative controls on live loading, but concluded that no further vulnerability assessment of PF-4's structure was warranted.



**New Drag Strut across PF-4 Roof**

On July 24, 2015, NNSA directed its Los Alamos Field Office to develop a request for proposal to identify contractors capable of completing the alternate analysis of PF-4 using a dynamic non-linear seismic analysis. Such a model should allow NNSA to defensibly determine the likelihood of facility collapse and the extent of upgrades needed. NNSA's current schedule indicates the request for proposal will be completed in September 2016.

### Board Actions

In light of the potential for very high offsite dose consequences and the time required to address PF-4's structural vulnerabilities, the Board issued a letter to the Secretary of Energy on January 3, 2013, urging that DOE implement additional near-term measures to reduce the consequences of a facility collapse. The Board's letter suggested measures such as accelerated disposition of plutonium already designated as waste or surplus material, robust containerization of dispersible plutonium forms, and strengthened emergency planning and

preparedness protocols and measures. Based on NNSA's limited progress in accomplishing the first two suggestions, the Board provided a Technical Report entitled *Opportunities for Risk Reduction at the Los Alamos National Laboratory Plutonium Facility through the Minimization of Material-at-Risk* to NNSA on September 21, 2015. This report provided a number of actions for NNSA to consider, including the use of robust, certified storage containers for nuclear materials; disposition of materials with no defined use; and effective use of the PF-4 vault and other hardened storage locations.

## Early Integration of Safety in Design

### Board Actions

The Board supports DOE's efforts to integrate safety concepts at an early stage in design and construction projects. To this end, the Board uses "project letters" to provide timely notification of safety issues to DOE at major project milestones (known as "Critical Decisions"). This process ensures that DOE is aware of unresolved safety issues and assists DOE in evaluating a project's readiness to move forward. During 2015, the Board completed five project letters as summarized below:

- *Hanford Site, WTP High-Level Waste Facility, May 8, 2015*—Described open safety issues that require DOE senior management's attention to achieve resolution and produce a defensible safety basis for the facility.
- *Savannah River Site, Waste Solidification Building, May 13, 2015*—Noted no unresolved safety issues, but noted that certain activities required for project completion were deferred because the facility was entering cold standby.
- *Hanford Site, Low Activity Waste Pretreatment System (LAWPS), May 14, 2015*—Concluded that no significant safety issues existed at the completion of conceptual design that would preclude the project from advancing. The Board identified three concerns that the LAWPS project plans to address during the preliminary design phase.
- *Savannah River Site, K-Area Complex Purification Area Vault, June 22, 2015*—Noted no issues that would question DOE's declaration of project completion. However, the Board did note that potential vulnerabilities exist in the facility's safety posture, and acknowledged that DOE and the project contractor had already identified opportunities to resolve several of the issues.
- *Y-12 National Security Complex, Electrorefining Project, October 29, 2015*—Concluded that at the conceptual design phase the project had appropriately identified structures, systems, and components (SSCs) necessary to confine and control hazardous material, but did not fully analyze some of these SSCs to determine whether they can perform their credited safety functions.

In July of 2007, the Board and DOE issued a Joint Report to Congress entitled *Improving the Identification and Resolution of Safety Issues during the Design and Construction of DOE Defense Nuclear Facilities*. Subsequently, the Board implemented a review process that included formally communicating identified safety issues early in the design process to minimize schedule and cost impacts to projects. In a letter to the Secretary of Energy dated April 21, 2015, the Board proposed a joint effort to review the processes by which the Board interacts with DOE to identify potential safety issues in the design and construction of new facilities. In the letter, the Board stated that after eight years of experience with the process, both organizations might benefit from a joint review to identify any lessons learned or potential improvements.

#### DOE Response

In a response letter dated June 12, 2015, DOE agreed that performing a joint review would be beneficial to both organizations and identified NNSA and DOE Office of Environmental Management points of contact for this review. The Board and DOE are planning to conduct a workshop as a key piece of this effort.

### III. Recommendations Issued to the Secretary in 2015

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

##### Board Actions

On November 24, 2015, the Board issued Recommendation 2015-1, *Emergency Preparedness and Response at Pantex*. This Recommendation identified problems with the implementation of emergency preparedness and response requirements at the Pantex Plant. The full text of the Recommendation can be found at <http://www.dnfsb.gov/board-activities/recommendations>.

Over the past several years, the Board has been evaluating the state of Pantex's emergency management program. Based on a series of interactions with NNSA and the Pantex contractor, including on-site reviews, exercise observations, and a Board public hearing, the Board determined that there were significant weaknesses in specific elements of the Pantex Plant's capability to respond to an emergency and recommended that action be taken in a timely manner to address the shortcomings.

Based on these concerns, the Board issued Recommendation 2015-1 to the Secretary of Energy on November 24, 2015, with three specific sub-recommendations. The first sub-recommendation focused on ensuring the Pantex Plant drill and exercise programs comprehensively demonstrate proficiency in responding to emergencies for all hazards, all facilities, and all responders over a five-year period. The second sub-recommendation addressed the need to develop and demonstrate the capacity to provide accurate and timely notification to state and local authorities and, in the event of an off-site release of radiological material, ensure consistent monitoring support is provided until state resources can arrive and be deployed for that purpose. The third sub-recommendation addressed the need to re-evaluate the processes followed during emergency response in order to shorten decision-making timelines for taking protective actions and determine if additional monitoring systems are needed to enhance timely response. As part of this evaluation, the Board recommended that the site should also differentiate between scenarios in which action should be taken immediately as a precaution, and scenarios in which action may be delayed until there is additional confirmation of an accident or emergency.

##### DOE Response

By letter dated January 13, 2016, the Secretary accepted the Recommendation. DOE will develop an Implementation Plan to accomplish the improvements specified in the Recommendation.

#### **IV. Recommendations Open in 2015**

##### **Recommendation 2014-1, *Emergency Preparedness and Response***

###### *Board Action*

In September of 2014, the Board issued Recommendation 2014-1, *Emergency Preparedness and Response*. The Board recommended DOE standardize and improve its criteria and review approach for oversight of emergency management and update the emergency management directive.

###### *DOE Response*

On April 24, 2015, the Board received DOE's Recommendation 2014-1 Implementation Plan. DOE's Implementation Plan committed to improving DOE's emergency management programs. The plan outlined a collaborative approach for addressing portions of the sub-recommendations with working groups to improve programs and directives. It committed to issuing a new risk-based oversight approach to ensure oversight is properly applied to each defense nuclear facility. DOE has issued a memorandum requiring field elements to report all open discrepancies in an effort to identify the current status of emergency preparedness and response at defense nuclear facilities. However, as noted in Section II, DOE's actions in response to Recommendation 2014-1 have not met the schedule defined in the Secretary's Implementation Plan for the Recommendation. By the end of 2015, six deliverables for the plan were past due, including key items such as the draft Criteria and Review Approach Document for DOE oversight of emergency preparedness and response programs. DOE is preparing a revision to the Implementation Plan to update the schedule and make other improvements.

##### **Recommendation 2012-2, *Hanford Tank Farms Flammable Gas Safety Strategy***

###### *Board Action*

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.

###### *DOE Response*

DOE is now treating the ventilation systems as a safety-significant control in the safety basis, and is developing a plan to ensure that the ventilation strategy meets requirements for safety-related systems. During 2015, DOE also continued the design of safety-related instrumentation to continuously monitor ventilation flow rates, and completed an evaluation of potential methods for reducing the current flammable gas inventory in the tank wastes.

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

### Board Action

In May 2012, the Board issued Recommendation 2012-1, which identified the need for DOE to remove or immobilize the residual plutonium-238 contamination located within Building 235-F, in order to mitigate the hazard posed by the significant quantity of respirable plutonium-238 that could be released from a loss of confinement event. This Recommendation also identified the need for near-term actions and compensatory measures to improve the safety posture of Building 235-F while cleanout work is being planned.

### DOE Response

The Secretary of Energy provided DOE's Implementation Plan to the Board on December 5, 2012, committing to mitigate the plutonium-238 hazard by December 2017 and to complete all actions under the plan by December 31, 2018. On November 28, 2014, the Secretary of Energy notified the Board of schedule changes that extend completion of plutonium-238 hazard mitigation activities to January 2020, and committed to a new overall completion date for the plan of May 31, 2021.

### Board Action

In a letter dated November 10, 2015, the Board requested an update on DOE's plan for decontamination work during fiscal years 2016 and 2017.

### DOE Response

DOE provided the requested information on January 15, 2016, including a month-by-month schedule for decontamination of the lowest hazard cells (cells 6 through 9) and for planning and initial field work on the next set of cells (cells 3 through 5).

During 2015, DOE implemented compensatory measures to improve the safety posture of Building 235-F to enable cleanout work to begin. DOE conducted an emergency exercise aimed at preparing for a loss of confinement event at Building 235-F. Additionally, DOE conducted a readiness assessment, resolved all pre-start findings from the assessment, and released its contractor to initiate deactivation work. DOE's contractor has removed the outer windows from the cells 6 through 9, cleaned the inner windows, and installed temporary lighting and is now working to measure the contamination in the cells.



**Mock-up Training for Building 235-F Remediation**

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

### *Board Actions*

The Board issued Recommendation 2011-1 following an investigation into the safety culture of the WTP project at the Hanford Site. On August 26, 2015, the Board held a public hearing in Kennewick, Washington, to discuss the safety culture at WTP and the DOE Office of River Protection with the responsible managers and the director of DOE's independent assessment organization.

### *DOE Response*

During 2015, DOE site offices and contractors completed developing and initiated the implementing actions for the safety culture sustainment plans started in 2014. DOE also established the DOE-wide Safety Culture Improvement Panel, reporting to the Deputy Secretary, to guide and encourage continued safety culture improvement within DOE. DOE has now completed all but one of the actions in its Implementation Plan for the Recommendation. That remaining commitment involves reviewing and changing the WTP contract to address balanced priorities and include safety culture elements, which will be completed when the contract is renegotiated.

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

### *Board Action*

Recommendation 2010-1 identified the need for DOE to strengthen its regulatory framework by developing a clear and unambiguous set of nuclear safety requirements to ensure adequate protection of the public and workers.

### *DOE Response*

In 2014, DOE reached an important milestone in implementing the Recommendation by issuing major revisions to 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 standards, which are cornerstones of DOE's regulatory framework, now include significant new requirements and clarified expectations for protecting the public and workers from nuclear facility hazards.

In June 2015, DOE issued a Level 1 Operating Experience document titled *Evaluation of Existing Facilities to DOE-STD-3009-2014*. In this document, the Deputy Secretary directed DOE field elements to assess existing facilities against newly-established requirements related to protecting the public from radiological hazards by December 2016.

### Board Action

Recommendation 2010-1 remains open as the Board monitors DOE's application of Standard 3009-2014 and Standard 1104-2014. The Board will continue to perform oversight of DOE's efforts to revise several other key nuclear safety directives integral to its regulatory framework.

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

#### Board Actions

The Board issued Recommendation 2009-2, *Los Alamos National Laboratory Plutonium Facility Seismic Safety*, on October 26, 2009, to focus the attention of DOE and NNSA leadership on the need to address the danger posed by an earthquake and subsequent fire at PF-4. As discussed in detail in Section II of this report, the Board remains concerned regarding the seismic vulnerability of PF-4 at Los Alamos National Laboratory. Knowledge of the Los Alamos site seismic hazard gained within the past decade revealed a potential for facility collapse caused by seismic activity. A collapse could result in a significant release of radioactive material and unacceptable radiological dose consequences to the public. The Board has worked closely with NNSA on the issue over the past several years.

#### DOE Response

During 2015, NNSA continued implementing upgrades to the facility structure and safety systems to improve the seismic performance of PF-4 and reduce the consequences of a large seismic event.

#### Board Action

On September 30, 2015, the Board issued a letter to the Secretary of Energy noting that the commitments DOE made in response to Recommendation 2009-2 have been largely completed, with the exception of providing an up-to-date project execution plan for seismic-related structural, system, and component upgrades. The Board is still awaiting a determination by NNSA that it will proceed with the design and installation of the upgrades needed to credit PF-4's active confinement ventilation system as a safety-class system that will continue to function following a seismic event.

#### DOE Response

NNSA changed course in 2015 with regard to the analysis of the facility structure, stopping an alternate seismic analysis that was intended to better characterize the facility's structural weaknesses and the potential of collapse, and instead convening a Seismic Expert Panel to examine all data available so far. NNSA ultimately directed its Los Alamos Field Office to develop a request for proposal to identify contractors capable of completing the alternate analysis of PF-4 using a dynamic non-linear seismic analysis. Such a methodology would allow

NNSA to defensibly determine the likelihood of facility collapse and the extent of upgrades needed. NNSA predicts the request for proposal to be completed in September 2016.

## **V. Nuclear Weapon Operations**

### **Lawrence Livermore National Laboratory**

#### ***Nuclear Safety***

##### **Board Staff Activities**

In 2015, the Board's staff executed several oversight visits, observed two full-participation emergency exercises, and monitored the safety of ongoing operations at Lawrence Livermore National Laboratory. The Board's staff specifically observed the level of conduct of operations and the performance of maintenance activities at the laboratory's nuclear facilities, reviewed the Documented Safety Analysis for the Waste Storage Facilities, and evaluated the implementation of Technical Safety Requirements, primarily focused on the Plutonium Facility. No major issues were identified.

#### ***Probabilistic Seismic Hazard Analysis***

##### **Board Staff Activities**

During 2015, the Board's staff reviewed the draft report for the updated probabilistic seismic hazard analysis for the Lawrence Livermore National Laboratory's Plutonium Facility. The previous analysis was completed in 2002. It is being updated based on NNSA's determination that the availability of new models, methods, and data made such an effort necessary. The Board's staff has worked closely with DOE to resolve the staff's comments on the draft report. The staff will assess whether any issues remain once the final report is completed and the project's peer review panel has signed off on the report.

### **Los Alamos National Laboratory**

#### ***Plutonium Facility – Reduction of Material-at-Risk***

##### **Board Action**

As noted in Section II of this report, the risk posed by an earthquake at Los Alamos National Laboratory remains among the Board's greatest safety concerns due to the seismic vulnerabilities of PF-4. One way to reduce risk is to minimize hazardous materials contained in a vulnerable facility. Accordingly, on September 21, 2015, the Board issued Technical Report 39, *Opportunities for Risk Reduction at the Los Alamos National Laboratory Plutonium Facility through the Minimization of Material-at-Risk*. This Technical Report discussed potential actions that would reduce hazards at PF-4 and identified opportunities for NNSA to minimize materials-at-risk and increase the use of robust, certified containers to better protect stored materials.



**Plutonium Storage at PF-4**

***Safety Basis for Radioassay and Nondestructive Testing Shipping Facility***

**Board Action**

The Los Alamos National Laboratory contractor uses the Radioassay and Nondestructive Testing Shipping Facility to load TRU waste packages into shipping containers. NNSA plans to continue using this facility, in conjunction with the Transuranic Waste Facility Project, to support the enduring TRU waste mission at Los Alamos after Area G is closed. On December 9, 2014, the Board sent a letter to NNSA identifying significant weaknesses in the Radioassay and Nondestructive Testing Shipping Facility hazard analysis, accident analysis, and safety controls.

**DOE Response**

On March 25, 2015, and during two subsequent quarterly briefings, NNSA responded to the Board's letter agreeing with many of the issues raised by the Board. In the response letter and associated briefings, NNSA stated that the shipping facility would remain in cold standby mode, which means that no material-at-risk would be allowed in the facility, until seismic upgrades were completed on the building structure and roof, the documented safety analysis was upgraded to be compliant with DOE Standard 3009-2014, and previously identified Board issues were resolved. The Board's staff will continue to work with the NNSA Field Office and contractor personnel to resolve these issues.

## ***Nitrate Salt-Bearing TRU Waste***

### **DOE Activities**

Los Alamos National Laboratory management largely curtailed operations at Area G and declared a PISA following initial indications that a TRU waste drum containing inappropriately-treated remediated nitrate salt-bearing (RNS) waste generated at Los Alamos was involved in the radiological release event at WIPP on February 14, 2014. Subsequently, in a letter dated June 25, 2015, the NNSA Field Office directed the Los Alamos contractor to “consider the profusion of New Information” contained in the reports by the DOE Accident Investigation Board and Technical Assessment Team on the WIPP radiological release relative to the Area G safety basis for the storage and treatment of RNS waste. Notably, the DOE Accident Investigation Board’s report dated April 16, 2015, indicated that the amount of radioactive material released during the accident was larger than the amount predicted using DOE Standard 5506, *Preparation of Safety Basis Documents for Transuranic Waste Facilities*, “by almost two orders of magnitude.” Use of this information within the Area G safety basis could increase the calculated radiological dose consequences to the public and workers at Los Alamos under the postulated accident scenarios for RNS waste.



**Board Members Observing Waste Storage at Area G**

Currently, Area G contains 60 containers of RNS waste. The key initiating event for many of the accident conditions of concern for these containers involves a wildfire; the next wildfire season in the vicinity of Los Alamos will begin in the spring of 2016. Los Alamos National Laboratory scientists continue to pursue testing to determine an appropriate treatment strategy to convert the RNS waste into a safe, WIPP-compliant waste form.

### **Board Member and Staff Activities**

Throughout 2015, the Board’s staff conducted multiple interactions with the Los Alamos contractor and NNSA Field Office. The Board’s staff reviewed test data to evaluate the chemical reactivity hazard and potential treatment strategies for the waste. Further, Board Members and staff have performed multiple walkdowns of the RNS waste storage areas to assess the controls to protect the workers and the public from RNS waste accidents.

### **Board Action**

The Board continues to prioritize oversight efforts to ensure adequate protection of the public and workers at Area G during the storage and treatment of RNS waste. The Board has voted to hold a public hearing early in 2016 that will cover this topic.

## ***Weapons Engineering Tritium Facility Restart***

### **DOE Activities**

The Weapons Engineering Tritium Facility at Los Alamos is used for tritium-related research and development and processing of tritium to meet the requirements of the present and future stockpile stewardship program. Routine gas transfer operations have been shut down since 2008 due to issues with equipment, the safety analysis, and operations. In October 2015, the facility successfully completed a federal readiness assessment. The facility commenced gas transfer operations for the first time since 2008 in December 2015. Continued operations at the Weapons Engineering Tritium Facility are important in order to dispose of legacy radioactive material that has no programmatic use and accounts for more than half of the material-at-risk in the facility.

### **Board Staff Activities**

Members of the Board's staff observed the readiness assessments and initial gas transfer operations for this facility and are providing ongoing oversight of operations.

## **Sandia National Laboratories**

### ***Nuclear Safety at the Annular Core Research Reactor Facility (ACRRF)***

#### **Board Actions**

In 2012, the Board sent letters and reports to NNSA regarding deficiencies in the ACRRF safety basis, operations, and quality assurance practices.

#### **DOE Response**

In 2015, Sandia National Laboratories completed implementation of a three-year ACRRF Improvement Plan that addresses the primary issues identified by the Board's letters.

#### **Board Staff Activities**

In November 2015, the Board's staff observed an external review of ACRRF operations. The Board's staff observed that reactor operators are highly skilled and that operations are conducted within a robust nuclear safety envelope.

### DOE Activities

On September 28, 2015, laboratory technicians conducting gamma spectroscopy of routine monitoring samples at the ACRRF reported that fission products were present in the reactor pool water at trace levels. The ACRRF staff initiated a series of reactor pool water sampling tests to identify the source of the fission products. The sampling results confirm fission products are being released to the pool water during reactor operations, but the source of the fission products has not been pinpointed. The fission products in the reactor pool water do not present a safety issue at their present small concentrations.



**Reactor Pulse at ACRRF**

### **Pantex**

#### ***Safety of Nuclear Explosive Operations***

### DOE Activities

In January 2015, NNSA issued revised requirements and guidance on establishing the safety of nuclear explosive operations. Among the requirements were revised nuclear explosive safety standards, which require positive independent measures to effectively interrupt accident scenarios that could lead to severe weapon responses.

### Board Staff Activities

Throughout 2015, the Board's staff provided oversight of NNSA's efforts to implement the revised directives at the design agencies and production plants. The W87 project team is the first major weapon program to demonstrate operations for a nuclear explosive safety study group under the new standards. This nuclear explosive safety study began in October, with demonstrations commencing in December 2015. The Board's staff observed the assessment of nuclear explosive safety utilizing these new standards and provided feedback to NNSA on improvements to increase the effectiveness of the standards in order to further enhance the safety of nuclear explosive operations at the Pantex Plant. The Board's staff will continue to provide oversight in this area in 2016 as NNSA evaluates additional programs using the revised safety standards.

#### ***Pantex Plant Safety Bases***

### Board Staff Activities

The Board's staff remains engaged with NNSA's efforts to improve specific aspects of the Pantex safety bases, most notably the site's Unreviewed Safety Question (USQ) procedure, treatment of new information, and the dispersion models used to calculate consequences of postulated accidents at Pantex. The Board's staff conducted a detailed review and continued with multiple follow-up interactions as the Pantex contractor has started to update its USQ and new information procedure to eliminate ambiguities and weaknesses and to align it more closely with the requirements in 10 C.F.R. Part 830, *Nuclear Safety Management*, and DOE directives.

#### DOE Response

Pantex personnel have informed the Board's staff of a plan to update radiological dose consequence and accident frequency calculations used as the technical basis to develop the Pantex safety bases. Because many dispersion accident models were dated and some had parameters that were not technically justifiable, the Pantex contractor has developed a multi-year dispersion modeling improvement plan.

#### ***Safety Controls for "Falling Man" Scenarios***

#### Board Action

In a letter dated June 2, 2014, the Board identified that NNSA had not demonstrated that special tooling used in nuclear explosive operations at Pantex adequately protected the public and workers from the potential consequences of a worker falling into the special tooling or nuclear explosive.

#### DOE Response

During 2014 and 2015, NNSA undertook several efforts that will ultimately lead to an updated hazard analysis that models the "Falling Man" accident scenario, including tests and analysis to determine the peak energies and forces involved. As part of this effort, a multi-year series of academic studies was completed this year to better characterize the accident scenario. Testing included experiments to simulate a human falling into a Pantex work stand and several different special tooling fixtures.

As an interim action, the Pantex contractor implemented new controls to mitigate the "Falling Man" hazard in the most susceptible nuclear explosive operations. These controls included: operational improvements, such as revised facility layouts; process changes to reduce tripping hazards and raise work stand heights to reduce impact forces; and administrative controls, such as stand-off zones and signage, to help production technicians avoid a "Falling Man" situation.

NNSA also chartered the Weapon Complex Falling Man Committee, a group composed of personnel from across the nuclear security enterprise, tasked with developing a new "Falling Man" model that describes the methods, practices, and strategies that special tooling

engineers, weapon responders, and authorization basis personnel can use to interpret and characterize the “Falling Man” phenomenon in a uniform manner. NNSA personnel expect it will take several years to develop and implement the model.

## **Savannah River Site Tritium Facilities**

### ***Tritium Extraction Facility Safety Basis***

#### **Board Staff Activities**

The Tritium Extraction Facility at the Savannah River Site provides the means to extract tritium from target rods, which were previously irradiated in commercial light water reactors, for use in the Nation’s nuclear weapon stockpile. The Board’s staff conducted an onsite review during December 2014, as well as a series of teleconferences in 2014 and 2015, on the Tritium Extraction Facility safety basis.



**Tritium Extraction Facility**

#### **Board Action**

The Board issued a letter to DOE on January 7, 2016, describing issues with the facility’s safety basis, including the potential need for new controls to protect collocated workers in some accident scenarios, issues with the fire suppression system, and the need to identify Specific Administrative Controls per DOE Standard 1186-2004, *Specific Administrative Controls*, where the safety basis credits safety management programs for specific risk reductions.

#### **DOE Response**

The facility contractor has already addressed a number of the concerns; however, the schedule for fixing the remaining issues has slipped further into Fiscal Year 2017.

## **Y-12 National Security Complex**

### ***Conduct of Operations and Maintenance***

#### **Board Actions**

In letters to NNSA in August 2011 and December 2011, the Board identified implementation issues in conduct of operations and maintenance at the Y-12 National Security Complex.

### DOE Response

NNSA and the Y-12 contractor subsequently implemented corrective measures to improve performance in these areas. However, NNSA was critical of the Y-12 contractor's operational discipline following the July 2014 contract transition and took further actions to drive improvement. A series of safety-related events between the fall of 2014 and the summer of 2015 involving breakdowns in operational discipline indicated that NNSA and the contractor's actions need further improvement.

### Board Staff Activities

Members of the Board's staff conducted a review of these events and the contractor's planned compensatory measures and provided several suggestions to improve the compensatory measures.

### ***Aging Infrastructure***

#### Board Actions

Since 2005, the Board has been monitoring NNSA's efforts to address the known 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. This issue is not limited to physical deterioration of structures due to aging, but also includes deficiencies in design that could not be foreseen given the state-of-practice at the time of construction.

### DOE Response

In August 2015, NNSA fulfilled an annual reporting requirement to the Board on the safety of continued operations and briefed the Board regarding the condition of the 9212 Complex. Key accomplishments at Y-12 in 2015 included continued reductions in the quantities of material-at-risk in the 9212 Complex, as well as the completion of the Nuclear Facility Risk Reduction Project, which improved safety by upgrading facility and utility infrastructure.

#### Board Action

In February 2015, the Board transmitted findings to NNSA regarding the structural performance of Building 9204-2E and the 9215 Complex for NNSA's use while the Y-12 contractor develops an extended life program for these facilities.

## VI. Design and Construction

### New Facilities

#### Board Actions

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 public health and safety during eventual operation. The Board uses a variety of methods to carry out this function, including detailed reviews by the Board’s technical staff, public hearings, requests for information, and visits by Board members to construction sites. Currently, the Board is actively overseeing the design and construction of over a dozen new defense nuclear facilities with a combined projected cost exceeding \$25 billion. The Board is waiting to see what action DOE takes on several other 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. As noted in Section II, the Board and DOE are pursuing a joint review to identify any lessons learned or potential improvements for the Board’s oversight approach.

**Design and Construction Projects under Review in 2015**

Project Name	Location	Projected Cost <sup>2</sup>	Status of Project	Status of Board Review
Waste Treatment and Immobilization Plant	Hanford Site, Richland, WA	\$12.3 billion	Concurrent design and construction	Ongoing-multiple open safety issues
K-Basin Closure Sludge Treatment Project	Hanford Site, Richland, WA	\$308 million	Phase 1: Construction Phase 2: Conceptual design	Ongoing-multiple open safety issues
Low Activity Waste Pretreatment System <sup>3</sup>	Hanford Site, Richland, WA	\$470 million	Preliminary design	Ongoing-no current safety issues
Idaho Calcine Disposition Project	Idaho National Laboratory, Idaho Falls, ID	\$2–16 billion	Conceptual design	Ongoing-no current safety issues
Transuranic Waste Facility Project	Los Alamos National Laboratory,	\$99 million	Construction	Ongoing-multiple open safety issues

<sup>2</sup> Project costs were obtained from the DOE Project Assessment & Reporting System (PARS II<sub>E</sub>)

<sup>3</sup> The Low Activity Waste Pretreatment System has a budget line item separate from WTP, but upon completion, is intended to function as part of WTP.

<b>Project Name</b>	<b>Location</b>	<b>Projected Cost<sup>2</sup></b>	<b>Status of Project</b>	<b>Status of Board Review</b>
	Los Alamos, NM			
Transuranic Waste Processing Center Sludge Processing Facility Buildouts Project	Oak Ridge National Laboratory, Oak Ridge, TN	\$171 million	Preliminary design	Ongoing- no current safety issues
K-Area Complex Purification Area Vault Project	Savannah River Site, Aiken, SC	\$27 million	Construction complete	Complete- issued project letter
Saltstone Disposal Unit #6	Savannah River Site, Aiken, SC	\$143 million	Construction	Ongoing- no current safety issues
Salt Waste Processing Facility	Savannah River Site, Aiken, SC	\$2.32 billion	Construction	Ongoing- no current safety issues
Waste Solidification Building	Savannah River Site, Aiken, SC	\$360 million	Construction complete	Complete- issued project letter
Underground Ventilation System	Waste Isolation Pilot Plant, Carlsbad, NM	\$309 million	Conceptual design	Ongoing- no current safety issues
Uranium Processing Facility	Y-12 National Security Complex, Oak Ridge, TN	\$6.3 billion	Conceptual design	Ongoing- no current safety issues
Electrorefining Project	Y-12 National Security Complex, Oak Ridge, TN	\$77 million	Preliminary design	Ongoing- no current safety issues
Tank Waste Characterization and Staging Capability	Hanford Site, Richland, WA	\$690 million	Conceptual design	Ongoing- no current safety issues

Beginning in 2007, the Board has provided periodic reports to Congress on the status of significant unresolved safety issues concerning the design and construction of DOE's defense nuclear facilities. Beginning with the *24<sup>th</sup> Annual Report to Congress*, the Board has included the periodic report as an appendix to the Board's Annual Report to Congress (see Appendix C).

## Hanford Site, Hanford Tank Waste Clean-up

### DOE Activities

The Tank Farms at the Hanford Site near Richland, Washington contain 56 million gallons of radioactive and toxic waste stored in 177 underground tanks. In the late 1990s, DOE began work on the Waste Treatment and Immobilization Plant intended to immobilize the Hanford tank waste. WTP is a radiochemical processing plant consisting of four primary facilities: the Analytical Laboratory, Low-Activity Waste (LAW) Facility, High-Level Waste (HLW) Facility, and Pretreatment (PT) Facility. As initially designed, all waste sent to WTP was to be processed 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 basis 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.

To mitigate the impact of technical and safety issues with the PT Facility, DOE is pursuing a new project—the Low-Activity Waste Pretreatment System (LAWPS)—to pretreat the liquid portion of the Hanford tank waste and directly feed it to the LAW Facility. This approach would enable the LAW Facility to begin vitrifying waste before completion of WTP's PT Facility. In 2015, DOE approved the LAWPS project to move into the preliminary design phase.

### Board Actions

For more than a decade, the Board has devoted time and resources to oversight of WTP with two main safety objectives. First, operation of the plant must not expose the public or workers to undue risk. Second, the plant must achieve its design objectives to eliminate the safety risks posed by continued storage of waste in aging underground tanks. Design of WTP is proceeding concurrently with construction. As a result, timely identification and resolution of technical and safety issues are paramount to meeting the objectives of the Hanford cleanup effort.

The Board issued a LAWPS project letter on May 14, 2015. The letter communicated that the Board found no safety issues that would preclude the LAWPS project from advancing to the next design phase. The Board identified three concerns that the project plans to address during the preliminary design phase. The Board also communicated three important design inputs for the LAWPS project to consider in the preliminary design phase.



### **Waste Treatment and Immobilization Plant, Hanford Site**

In 2015, the Board identified new safety issues for the HLW Facility regarding the control strategy for hydrogen in process vessels and the seismic classification of the confinement boundary. The Board communicated these safety issues to DOE in letters dated January 21, 2015, and February 2, 2015, respectively. In a letter to DOE dated March 25, 2015, the Board communicated its concern with the recommended aerosol entrainment coefficient (AEC) value for the WTP high-efficiency particulate air filter design. The letter did not open a new safety issue, but rather provided technical information to DOE.

The Board also continues to work closely with DOE to oversee resolution of the 13 previously identified technical and safety issues for WTP:

- Criticality in process vessels;
- Generation and accumulation of hydrogen in process vessels;
- Pulse jet mixer control;
- The ability to obtain representative samples;
- Controls for hydrogen gas;
- Modelling of spray leak accidents;
- Heat transfer analyses for process vessels;
- 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;
- Volcanic ashfall hazard; and

- Potential melter accidents in the HLW Facility.

Additional information on these safety issues can be found in the Board's report to Congress on the status of significant unresolved issues with DOE design and construction projects, included as Appendix C of this report.

#### DOE Response

As a result of the Board's letter on AEC values, the WTP contractor proposed changes to the AEC value for the design and safety basis of the WTP confinement ventilation systems. The WTP contractor plans to use more conservative values of AEC for the design and safety analysis than the project personnel previously recommended.

### **Y-12 National Security Complex, Uranium Processing Facility**

#### DOE Activities

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. Original plans for the Uranium Processing Facility (UPF) would have replaced the aging 9212 and 9215 Complexes and Building 9204-2E with a single modern building. However, the current NNSA strategy calls for replacing only the capabilities of the 9212 Complex by 2025. Rather than a single building, these 9212 Complex capabilities will be installed in multiple facilities segregated by safety risk and security requirements. NNSA has commenced conceptual design activities consistent with its new strategy.

In May 2015, NNSA approved the contractor's revised Conceptual Safety Design Report, which captures key facility-level controls and describes the function of major processes as it relates to the mission of the new facility. Each process is segregated into physically separate buildings based on safety risk and security requirements. The Main Process Building and the Salvage and Accountability Building will house operations, while other buildings will contain various support capabilities.

#### Board Staff Activities

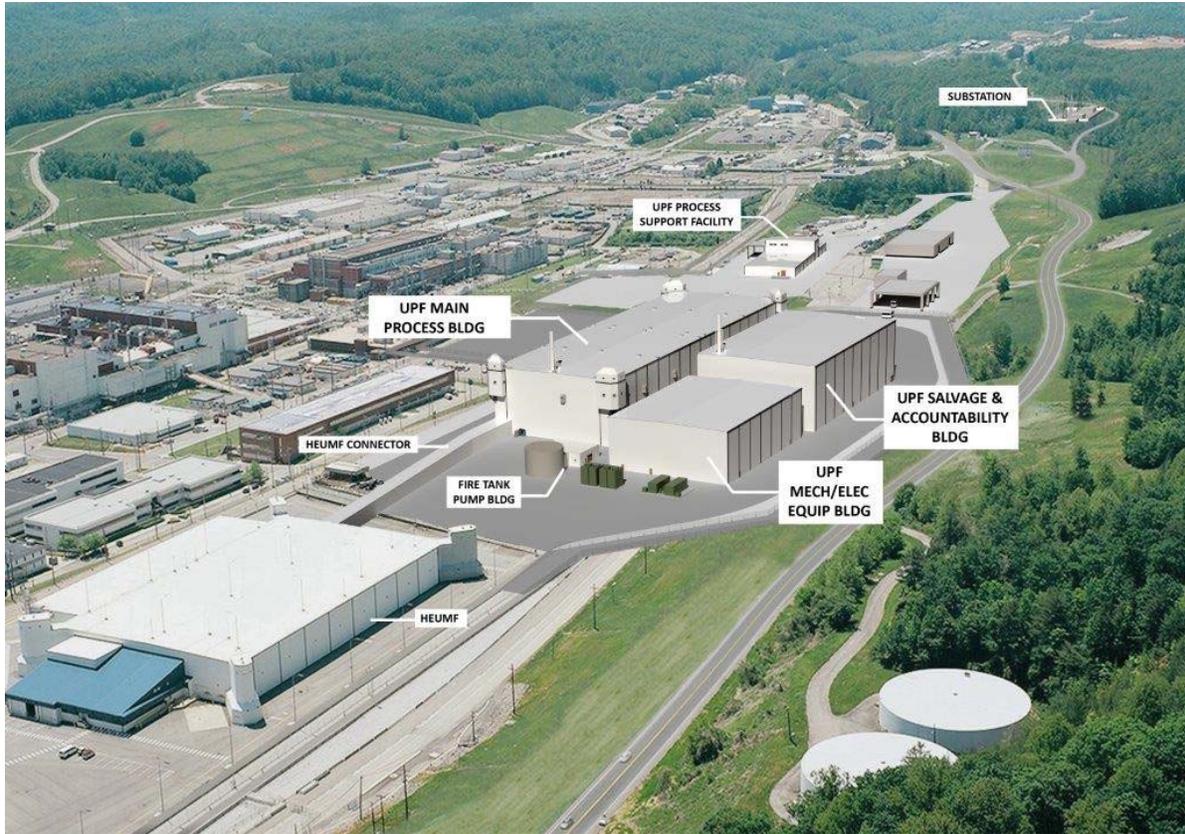
The Board's staff conducted a review of the Conceptual Safety Design Report in April 2015, and will review the preliminary design and Preliminary Safety Design Report when they become available in 2016.

#### Board Action

In a letter dated June 25, 2015, the Board requested NNSA to provide additional information regarding the UPF confinement strategy and the need to provide confinement of radioactive material following a seismic event.

DOE Response

The NNSA Production Office responded to the Board's information request on September 11, 2015, with a letter describing the confinement approach for UPF.



**Artist's Rendering of the Uranium Processing Facility**

**Los Alamos National Laboratory, Transuranic Waste Facility**

DOE Activities

In order to support enduring missions at Los Alamos, NNSA is constructing a new Transuranic Waste Facility to replace the TRU waste storage and characterization activities currently carried out in Area G. The new facility will be capable of staging and storing up to 1,240 drums of waste. Its characterization function will certify that waste containers meet the acceptance requirements for shipment to and disposal at WIPP. Based on the hazards associated with the facility due to the proposed maximum inventory of radioactive waste, the Board is monitoring the development and implementation of safety controls that ensure the safety of the public and workers.

NNSA approved Critical Decision-3, *Approve Start of Construction*, in July 2014. The Board reviewed the approved Preliminary Documented Safety Analysis (DSA), and

communicated five safety issues concerning the effectiveness of the facility's safety controls in a project letter dated August 7, 2014.

### Board Staff Activities

The Board's staff continues to monitor the development of the project's safety basis documentation and is currently reviewing the project's draft DSA and implementation of the final control set. Through this and other review efforts, the Board's staff is continuing to monitor progress towards adequate resolution of the Board's open safety issues prior to operation.



**Layout of the Transuranic Waste Facility**

### **Hanford Site, Sludge Treatment Project**

#### DOE Activities

The purpose of the K-Basin Closure Sludge Treatment Project is to remove radioactive sludge from the K-West Basin at the Hanford Site. The sludge was generated by spent nuclear fuel that deteriorated during decades of storage. In Phase 1 of the Sludge Treatment Project, sludge will be transferred into storage containers and transported to T-Plant for interim storage.

### Board Actions

In a project letter to DOE dated May 2, 2014, the Board indicated that no significant safety concerns remain with the final design and safety basis for Phase 1 of the project. However, the Board also noted that the project's contractor was pursuing several nuclear safety initiatives likely to result in design and safety basis changes that will require further review by the Board.

The Board transmitted two letters to DOE on August 21, 2015, regarding the revised Preliminary DSA that DOE approved on February 5, 2015, with three conditions of approval. One letter communicated a safety issue regarding the project's removal of a specific administrative control to protect the public by controlling public access to portions of the Columbia River during sludge transfers. The Board's second letter identified deficiencies in the methodology used to determine the uranium metal concentration in one of the sludge storage containers. Recognizing that these deficiencies may be addressed as the project works to close DOE's conditions of approval, the letter was sent for DOE's consideration.

### DOE Response

On November 18, 2015, DOE responded to the Board's letter on public access to the Columbia River during sludge transfers, indicating that the specific administrative control was no longer considered necessary.

## **System for the Analysis of Soil-Structure Interaction**

### DOE Activities

DOE has successfully resolved the technical and quality assurance issues that the Board had previously identified with the computer program System for the Analysis of Soil-Structure Interaction (SASSI). This computer program is used in the design and analysis of many facilities in the defense nuclear complex. DOE completed a guidance memo for the use of SASSI that identified the root cause of the technical issue. DOE also developed a database of problems that can be used to verify and validate the computer program for use on current and future projects.

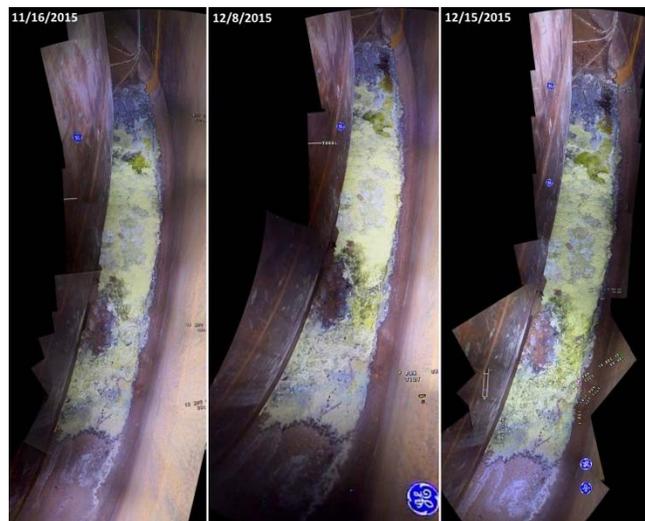
## VII. Hazardous Materials

### Hanford Site

#### *High-Level Waste Tank Integrity*

##### DOE Activities

DOE continued to investigate the primary shell failure of double-shell tank 241-AY-102, which continues to leak small quantities of waste onto the floor of the outer shell. DOE initially believed the leak was due to stress corrosion cracking or pitting corrosion of the interior steel surface in contact with the waste. More recently, DOE believes the cause may have been corrosion of the exterior steel surface from excess moisture that accumulated in the annulus during historical protracted ventilation outages. DOE is identifying methods to inspect the primary tank bottom shells of the double-shell tanks. These inspections may be useful in assessing corrosion in the primary tank bottoms as well as predicting failure and the remaining service life for other double-shell tanks.



**Dried Waste Material in Double-Shell Tank 241-AY-102 Annulus**

DOE has also been assessing the potential for failure of the tank 241-AY-102 secondary shell exposed to the leaking waste. Based on the results of that assessment, DOE has determined that near-term failure of the tank 241-AY-102 secondary shell is unlikely. Many double-shell tanks will be well beyond their design life before they are emptied.

##### Board Staff Activities

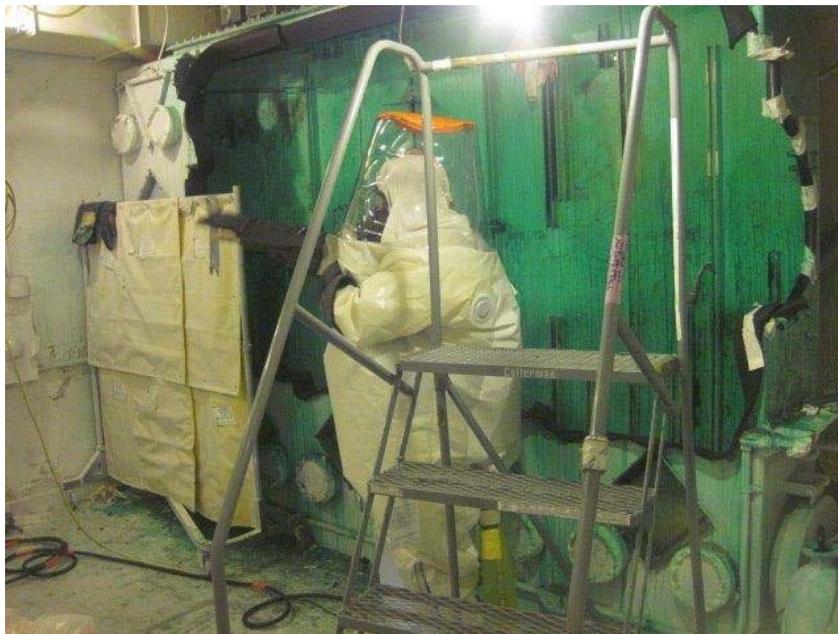
While the leakage from tank 241-AY-102 has been safely contained within the secondary shell, members of the Board's staff reviewed actions taken by DOE to assess the implications of the leak for the hazard analyses for the Hanford Tank Farms, 242-A Evaporator, and 222-S Laboratory. Notably, the leaking tank challenged aspects of DOE's hazards analysis methodology at Hanford that presumes simultaneous failure of multiple barriers will not occur.

The staff members determined that DOE has taken appropriate action to update the hazard analyses at its nuclear facilities managing high-level waste based on the lessons learned from the leaking tank. The Board's staff is also monitoring DOE's preparations to remove the waste from tank 241-AY-102 in 2016.

### ***Deactivation and Decommissioning***

#### **Board Actions**

Part of the Board's statutory mission is to ensure that defense nuclear facilities are safely deactivated and decommissioned. Key Board efforts in this area include safety bases reviews, evaluations of activity-level hazard analyses, and review of work planning and control programs. In 2015, the Board focused attention on the deactivation and decommissioning of the Plutonium Finishing Plant at Hanford. Operations at the Plutonium Finishing Plant began in 1949 and included the production of plutonium metal for defense purposes. In 1991, the mission changed to stabilization of plutonium-bearing materials, deactivation, decommissioning, and environmental restoration.



**Glovebox Dismantlement in the Hanford Plutonium Finishing Plant**

In a letter to DOE dated March 6, 2015, the Board identified issues with the facility contractor's decommissioning strategy for safety systems and with the facility confinement ventilation system. Collectively, the issues identified in the letter illustrate the need to improve contractor and federal processes for evaluating, controlling, and accepting the safety risks inherent in hazardous cleanup activities at Hanford's aging facilities.

### DOE Activities

In December 2015, the contractor suspended much of the high hazard work in the Plutonium Finishing Plant after meeting with the DOE Richard Operations Office to discuss ongoing safety trends and other concerns. DOE subsequently approved a plan developed by the contractor for a controlled resumption of high hazard work. Among other actions, the plan includes a follow-up review by a corporate assessment team, increased radiological control oversight, and implementation of a peer observation program.

### Board Staff Activities

The Board's staff focused during the latter half of 2015 on contractor work packages, demolition planning documents, and corrective actions associated with recent facility events. Of note, the Board's staff provided close oversight after the contractor identified an unexpected chemical reaction in waste retrieved from the Plutonium Reclamation Facility canyon in October 2015. The staff continues to work with DOE and the contractor as they develop a path forward for this waste.

## **Idaho National Laboratory**

### ***Integrated Waste Treatment Unit***

#### DOE Activities

The Integrated Waste Treatment Unit (IWTU) was built to solidify 900,000 gallons of radioactive liquid waste stored in underground tanks as part of DOE's Idaho Cleanup Project. IWTU's management and operating contractor continues to conduct facility performance testing in preparation for the start of radioactive waste processing operations.



**Integrated Waste Treatment Unit**

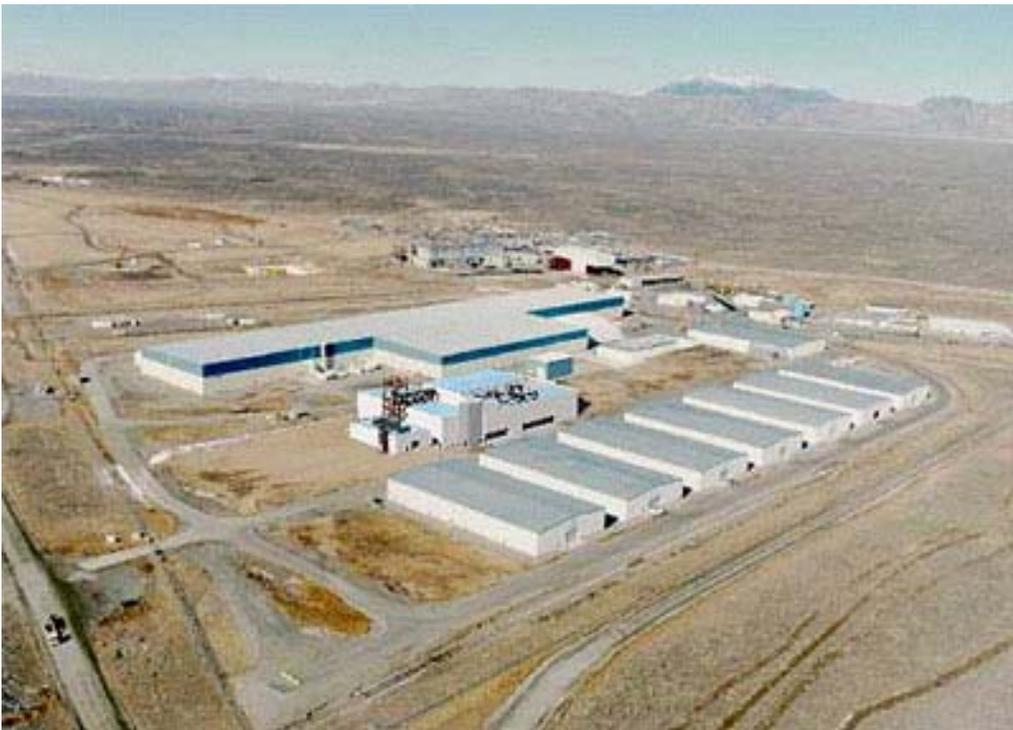
#### Board Staff Activities

Members of the Board's staff conducted on-site reviews of the facility's safety basis in March 2015 and of its Safety Instrumented System in October 2015. A staff review team also reviewed an issue regarding the concrete temperature in the IWTU Process Confinement Area. The staff members did not identify any significant issues during these reviews that would preclude the start of radioactive waste processing at IWTU.

## ***Advanced Mixed Waste Treatment Project***

### **DOE Activities**

The purpose of the Advanced Mixed Waste Treatment Project (AMWTP) is to retrieve stored waste containers, then characterize, treat, and package the waste for long-term disposal. The waste being retrieved at AMWTP originated at various locations across the nuclear weapons complex, such as the Rocky Flats Plant. Beginning in 1970, approximately 100,000 boxes and drums of TRU waste were stored on asphalt pads in AMWTP's Transuranic Storage Area (TSA). This waste was then covered with plywood, polyvinyl sheets, and several feet of soil. A steel building, known as the TSA-Retrieval Enclosure (TSA-RE), was constructed over the soil-covered waste containers in 1996.



**Advanced Mixed Waste Treatment Project, Idaho National Laboratory**

### **Board Staff Activities**

Members of the Board's staff reviewed AMWTP's safety basis and identified significant issues. These issues included an improper consequence evaluation of a fossil fuel fire in the TSA-RE and other TRU waste storage facilities, the lack of a consequence evaluation of a boiling liquid-expanding vapor explosion for propane storage tanks, and an evaluation of propane vapor cloud explosions that underestimated the potential consequences of such accidents.

### Board Action

The Board sent a letter to DOE on November 23, 2015, identifying the issues with AMWTP's safety basis and noting that the DOE Idaho Operations Office was taking action to resolve the Board's associated concerns.

## **Savannah River Site**

### ***Defense Waste Processing Facility***

#### Board Staff Activities

The Board's staff conducted a detailed review of the safety basis for the Defense Waste Processing Facility (DWPF) in 2014.

#### DOE Response

The review by the Board's staff led DOE to declare two Potential Inadequacies of the Safety Analysis (PISA) DWPF, which became two Unreviewed Safety Questions (USQ) in late 2014. The first PISA concerned a key technical assumption associated with the limits on the feed rate for the high-level waste melter. The second PISA concerned the potential for flammable gases to be generated and retained in sludge during periods when process vessels were not being agitated. Consequently, DOE and the contractor, Savannah River Remediation, developed compensatory measures to place DWPF in a safe condition while new controls were developed.

#### Board Staff Activities

In 2015, the Board's staff had multiple interactions with DOE to understand and resolve concerns about the compensatory measures and the new controls that DOE and its contractor had developed for DWPF.

#### Board Action

On August 3, 2015, the Board issued a letter to DOE requesting a report that addresses DOE's analysis of interactions between non-safety and safety components in the melter off-gas system; the adequacy of compensatory measures for the retained hydrogen PISA; and the path forward for resolving the melter feed rate PISA, retained hydrogen PISA, and a previously-existing antifoam flammability PISA.

#### DOE Response

In response to the Board's letter, DOE briefed the Board on October 15, 2015, and transmitted a supporting report to the Board on December 16, 2015. The supporting report detailed the analysis of interactions between the non-safety and safety components in the

melter off-gas system, evaluated plant data to determine the adequacy of current compensatory measures for the retained hydrogen PISA, and described the formation of a dedicated team to resolve the PISAs. Additional actions for resolving the three PISAs include development and implementation of a new DWPF flowsheet using glycolic acid instead of formic acid as a reductant.

### ***L-Area Safety Basis***

#### **Board Staff Activities**

The Board's staff conducted a detailed review of the safety basis for the L-Area facility, which has a long-term mission to store nuclear materials, including significant quantities of spent fuel in a water basin.

#### **Board Action**

The Board issued a letter to DOE regarding the safety basis for L-Area on October 20, 2015, identifying several areas for improvement including identification of Specific Administrative Controls, as well as issues regarding initial conditions and assumptions used in the unmitigated accident analysis, legacy assumptions, and compensatory measures for a safety system.

#### **DOE Response**

DOE personnel are working to strengthen the facility's safety basis in response to the Board's letter.

### ***Criticality Safety***

#### **Board Staff Activities**

In 2015, the Board's staff evaluated the Savannah River Site nuclear criticality safety program's compliance with applicable DOE requirements and industry consensus standards. The staff reviewed implementation of the program at H-Canyon and HB-Line because activities at these facilities are complex and involve quantities of fissile material that represent a credible nuclear criticality risk. The staff also reviewed corrective actions associated with criticality safety infractions that occurred at HB-Line in February 2015 and September 2015. The staff team concluded this review in November 2015 and passed their observations to DOE.



**L-Basin**

## VIII. 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.

#### Board Staff Activities

In 2015, the Board's staff completed its review and provided substantial comments to DOE on DOE Guide 423.1-1B, *Implementation Guide for Use in Developing Technical Safety Requirements*; DOE Standard 3020, *Specification for HEPA Filters Used by DOE Contractors*; and DOE Standard 1129, *Tritium Handling and Safe Storage*.

#### DOE Response

DOE has adequately responded to the comments and has reissued these directives with important updates to safety protocols and programs.

#### Board Staff Activities

Also in 2015, the Board's staff reviewed five DOE Orders that govern vital elements of safety in design, operations, and oversight of DOE's defense nuclear facilities. They included DOE Order 413.3B Change 1, *Program and Project Management for the Acquisition of Capital Assets*; DOE Order 460.1D, *Hazardous Materials Packaging and Transportation Safety*; DOE Order 461.1C, *Packaging and Transportation for Offsite Shipment of Materials of National Security Interest*; DOE Order 227.1A, *Independent Oversight Program*; and DOE Order 442.1B, *Department of Energy Employee Concerns Program*. The Board's staff conducted 57 reviews of DOE directives that were being developed, revised, reaffirmed, or canceled. The total number of reviews is higher than previous years because DOE underwent a major effort to cancel and archive DOE training handbooks that may contain dated information. Thirty-three such handbooks have been canceled or proposed for cancellation.

#### DOE Activities

Throughout 2015, NNSA has been working to update DOE Limited Standard, DOE-NA-3016-2006, *Hazard Analysis Reports for Nuclear Explosive Operations*. This standard provides a safe harbor methodology for safety analysis of nuclear explosive operations subject to the DOE nuclear facility safety rule (10 C.F.R. 830, *Nuclear Safety Management*). Implementation of the revised standard should significantly improve NNSA's framework for nuclear explosive safety analysis.

### Board Activities Expected in 2016

The Board expects to review a substantial number of DOE directives during 2016, including revisions to DOE Standard 1186-2004, *Specific Administrative Controls*, and DOE Standard 1189-2008, *Integration of Safety into the Design Process*. As noted in Section IV, DOE is revising DOE Order 251.1C, *Comprehensive Emergency Management System*, in response to the Board's Recommendation 2014-1, *Emergency Preparedness and Response*. DOE is also revising DOE Standard 5506-2007, *Preparation of Safety Basis Documents for Transuranic Waste Facilities*, because of the realization that the February 2014 exothermic reaction at WIPP was more energetic than accidents previously considered in that standard. The Board will review the revisions to both of those important directives.

### **Quality Assurance/Software Quality Assurance**

#### Board Staff Activities

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. The reviews identified deficiencies in federal oversight and the contractor's noncompliance 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 package classification for transport of radioactive materials, including radioactive waste, based on the isotopic content.

#### Board Actions

Based on the results of the staff's reviews, the Board issued two letters to advise DOE of these deficiencies and the need for compensatory measures.

#### DOE Response

In response, DOE alerted users to suspend use of the noncompliant software, audited the responsible vendor and issued a stop work order based on the audit's results, and initiated an extent of condition review for similar software.

### **Conduct of Maintenance and Operations**

#### Board Staff Activities

In 2015, members of the Board's staff continued to perform assessments of conduct of maintenance and operations programs at the DOE's defense nuclear facilities. The Board's staff assessed maintenance programs at the Waste Isolation Pilot Plant, the Pantex Plant, Lawrence Livermore National Laboratory, and the Transuranic Waste Processing Center at the Oak Ridge National Laboratory. The maintenance review at the Waste Isolation Pilot Plant followed up on maintenance issues identified in a 2012 Board letter to DOE and actions taken to recover from

maintenance issues noted in the DOE Accident Investigation Board reports issued following the underground vehicle fire and radioactive material release event in February 2014. During each of the four reviews, the Board's staff identified weaknesses in the implementation of numerous elements of DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities*.

Members of the Board's staff also performed conduct of operations assessments at the Lawrence Livermore National Laboratory and Oak Ridge Transuranic Waste Processing Center, identifying issues with documentation and implementation of requirements in DOE Order 422.1, *Conduct of Operations*. The Board's technical staff provided direct feedback and suggestions for operational program improvements to personnel at both sites. Members of the Board's staff will continue to monitor the implementation and effectiveness of DOE's operations and maintenance programs.

#### *Board Action*

The Board issued a letter to NNSA on November 12, 2015, highlighting several areas of concern related to the Pantex Plant maintenance program.

### **IX. Informing the Public**

#### **Public Hearings**

The Board's enabling legislation vests it with a comprehensive suite of statutory tools to execute its oversight mission, including the power to hold public hearings. Public hearings play an essential role in the Board's mission of ensuring adequate protection because they assist the Board in obtaining vital safety information from DOE, NNSA, expert sources, and the public at large. In 2015, the Board held two statutory hearings: the first addressed safety during recovery and resumption of operations at the Waste Isolation Pilot Plant (WIPP), and the second focused on DOE efforts to improve the safety culture at the Waste Treatment and Immobilization Plant (WTP). The *Federal Register* notice and agenda for both hearings were posted on the Board's website in advance of the hearings. The Board received testimony from the public during each hearing, which was included in the respective public record. Transcripts and videos of both hearings may be viewed on the Board's public website.

#### *Recovery and Resumption of Operations at WIPP*

The Board's first public hearing of 2015 convened on April 29 in Carlsbad, NM, and was divided into four sessions. In the first session, the Board received testimony from DOE's Acting Assistant Secretary for Environmental Management (EM) regarding actions taken by DOE to safely recover the WIPP underground from events following a salt haul truck fire on February 5, 2014, and a separate radiological release on February 14, 2014. During the second session, the Board questioned Nuclear Waste Partnership, the site contractor, and a panel of senior managers from EM and DOE's Carlsbad Field Office about the specific actions necessary to safely recover the underground prior to resuming waste handling operations. The third session discussed DOE's strategy for improving the effectiveness of federal oversight of

contractor activities, including specific actions to ensure that improvements made by the site contractor and DOE are sustained over the long term. The hearing concluded with testimony from the Board’s senior technical staff regarding an update to the public on the Board’s proposed oversight actions associated with safe recovery of the underground, and oversight of corrective actions to resume and sustain safe waste operations.

### *Safety Culture at WTP*

The second hearing was held on August 26, 2015, in Kennewick, WA, and occurred in two sessions. In the first session, the Board questioned senior DOE officials, the manager of DOE’s Office of River Protection (ORP), and WTP’s Federal Project Director on the actions taken to strengthen and sustain a healthy safety culture at WTP, the effectiveness of improvements, and the expectations for further progress. DOE’s Office of Independent Enterprise Assessment was also given the opportunity to discuss the WTP independent safety culture assessments. In the second session, the Board received testimony from a senior Board technical staff employee concerning the staff’s perspective on the status of DOE’s execution of the Implementation Plan for Recommendation 2011-1, the corrective actions taken at WTP in response to the Recommendation, and the results of the extent-of-condition reviews conducted by DOE. Twelve public citizens testified on the record before the hearing concluded.



**Safety Culture Hearing in Kennewick, WA**

## Public and Closed Meetings

In addition to the two public hearings noted above, the Board held three public meetings and four closed meetings in 2015 pursuant to the Government in the Sunshine Act (“Sunshine Act”) and the Board’s regulations implementing the Sunshine Act. Like the public hearings, the *Federal Register* notice and agenda were posted on the Board’s website in advance of each meeting.

### *Public Meetings*

The first public meeting took place on April 29, 2015, in Carlsbad, New Mexico immediately after the WIPP hearing concluded. The Board’s deliberations focused on the Board’s planned approach for providing oversight of DOE activities to recover the underground and resume waste operations at WIPP. Following their deliberations, the Board unanimously voted to approve the staff’s proposed work plan for oversight of recovery and resumption of operations at WIPP. A transcript of the meeting is available for public inspection on the Board’s website.

The Board convened the second public meeting on June 3, 2015, at its Washington, DC, headquarters. During this meeting, the Board members received presentations from each of the Board’s Office Directors: the General Manager reported on the Board’s performance metrics and recent organizational assessments of the Board, the Acting General Counsel explained the Board’s policies and their underlying legal bases, and the Technical Director presented on the technical staff’s organizational structure. The Board then considered four previously submitted requests for Board action, engaged in deliberations, and voted on whether to approve or disapprove each request. The vote results, meeting transcript, and video recording are all available on the Board’s website.

The final public meeting of 2015 was held on November 23 at the Board’s headquarters. During this meeting, technical staff members provided an overview of technical staff work plan activities and crosscutting issues, as well as ongoing technical staff work related to NNSA and EM programs. Based on this information, the Board deliberated on programmatic issues at NNSA and EM and Board staff priorities. At the end of the meeting, the Board voted to approve the “DNFSB Office of the Technical Director Fiscal Year 2016 Work Plan.” A summary of the Work Plan and its corresponding Board vote, along with a video recording and transcript of the meeting, are available on the Board’s website.

### *Closed Meetings*

The Board held closed meetings at its headquarters on June 3, July 29, December 1, and December 11, to deliberate on potential recommendations to the Secretary of Energy. All four meetings were closed pursuant to Sunshine Act Exemption 3, which permits closure when a meeting is likely to disclose matters that are specifically exempted from disclosure by statute. In each case, the deliberations pertained to potential Board recommendations which, under

sections 2286d(b) and (h)(3) of the Board’s statute, may not be made publicly available until after they have been received by the Secretary of Energy or the President, respectively.



**November 23, 2015, Public Business Meeting**

**Responses to FOIA Requests**

The Board received 20 formal requests for Board records filed under the Freedom of Information Act (FOIA) in calendar year 2015. The average response time was 17.78 working days, as compared with the statutory requirement of 20 working days. The table below outlines how the Board responded to each request.

**Board Response to 2015 FOIA Requests**

	<b>Denial Based on Exemption</b>	<b>Partial Grant</b>	<b>Full Grant</b>	<b>No Records Located</b>	<b>Other</b>
<b>Board Response to FOIA Requests</b>	0	6	4	5	5

**Inspector General Activities**

The Consolidated Appropriations Act for FY 2014 assigned the Inspector General (IG) of the Nuclear Regulatory Commission (NRC) to act as the Board’s permanent IG. To execute this statutory mandate, the Consolidated Appropriations Act for FY 2016 provided a direct appropriation of \$958,000 to the NRC-IG. The NRC-IG conducts performance inspections for the Board which focus on fact-finding and analysis regarding specific management issues. The NRC-IG also conducts expedited reviews involving sensitive matters, such as issues of immediate interest to Congress, the NRC-IG, and/or the Board. The NRC-IG issues recommendations identifying concrete opportunities to reform Board management in areas

such as: Sunshine Act requirements; travel programs; information security; and financial reviews.

### **Information Technology Activities**

The addition of new content to the Board's website has provided greater transparency of Board operations to Congress, other stakeholders, and the public. For example, the Board began posting Monthly Site Reports for the Waste Isolation Pilot Plant, the Nevada National Security Site, the Idaho National Laboratory, the Sandia National Laboratories, and the Lawrence Livermore National Laboratory, on its website in order to provide greater visibility into the sites which do not have permanent site representatives.

The process for posting Board notational votes was also enhanced to show the "Date of Action" on the Board's website. Previously, only the date the notational vote was uploaded to the website was shown. The new "Date of Action" category will make it easier for the public and key stakeholders to determine when Board actions were actually decided.

Finally, the Board created a YouTube channel to store recently recorded public hearings and meetings. Three videos are currently available on the Board's channel: (1) the June 3, 2015, public meeting; (2) the August 26, 2015, public hearing on improving safety culture at WTP; and (3) the November 23, 2015, public meeting.

## **X. Funding and Human Resources**

### **Budget Levels and Staffing**

The Board began calendar year 2015 under the Consolidated and Further Continuing Appropriations Act for FY 2015, which appropriated \$28.5 million for the Board's salaries and expenses through September 30, 2015. The Board entered FY 2016 under a continuing resolution, which funded the Board at its FY 2015 rate through December 11, 2015. On December 18, 2015, Congress enacted the Consolidated Appropriations Act for FY 2016 ("Omnibus"), to provide funding through September 30, 2016. The Omnibus appropriated \$29.15 million for the Board's salaries and expenses.

For the first seven months of 2015, the Board operated with only three of its statutory five members due to two vacancies. The Board achieved its full complement of five members in August 2015. The Chairman vacancy was filled by Ms. Joyce Connery of Gainesville, Virginia, who was confirmed by Congress on August 5, 2015, for a term expiring October 18, 2019. The second vacancy was filled by Mr. Bruce Hamilton of Dallas, Texas, who was also confirmed by Congress on August 5, 2015, for a term expiring October 18, 2016. By the end of calendar year 2015, the Board had 75 engineers on board. Total federal employee strength at the end of 2015 was 106 full-time-equivalent (FTE) employees. Consistent with the Board's FY 2017 Budget Request, the Board hopes to increase its workforce to 116 FTEs by the end of FY 2016.

To fulfill a requirement of the National Defense Authorization Act for FY 2004 that federal agencies conduct annual employee surveys, the Board participated in the Office of Personnel Management's 2015 Federal Employee Viewpoint Survey (FEVS). The Board's scores indicated that the agency made notable progress in multiple areas in FY 2015, which was the result of continuing efforts to improve employee engagement, communication, employee recognition, and overall employee satisfaction. In recognition of the Board's continued improvement, the Director of OPM publicly acknowledged the Board for its internal efforts to enhance its organization.

In the spring of 2015, the NRC-IG commissioned Towers Watson, a government consulting company, to conduct a survey to evaluate the current culture and climate of the Board. The objective of the Culture and Climate Survey was to gather employees' perspectives on their work experience and environment in order to identify areas of concern and opportunities for improvement. In August 2015, Towers Watson issued its final report, *DNFSB 2015 Culture and Climate Survey: Executive Overview of Key Findings*. In response, the Board subsequently asked a group of volunteer employees to develop an action plan focused on the following "key drivers of engagement" articulated in the report: communication, respect and professionalism, and operating efficiency/procedures.

In order to fully address organizational climate concerns at the agency, the Board is currently moving forward with developing action plans for FY 2016 that combine the input and feedback from the 2015 Culture and Climate Survey, the volunteer employee group, and the data and trend results from the 2015 FEVS.

### **Prioritization of Work**

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. The Board considers the following main factors:

- Quantity, chemical composition, physical form, and radiological characteristics of the nuclear material stored or handled in the facility;
- Potential for accidents involving energetic release of materials (e.g., earthquakes, tornados, runaway chemical reactions, fires, or explosions), criticality accidents, or nuclear detonations;
- Complexity of safety controls and the degree of reliance on active safety systems or administrative controls instead of passive design features;
- Novelty of materials, facilities, or operations;
- The significance of changes in facility configuration, facility conditions (e.g., degradation of aging systems and structures), operations, or personnel (e.g., transition to a new operating contractor); and

- Proximity to collocated workers and the offsite public.

The Board obtains the information needed for this risk-based prioritization through multiple avenues. Continuous in-field observations by the Board's site representatives provide real-time information regarding safety issues and potential risks to the workers and the public at five major DOE defense nuclear facilities. The site representatives provide weekly activity reports to the Board and are in constant communication with the Board's headquarters staff. This information is invaluable in allowing the Board to assess the priority of work and assign resources appropriately. Similarly, the Board's headquarters staff interacts frequently with DOE's headquarters and field offices to inform the Board of the status and future plans for facilities and activities at defense nuclear sites. The Board's staff also monitors DOE's various reporting mechanisms for off-normal events (e.g., the Occurrence Reporting and Processing System) to identify individual occurrences or trends which indicate a need for safety oversight.

The Board members directly obtain information needed to prioritize oversight through a variety of other means. For example, Board members visit principal DOE defense nuclear facilities each year to review activities and safety issues. Board members are briefed regularly by senior DOE officials on the status of activities and safety initiatives. Finally, Board members interact informally with personnel at DOE's headquarters and field offices to gather information pertinent to safety oversight.

Based on this prioritization of work, four types of safety oversight are underway at all times:

- Evaluation of DOE's organizational policies and processes. These reviews evaluate topics such as technical competence of DOE and contractor personnel, adequacy of safety requirements and guidance, and the presence of a strong safety culture.
- Evaluation of actual hazardous activities and facilities in the field. These reviews focus on identifying the hazards and evaluating controls put in place to mitigate those hazards.
- Expert-level reviews of the safety implications of DOE's actions, decisions, and analyses.
- Identification of new safety issues otherwise unknown in the DOE complex. Since, by definition, these safety issues would not have been addressed but for the Board's efforts, this may be the area in which the Board has the largest impact on the safety of DOE's highly hazardous operations.

To ensure safety is integrated into the design of new defense nuclear facilities, the Board tracks every project and schedules its reviews to match each project's design maturity. The Board prioritizes these reviews based on the following considerations:

- Hazards in the facility and potential for energetic release of materials;

- Maturity of safety documentation at key points in the project's life, e.g., prior to DOE's approval of the conceptual safety design report, preliminary safety design report, preliminary documented safety analysis, and the final documented safety analysis;
- Importance of safety controls at the facility level and process level, with controls for more hazardous and likely accidents reviewed in greater detail; and
- Oversight capability of the DOE project management organization.

The Board uses its Strategic Plan, Annual Performance Plan, and annual staff work plans to ensure that its resources remain focused on the most significant safety challenges. This approach gives the Board confidence that its staff and budget are dedicated to the highest risk activities under the Board's jurisdiction.

### Appendix A: Reporting Requirements Issued in 2015

<b>Date</b>	<b>Addressee</b>	<b>Topic</b>	<b>Date of DOE Response</b>
Jan. 21	Acting Assistant Secretary for Environmental Management (EM)	Hydrogen Control Strategy for the High-Level Waste Facility at the Hanford Waste Treatment and Immobilization Plant (WTP)	Jun. 5, 2015
Feb. 2	Acting Assistant Secretary for EM	Seismic Design Basis Accident at WTP	Jul. 24, 2015
Mar. 16	Deputy Under Secretary for Management and Performance	Federal Oversight of Radcalc	Jun. 9, 2015
Jun. 25	Manager, NNSA Production Office	Uranium Processing Facility Confinement Strategy	Sept. 11, 2015
Aug. 3	Principal Deputy Assistant Secretary for EM	Defense Waste Processing Facility Safety Basis Review	Dec. 16, 2015
Aug. 10	Deputy Secretary of Energy	Radcalc Safety Calculation Results	Aug. 21, 2015 (briefing)
Aug. 21	Assistant Secretary for EM	Hanford Sludge Treatment Project Site Boundary	Nov. 18, 2015
Aug. 31	Associate Under Secretary for Environment, Health, Safety and Security	Idaho National Laboratory Probabilistic Seismic Hazard Analysis	Dec. 15, 2015
Oct. 29	Administrator, NNSA	Conceptual Design for the Electrowinning Project at the Y-12 National Security Complex	Jan. 7, 2016
Nov. 10	Secretary of Energy	Recommendation 2012-1 Implementation Plan Progress	Jan. 15, 2016

**Appendix B: Significant Board Correspondence in 2015**  
**(letters available on the Board's website at [www.dnfsb.gov](http://www.dnfsb.gov))**

**Hanford**

January 21, 2015, Board letter establishing a 90-day reporting requirement for a path forward on developing a nuclear safety control strategy for hydrogen explosion hazards in the High-Level Waste Facility (HLW).

February 2, 2015, Board letter establishing a 90-day reporting requirement for a plan to develop a nuclear safety control strategy that ensures the HLW Facility's confinement ventilation system will perform its intended safety functions during a seismic design basis accident.

March 6, 2015, Board letter concerning DOE's strategy for decommissioning safety systems at the Plutonium Finishing Plant.

March 25, 2015, Board letter addressing aerosol entrainment coefficient value for confinement ventilation system designs at WTP.

April 7, 2015, Board letter assessing DOE's progress in implementing Recommendation 2011-1, *Safety Culture at the Waste Treatment and Immobilization Plant*.

May 8, 2015, Board project letter on the safety basis for the HLW Facility.

May 14, 2015, Board project letter analyzing the Safety Design Strategy and Conceptual Safety Design Report for the Low-Activity Waste Pretreatment System project.

June 12, 2015, Board letter recognizing Mr. Mark Hahn of the Richland Operations Office as the recipient of the 2014 DOE Annual Safety System Oversight Award.

June 12, 2015, Board letter recognizing Mr. Joshua Allen of the Richland Operations Office as the 2014 DOE Facility Representative of the Year.

August 21, 2015, Board letter reviewing the Sludge Treatment Project Preliminary Documented Safety Analysis Hydrogen Hazards.

August 21, 2015, Board letter establishing a 45-day reporting requirement for DOE's position on controlling river access and protecting public receptors from accidents during slurry transfers.

October 26, 2015, Board letter evaluating DOE's progress on Recommendation 2012-2, *Hanford Tank Farms Flammable Gas Safety Strategy*.

### **Idaho National Laboratory**

August 31, 2015, Board letter establishing a 90-day reporting requirement for a report on the technical basis for the planned risk assessment approach to update the Idaho National Laboratory's probabilistic seismic hazard analysis.

November 23, 2015, Board letter addressing issues with the safety basis for the Advanced Mixed Waste Treatment Project.

### **Los Alamos National Laboratory**

September 21, 2015, Board letter discussing potential actions that would reduce hazards at the Plutonium Facility.

September 30, 2015, Board letter assessing DOE's progress on Recommendation 2009-2, *Los Alamos National Laboratory Plutonium Facility Seismic Safety*.

### **Pantex Plant**

November 12, 2015, Board letter highlighting deficiencies with the maintenance program at Pantex.

November 24, 2015, Board letter forwarding Recommendation 2015-1, *Emergency Preparedness and Response at the Pantex Plant*.

### **Savannah River Site**

March 9, 2015, Board letter concerning delays in DOE's implementation of Recommendation 2012-1, *Savannah River Site Building 235-F Safety*.

May 13, 2015, Board project letter for Critical Decision (CD)-4, *Approve Start of Operations or Project Completion*, for the Waste Solidification Building.

June 22, 2015, Board project letter for CD-4 for the K-Area Complex Purification Area Vault Project.

August 3, 2015, Board letter establishing a 90-day reporting requirement to address issues with the safety basis for the Defense Waste Processing Facility.

October 20, 2015, Board letter detailing several areas for improvement within the L-Area safety basis.

November 10, 2015, Board letter establishing a 60-day reporting requirement for information on the scope and schedule for Building 235-F decontamination work in fiscal years 2016 and 2017 to ascertain progress under the Recommendation 2012-1 Implementation Plan.

December 16, 2015, Board letter identifying issues with the seismic analysis for the H-Canyon Exhaust Tunnel.

December 22, 2015, Board letter reviewing emergency preparedness and response at the Savannah River Site.

### **Waste Isolation Pilot Plant**

April 7, 2015, Board letter inviting Secretary Moniz or his designee to testify at the Board's April 29, 2015, public meeting on the recovery and resumption of operations at WIPP.

### **Y-12 National Security Complex**

February 4, 2015, Board letter reviewing structural calculations for natural phenomena hazards at the 9215 Complex and Building 9204-2E.

June 25, 2015, Board letter establishing a 90-day reporting requirement regarding the design methodology and technical basis associated with the design of the UPF confinement ventilation system in a post-seismic condition.

October 29, 2015, Board letter establishing a 60-day reporting requirement for a schedule of when specific analyses of various SSCs for the Electrorefining Project will be conducted.

### **Other Correspondence**

March 11, 2015, Board letter transmitting the Board's *25<sup>th</sup> Annual Report to Congress*.

March 16, 2015, Board letter establishing a 90-day reporting requirement for DOE's federal oversight activities and risk assessments performed to date associated with Radcalc.

April 1, 2015, Board letter assessing DOE's progress in implementing Recommendation 2010-1, *Safety Analysis Requirements for Defining Adequate Protection for the Public and the Workers*.

April 21, 2015, Board letter proposing a joint effort to review the processes by which the Board interacts with DOE to identify potential safety issues in the design and construction of new DOE defense nuclear facilities.

August 10, 2015, Board letter establishing a 10-day reporting requirement for a briefing on DOE's rationale for using a new version of Radcalc at defense nuclear facilities and what compensatory measures are in place to offset deviating from the oversight requirements of DOE Order 414.1D, *Quality Assurance*, and DOE Order 226.1B, *Implementation of Department of Energy Oversight Policy*.

November 25, 2015, Board letter transmitting the Board's *FY 2015 Performance and Accountability Report* to Congress.

## **Appendix C: Status of Significant Unresolved Issues with DOE's Design and Construction Projects**

Since 2007, the Defense Nuclear Facilities Safety Board (Board) has provided periodic reports to Congress presenting the status of significant unresolved safety issues concerning the design and construction of the Department of Energy's (DOE) defense nuclear facilities. This report summarizes the status of significant unresolved safety issues through December 2015.

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 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, three new issues were identified, one new project has been listed, and the status of one project has significantly changed. Enclosure C-1 of this report identifies significant unresolved safety issues for current design and construction projects. Enclosure C-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 at WTP, 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 of the designs and nuclear safety bases. During the last reporting period, 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 safety issues.

To mitigate the impact of technical and safety issues with the PT Facility, DOE is pursuing a new project—the Low-Activity Waste Pretreatment System (LAWPS)—to pretreat the liquid portion of the Hanford tank waste and directly feed it to the LAW Facility. This approach would enable the LAW Facility to begin vitrifying waste before completion of WTP's PT Facility. In 2015, DOE approved the LAWPS project to move into the preliminary design phase.

During this reporting period, DOE continued work to resolve open safety issues, with a focus on the PT and HLW Facilities. The Board identified two new safety issues associated with

the HLW Facility. The issues involve the control strategy for hydrogen in process vessels and the seismic classification of the confinement boundary at the HLW Facility. A description of the new and unresolved safety issues at WTP can be found below.

The first four of the Board's unresolved safety issues summarized below are associated with inadequate performance of the 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 lead to the accumulation of fissile material at the bottom of WTP 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. The WTP contractor conducted engineering studies and hazards assessments to evaluate criticality safety hazards and potential controls for the vessels with high solids content in the PT and HLW Facilities.

*Generation and Accumulation of Hydrogen in Process Vessels*—Inadequate pulse jet mixing can lead to the accumulation of solids in process vessels, resulting in the generation and accumulation of hydrogen, and can potentially lead to explosions. DOE is developing a new hydrogen control strategy and associated mixing requirements. DOE is also developing a new standard vessel design that will be used for all vessels with high solids content in the PT Facility.

*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 design and ensure the control system can adequately perform its safety functions. The WTP project team conducted structural evaluations of HLW Facility process vessels containing pulse jet mixers to assess their performance under overblow loads.

*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 explosions. Also, waste that does not meet the WAC could produce unacceptable radiation hazards for the public and workers during potential accident scenarios. The Tank Farms contractor plans to perform additional testing of the proposed sampling system to verify its performance.

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 facility. The WTP

contractor is performing a deterministic analysis to establish whether safety controls will be required for this hazard. Also, the WTP contractor is using a probabilistic risk assessment for 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. DOE previously completed a two-phase spray leak testing program at Pacific Northwest National Laboratory and is currently incorporating the test results into accident analyses for WTP.

*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 hydrogen mixing requirements. These requirements are necessary to prevent explosions in PT Facility process vessels that will contain waste that develops distinct sludge and supernatant layers if not agitated. Due to challenges associated with pulse jet mixing, DOE is developing a new standard vessel design and a new hydrogen control strategy with associated mixing requirements. Resolution of the heat transfer safety issue is dependent on the completion of those efforts.

*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.

*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. DOE plans to address this issue through systematic evaluation of hazards, reassessing the pipeline design strategy, performing additional erosion testing, and establishing appropriate WAC.

*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. The incorporation of the updated assessment will have significant impacts on the structural, ventilation, and emergency power design requirements. By continuing design activities without incorporating the latest assessment of the hazard, the project is not meeting the requirement of DOE Order 420.1B, *Facility Safety*, to design and construct facility structures, systems, and components to withstand natural phenomena hazards and ensure protection of the public. On February 11, 2015, DOE provided a response that describes a phased approach to address the ashfall hazard. DOE is revising the estimate of ashfall consequences and evaluating hazard analysis alternatives and additional operational controls.

*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 ensure adequate protection of 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. An incomplete SDS can lead to a safety basis that does not meet the requirements of 10 C.F.R. 830. In a March 9, 2015, response, DOE stated its intent to perform comprehensive hazard analyses.

## **SAFETY ISSUE RESOLVED DURING THE PERIOD**

### **1. Project: System for the Analysis of Soil-Structure Interaction (SASSI) Computer Program**

***Issue—Technical and Quality Assurance Deficiencies.*** Many DOE contractors use SASSI to evaluate the impact of soil-structure interaction effects on a building during a seismic event. Problems with a particular subroutine in the SASSI computer program, the subtraction method, were identified. This method was predicting unrealistic seismic responses of certain buildings. Upon further review, it was determined that various versions of the computer program used across the DOE complex had not been properly verified and validated or controlled under rigorous quality assurance programs. On April 8, 2011, the Board sent a letter to DOE outlining these issues and requesting a plan for corrective actions.

***Resolution***—The DOE Office of the Chief of Nuclear Safety put together a technical team to address these deficiencies. The team determined the root cause of the subtraction method issue and developed a database of problems that can be used to verify and validate the SASSI computer program. DOE then developed a guidance document for the use of SASSI on

current and future projects. The issue is closed, as noted in the Board’s January 5, 2016, letter to DOE.

## **NEW SAFETY ISSUES IDENTIFIED DURING THE PERIOD**

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

***New Issue—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 containing non-Newtonian waste. This hazard, if not properly addressed, may result in releases of radioactive materials. The lack of a viable hydrogen control strategy for the HLW Facility can lead to a safety basis that is insufficient to ensure adequate protection of the public and the workers. The Board also expressed concerns that the WTP project team plans to rely on evaluations for resolving similar issues in the PT Facility to support and inform the development of a hydrogen control strategy for the HLW Facility. Due to significant differences in the design of the mixing systems and waste properties at these facilities, evaluations for the PT Facility may not apply to the HLW Facility.

In its June 5, 2015, response, DOE described a path forward to define a compliant nuclear safety control strategy consisting of three elements:

- Determine the safety significance level of the controls required to mitigate or prevent a hydrogen explosion in a HLW vessel. This will include HLW process vessels containing non-Newtonian waste.
- Perform an engineering study to evaluate implementable controls for hydrogen explosion event mitigation. The study will consider sparging, mixing, and purging as control options and parallel the development of a hydrogen control strategy for the PT Facility.
- Complete process hazards analysis for receipt, storage, and transfer of HLW process streams, including a hydrogen explosion event and associated impacts, for selection of controls.

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

***New Issue—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 effectively perform its credited safety class functions. 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 the workers, public, and the environment. As a result, the preferred nuclear safety control strategy described in the SDS does not meet DOE requirements for protecting the public and workers.

In its July 24, 2015, response, DOE acknowledged that the safety control strategy for a seismic event could result in potential unfiltered flow paths out of the facility. However, DOE stated the potential unfiltered releases may not result in a significant loss of confinement due to continued operation of the C5V system. DOE plans to evaluate the seismic event and validate the seismic classification of SSCs through hazard analyses scheduled for completion in 2017.

### **3. Project: Hanford Site, Sludge Treatment Project**

***New Issue—Site Boundary and Columbia River Control.*** In an August 21, 2015, letter to DOE, the Board communicated a concern that a Specific Administrative Control (SAC) had been removed from the control strategy identified in Revision 1 of the Engineered Container Retrieval and Transfer System Preliminary Documented Safety Analysis. In Revision 0, the SAC was included to protect the public by controlling public access to portions of the Columbia River prior to and during slurry transfers of radioactive material. Relying on emergency response would not adequately protect individuals located on the Columbia River in the event of a rapidly developing accident, such as a spray release. In the letter, the Board requested a written response within 45 days documenting DOE's position on controlling Columbia River access and protecting public receptors from accidents during slurry transfers and the technical basis supporting this position.

The Board received DOE's response on November 18, 2015. DOE believes that Revision 1 of the Sludge Treatment Project Engineered Container Retrieval and Transfer System Preliminary Documented Safety Analysis demonstrates adequate protection of the public and workers and that the SAC is not needed.

## **NEWLY LISTED PROJECT**

### **1. Project: Hanford Site, Tank Waste Characterization and Staging Capability**

***Description***—The Tank Waste Characterization and Staging (TWCS) capability will be designed to stage, mix, potentially pre-condition, and blend tank waste prior to transfer to the WTP HLW Facility for vitrification. This is intended to allow direct feed of waste to the HLW Facility to begin before the PT Facility is operational. In addition, the TWCS capability could provide the tank farms and WTP with operational flexibility and feed optimization to reduce cost and schedule for WTP operations.

***Status of Facility***—DOE approved Critical Decision (CD)-0, *Approve Mission Need*, for this project on September 11, 2015.

## **CHANGE IN PROJECT STATUS**

### **1. Project: Savannah River Site, Waste Solidification Building**

On July 30, 2015, NNSA approved CD-4 for the Waste Solidification Building (WSB), signifying the start-up of operations or project completion. The Board has no unresolved issues with WSB. Since the completion of the Mixed Oxide Fuel Fabrication Facility (MFFF) has been delayed, there is no near-term need to operate WSB, which will process waste from MFFF. NNSA approved CD-4 without completing key CD-4 activities, including approval of the WSB Documented Safety Analysis and conduct of an Operational Readiness Review, as required by DOE Order 413.3B, *Program and Project Management for Acquisition of Capital Assets*.

**ENCLOSURE C-1**

<b>DECEMBER 2015 REPORT SUMMARY OF SIGNIFICANT UNRESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES</b>			
SITE	FACILITY	Critical Decision (CD) Approved	ISSUES <sup>1</sup>
<b>Hanford Site</b>	<b>Waste Treatment and Immobilization Plant (WTP)<sup>2</sup></b>	--	--
	<b>a. WTP Pretreatment Facility</b>	CD-3	<ol style="list-style-type: none"> <li>1. Hydrogen in pipes and ancillary vessels—<b>(Jun. 09)</b></li> <li>2. Criticality in process vessels—<b>(Apr. 10)</b></li> <li>3. Generation and accumulation of hydrogen in process vessels—<b>(Apr. 10)</b></li> <li>4. Pulse jet mixer control—<b>(Apr. 10)</b></li> <li>5. Ability to obtain representative samples—<b>(Apr. 10)</b></li> <li>6. Inadequacies in the spray leak methodology—<b>(Jun. 11)</b></li> <li>7. Heat transfer analysis for process vessels—<b>(Sept. 11)</b></li> <li>8. Ammonia controls—<b>(Mar. 12)</b></li> <li>9. Erosion and corrosion—<b>(Jun. 12)</b></li> <li>10. Design and construction of electrical distribution system—<b>(Jun. 12)</b></li> <li>11. Plugging and wear of process piping—<b>(Dec. 12)</b></li> <li>12. Volcanic ashfall hazard—<b>(Dec. 14)</b></li> </ol>
	<b>b. WTP High-Level Waste Facility</b>	CD-3	<ol style="list-style-type: none"> <li>1. Hydrogen in pipes and ancillary vessels—<b>(Jun. 09)</b></li> <li>2. Pulse jet mixer control—<b>(Apr. 10)</b></li> <li>3. Inadequacies in the spray leak methodology—<b>(Jun. 11)</b></li> <li>4. Ammonia controls—<b>(Mar. 12)</b></li> <li>5. Erosion and corrosion—<b>(Jun. 12)</b></li> <li>6. Design and construction of electrical distribution system—<b>(Jun. 12)</b></li> <li>7. Plugging and wear of process piping—<b>(Dec. 12)</b></li> <li>8. Volcanic ashfall hazard—<b>(Dec. 14)</b></li> <li>9. Unanalyzed melter accidents—<b>(Dec. 14)</b></li> <li>10. Hydrogen control strategy—<b>(Dec. 15)</b></li> <li>11. Seismic categorization of safety controls—<b>(Dec. 15)</b></li> </ol>
	<b>c. WTP Low- Activity Waste Facility</b>	CD-3	<ol style="list-style-type: none"> <li>1. Ammonia controls—<b>(Mar. 12)</b></li> <li>2. Erosion and corrosion—<b>(Jun. 12)</b></li> <li>3. Design and construction of electrical distribution system—<b>(Jun. 12)</b></li> <li>4. Volcanic ashfall hazard—<b>(Dec. 14)</b></li> </ol>
	<b>d. WTP Analytical Laboratory</b>	CD-3	<ol style="list-style-type: none"> <li>1. Ammonia controls—<b>(Mar. 12)</b></li> <li>2. Design and construction of electrical distribution system—<b>(Jun. 12)</b></li> <li>3. Volcanic ashfall hazard—<b>(Dec. 14)</b></li> </ol>

<sup>1</sup> 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 C-2.

<sup>2</sup> 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 2015 REPORT  
SUMMARY OF SIGNIFICANT UNRESOLVED ISSUES  
WITH NEW DEFENSE NUCLEAR FACILITIES**

<b>SITE</b>	<b>FACILITY</b>	<b>Critical Decision (CD) Approved</b>	<b>ISSUES</b>
<b>Hanford Site (continued)</b>	<b>K-Basin Closure Sludge Treatment Project</b>	Phase 1: CD-2/3 Phase 2: CD-0	1. Site boundary and Columbia River control— <b>(Dec. 15)</b>
	<b>Waste Feed Delivery System</b>	Not formally implementing CD process	No open issues remain.
	<b>Low-Activity Waste Pretreatment System</b>	CD-0	No issues identified.
	<b>Tank Waste Characterization and Staging Capability</b>	CD-0	No issues identified.
<b>Idaho National Laboratory</b>	<b>Calcine Disposition Project</b>	CD-1	No issues identified.
<b>Los Alamos National Laboratory<sup>3</sup></b>	<b>Plutonium Facility (PF-4) Seismic Upgrades</b>	Not formally implementing CD process	1. Inadequate seismic safety posture— <b>(Jun. 12)</b>
	<b>Radioactive Liquid Waste Treatment Facility Upgrade Project—Transuranic Liquid Waste Facility</b>	CD-1	No open issues remain.
	<b>Transuranic Waste Facility</b>	Phase A: CD-4 Phase B: CD-3	1. Deficiencies in the Preliminary Documented Safety Analysis— <b>(Aug. 14)</b>
<b>Oak Ridge National Laboratory</b>	<b>Transuranic Waste Processing Center Sludge Project</b>	CD-1	No issues identified.
<b>Savannah River Site</b>	<b>Salt Waste Processing Facility</b>	CD-3	No open issues remain.
	<b>Waste Solidification Building</b>	CD-4	No open issues remain.
	<b>K-Area Purification Area Vault</b>	CD-4	No issues identified.
	<b>Saltstone Disposal Unit #6</b>	CD-3	No issues identified.
<b>Waste Isolation Pilot Plant</b>	<b>Underground Ventilation System</b>	CD-0	No issues identified.

<sup>3</sup> Issues with two new subprojects of the Chemistry and Metallurgy Research Replacement (CMRR) Project replacing the cancelled CMRR Nuclear Facility subproject are not tracked in this report. The new subprojects will install analytical equipment in two existing facilities at Los Alamos National Laboratory.

**ENCLOSURE C-2**

<b>DECEMBER 2015 REPORT SUMMARY OF RESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES</b>		
<b>SITE</b>	<b>FACILITY</b>	<b>RESOLVED ISSUES<sup>4</sup></b>
<b>Hanford Site<sup>5</sup></b>	<b>a. Waste Treatment and Immobilization Plant (WTP) Pretreatment Facility</b>	<ol style="list-style-type: none"> <li>1. Seismic ground motion—<b>resolved Feb. 08</b>. 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.</li> <li>2. Structural engineering—<b>resolved Dec. 09</b>. 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.</li> <li>3. Chemical process safety—<b>resolved Oct. 07</b>. 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, 2009, periodic report to Congress as “hydrogen gas control” when DOE changed the design approach.</li> <li>4. Fire safety design for ventilation systems—<b>resolved Dec. 09</b>. 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.</li> <li>5. Structural steel analysis and design—<b>resolved Dec. 10</b>. 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.</li> <li>6. Deposition velocity—<b>resolved Mar. 12</b>. 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.</li> <li>7. Use of Low-Order Accumulation Model—<b>resolved Mar. 12</b>. 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.</li> </ol>

<sup>4</sup> 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 1.

<sup>5</sup> 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 2015 REPORT  
SUMMARY OF RESOLVED ISSUES  
WITH NEW DEFENSE NUCLEAR FACILITIES**

SITE	FACILITY	RESOLVED ISSUES
Hanford Site (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.
	b. WTP High-Level Waste Facility	<ol style="list-style-type: none"> <li>1. Seismic ground motion—resolved Feb. 08. See Item a.1.</li> <li>2. Structural engineering—resolved Dec. 09. See Item a.2.</li> <li>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.</li> <li>4. Fire safety design for ventilation systems—resolved Dec. 09. See Item a.4.</li> <li>5. Structural steel analysis and design—resolved Dec. 10. See Item a.5.</li> <li>6. Deposition velocity—resolved Mar. 12. See Item a.6.</li> <li>7. Selection of validation set for computational fluid dynamics model—resolved July 13. See Item a.8.</li> </ol>
	c. WTP Low-Activity Waste Facility	<ol style="list-style-type: none"> <li>1. Fire protection—resolved Jun. 09. See Item b.3.</li> <li>2. Structural steel analysis and design—resolved Dec. 10. See Item a.5.</li> <li>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.</li> </ol>
	d. WTP Analytical Laboratory	<ol style="list-style-type: none"> <li>1. Fire protection—resolved Jun. 09. See Item b.3.</li> <li>2. Instrumentation and control systems design—resolved Dec. 14. See Item c.3.</li> </ol>
	K-Basin Closure Sludge Treatment Project	<ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>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.</li> </ol>

**DECEMBER 2015 REPORT  
SUMMARY OF RESOLVED ISSUES  
WITH NEW DEFENSE NUCLEAR FACILITIES**

SITE	FACILITY	RESOLVED ISSUES
Hanford Site (continued)	K-Basin Closure Sludge Treatment Project (continued)	<p>4. Inadequacies in safety basis development—<b>resolved Jun. 12</b>. 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.</p> <p>5. Non-bounding spray leak consequence analyses—<b>resolved Nov. 13</b>. 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.</p> <p>6. Safety-instrumented systems—<b>resolved Apr. 14</b>. 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.</p>
	Waste Feed Delivery System	<p>1. Design pressure rating of waste transfer system—<b>resolved Oct. 07</b>. 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.</p>
Idaho National Laboratory	Integrated Waste Treatment Unit Project	<p>1. Pilot plant testing—<b>resolved Feb. 09</b>. 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.</p> <p>2. Waste characterization—<b>resolved Feb. 09</b>. 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.</p> <p>3. Distributed Control System design—<b>resolved Feb. 09</b>. 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.</p>

**DECEMBER 2015 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	<ol style="list-style-type: none"> <li>1. Weak project management and federal project oversight—<b>resolved Sept. 10.</b> 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.</li> <li>2. Weak integration of safety into the design process—<b>resolved Sept. 10.</b> 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.</li> </ol>
	Transuranic Waste Facility	<ol style="list-style-type: none"> <li>1. Inadequate integration of safety into the design process—<b>resolved Sept. 10.</b> 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.</li> </ol>
Savannah River Site	Salt Waste Processing Facility (SWPF)	<ol style="list-style-type: none"> <li>1. Geotechnical investigation—<b>resolved Feb. 08.</b> 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.</li> <li>2. Structural evaluation—<b>resolved Dec. 09.</b> 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.</li> <li>3. Quality assurance—<b>resolved Jun. 07.</b> Quality assurance requirements were not implemented, as evidenced by inadequate calculations and the project team’s failure to report unrealistic predictions by software and the use of unapproved software. DOE completed a corrective action program to address these quality assurance issues.</li> <li>4. Hydrogen generation rate—<b>resolved Jun. 09.</b> 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.</li> </ol>

**DECEMBER 2015 REPORT  
SUMMARY OF RESOLVED ISSUES  
WITH NEW DEFENSE NUCLEAR FACILITIES**

SITE	FACILITY	RESOLVED ISSUES
Savannah River Site (continued)	SWPF (continued)	<p>5. Flammable gas control—<b>resolved July 13</b>. 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.</p> <p>6. Fire protection for final HEPA filters—<b>resolved Sept. 10</b>. 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.</p> <p>7. Operator actions following a seismic event—<b>resolved Jun. 12</b>. 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.</p> <p>8. Mixing system controls and operational parameters—<b>resolved Dec. 12</b>. 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.</p>
	Waste Solidification Building	<p>1. Structural design—<b>resolved Jun. 09</b>. 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.</p> <p>2. Deficiencies in Preliminary Documented Safety Analysis—<b>resolved Feb. 09</b>. 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.</p>

**DECEMBER 2015 REPORT  
SUMMARY OF RESOLVED ISSUES  
WITH NEW DEFENSE NUCLEAR FACILITIES**

<b>SITE</b>	<b>FACILITY</b>	<b>RESOLVED ISSUES</b>
<b>Multiple Sites</b>	<b>Multiple Sites</b>	1. Deficiencies with the System for the Analysis of Soil-Structure Interaction (SASSI) computer program— <b>resolved Jan. 16</b> . 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.

## **Appendix D: Summary of Significant Safety-Related Aging Infrastructure Issues at Defense Nuclear Facilities**

This is the Defense Nuclear Facilities Safety Board's (Board) sixth annual report on safety issues associated with aging infrastructure at the Department of Energy's (DOE) 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 D of this Appendix provide a summary of the operating defense nuclear facilities with significant safety-related aging infrastructure issues.

**ENCLOSURE D: 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 OR SAFETY ISSUES	ASSOCIATED NNSA ACTIONS	NNSA ACTIONS SINCE LAST REPORT
<b>Los Alamos National Laboratory (LANL)</b>	Plutonium Facility (PF-4)	1978	TBD	<p>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.</p> <p>Key facility-level safety systems (fire suppression system and active confinement ventilation system) are not qualified to survive certain seismic accident scenarios.</p> <p>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.</p>	<p>NNSA is implementing upgrades to the facility structure and selected safety systems to improve seismic performance.</p> <p>Additionally, NNSA is conducting an alternate seismic analysis to better characterize the likelihood of facility collapse and identify/prioritize structural upgrades.</p>	<p>The LANL contractor continued progress in upgrading facility structural members to address known seismic vulnerabilities. For example, 7 of 27 roof girders have been wrapped in carbon fiber.</p> <p>The contractor also continued progress in upgrading the seismic performance for portions of selected facility safety systems, including the fire suppression system, though the timeline may be extended by anomalies identified during a recent Board's staff review.</p> <p>It has lately become unclear whether NNSA will upgrade the active confinement ventilation system.</p> <p>NNSA completed the first of two phases of the planned alternate seismic analysis but discontinued the effort at that point and convened a Seismic Expert Panel to evaluate the path forward. NNSA is developing a request for proposals to complete a dynamic non-linear analysis instead.</p>

NNSA SITES						
SITE	FACILITY	BEGAN SERVICE	REMAINING SERVICE	IDENTIFIED CONCERN OR SAFETY ISSUES	ASSOCIATED NNSA ACTIONS	NNSA ACTIONS SINCE LAST REPORT
LANL (cont.)	Chemistry and Metallurgy Research (CMR) Facility	1952	Capabilities are being transitioned through the CMR Replacement Project. NNSA currently plans to terminate programmatic operations by 2019.	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.	<p>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.</p> <p>Additionally, NNSA is developing alternate strategies to transfer CMR capabilities into existing LANL facilities.</p> <p>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 (RLUOB).</p>	<p>The Deputy Secretary of Energy approved restructuring the subprojects covered under the CMR Replacement project. There are now four subprojects: (1) RLUOB Equipment Installation, Phase 2; (2) Plutonium Facility Equipment Installation, Phase 1; (3) Plutonium Facility Equipment Installation, Phase 2; and (4) Re-categorizing the RLUOB to Hazard Category-3 with a material-at-risk limit of 400g plutonium-239 equivalent.</p> <p>NNSA approved a Mission Need Statement for the Plutonium Modular Approach project.</p> <p>CMR building operators completed cleaning out the second of ten confinement vessels stored at TA-55 that have been slated for disposition. Confinement vessel disposition is a key activity that must be completed before exiting CMR.</p> <p>Waste-generating cleanout activities at CMR have been hampered by the WIPP and Area G closures.</p>

NNSA SITES						
SITE	FACILITY	BEGAN SERVICE	REMAINING SERVICE	IDENTIFIED CONCERN OR SAFETY ISSUES	ASSOCIATED NNSA ACTIONS	NNSA ACTIONS SINCE LAST REPORT
<b>Nevada National Security Site</b>	Device Assembly Facility (DAF)	1996	TBD	The fire protection system water tank is degrading and lead-in lines are corroding.	<p>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.</p> <p>In 2014, NNSA bypassed one of the three leaking lead-in lines.</p>	<p>In 2015, NNSA completed bypassing the second and third leaking lead-in lines and conducting associated hydrostatic testing.</p> <p>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.</p> <p>NNSA also discovered that the water tank corrosion is worse than first thought and is reconsidering the path forward.</p>
<b>Pantex Plant</b>	Site-Wide Fire Protection Systems	1950s	TBD	Fire protection lead-ins to numerous facilities and the fire water system's underground piping that have not been replaced exhibit corrosion-related failures. Aging fire detection system components continue to fail and are no longer being manufactured.	<p>NNSA 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) based on available funding. At present funding levels (\$20M-\$30M/year), NNSA projects that this effort will continue for approximately ten years.</p> <p>NNSA completed the start-up of a new diesel fire pump and water storage tank.</p>	<p>NNSA continues to replace fire protection lead-ins and underground piping. NNSA completed the design and testing of a replacement fire detection system and is starting installation on the first facility.</p> <p>Since the old fire detection system will remain in place for multiple years, NNSA also commenced a year-long program to test the old system's flame detectors for latent undetected failure modes, a potential vulnerability identified during a review by the Board's staff.</p>

NNSA SITES						
SITE	FACILITY	BEGAN SERVICE	REMAINING SERVICE	IDENTIFIED CONCERN OR SAFETY ISSUES	ASSOCIATED NNSA ACTIONS	NNSA ACTIONS SINCE LAST REPORT
<b>Y-12 National Security Complex</b>	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.	<p>The facility is vulnerable to collapse and loss of confinement resulting in high consequences for facility workers following certain seismic and high wind events.</p> <p>The 9212 Complex has reached its end of life. Continued deterioration of systems and components further increases operational safety risk.</p>	<p>NNSA performed Facility Risk Reviews (FRR) in 2006 and 2011 to identify infrastructure investment opportunities and executed the Nuclear Facility Risk Reduction (NFRR) capital project to reduce safety and operational risk.</p> <p>NNSA established the Continued Safe Operability Oversight Team (CSOOT) to maintain awareness of facility conditions and monitor progress toward implementing FRR recommendations. The FY 2013 charter for this team includes the 9212 and 9215 Complexes and Building 9204-2E.</p> <p>NNSA made significant changes to the UPF project to prioritize replacing functions performed in the 9212 Complex.</p>	NNSA continued execution of FRR recommendations and NFRR scope. Key accomplishments in 2015 included continued reductions in the quantities of material-at-risk in the 9212 Complex, as well as the completion of the NFRR Project, which improved safety by upgrading facility and utility infrastructure.

NNSA SITES						
SITE	FACILITY	BEGAN SERVICE	REMAINING SERVICE	IDENTIFIED CONCERN OR SAFETY ISSUES	ASSOCIATED NNSA ACTIONS	NNSA ACTIONS SINCE LAST REPORT
<b>Y-12 National Security Complex (cont.)</b>	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 latest charter (fiscal year 2013) for the CSOOT includes Building 9204-2E and the 9215 Complex.	In 2015, NNSA formally reduced the material-at-risk limits for the 9215 Complex. NNSA is now pursuing introducing reduced material-at-risk limits for Building 9204-2E.  In 2014, the CSOOT recommended the development of an Extended Life Program for these facilities. NNSA accepted the recommendation and has begun to develop the program.

ENVIRONMENTAL MANAGEMENT SITES						
SITE	FACILITY	BEGAN SERVICE	REMAINING SERVICE	IDENTIFIED CONCERN OR SAFETY ISSUES	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 retrieving waste from single-shell tanks to double-shell tanks for storage. DOE evaluated the integrity of the Hanford tanks and began 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. DOE began preparations for removing waste from double-shell tank 241-AY-102, which has a leak in its primary liner..
	T Plant	1944	TBD	T Plant does not meet minimum building code requirements for structural concrete. While T Plant capacity is suitable for current approved missions (e.g., waste storage, treatment, and packaging operations), 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 fiscal year 2020.

ENVIRONMENTAL MANAGEMENT SITES						
SITE	FACILITY	BEGAN SERVICE	REMAINING SERVICE	IDENTIFIED CONCERN OR SAFETY ISSUES	ASSOCIATED DOE ACTIONS	DOE ACTIONS SINCE LAST REPORT
<b>Hanford Site (continued)</b>	Waste Encapsulation and Storage Facility (WESF)	1974	TBD	The WESF K-3 ventilation system includes high efficiency particulate air filters that are more than 24 years old and that have been previously wetted.	DOE committed to K-3 ventilation system modifications in a report summarizing actions related to the Implementation Plan for Board Recommendation 2004-2. Funding has been allocated to support completion of modifications by the end of FY 2016.	The design for the ventilation system modifications has been finalized.  DOE approved the Mission Need Statement to meet the initial Critical Decision (CD-0) per DOE's Acquisition Management System for longer term safe capsule storage under the Capsule Extended Storage Project.

ENVIRONMENTAL MANAGEMENT SITES						
SITE	FACILITY	BEGAN SERVICE	REMAINING SERVICE	IDENTIFIED CONCERN OR SAFETY ISSUES	ASSOCIATED DOE ACTIONS	DOE ACTIONS SINCE LAST REPORT
<b>Savannah River Site (SRS)</b>	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 implemented compensatory measures to improve the safety posture of Building 235-F to enable cleanout work to begin.  DOE conducted a readiness assessment and resolved all pre-start findings from the assessment prior. DOE's contractor began deactivation work for the lowest-hazard cells (cells 6 through 9).

ENVIRONMENTAL MANAGEMENT SITES						
SITE	FACILITY	BEGAN SERVICE	REMAINING SERVICE	IDENTIFIED CONCERN OR SAFETY ISSUES	ASSOCIATED DOE ACTIONS	DOE ACTIONS SINCE LAST REPORT
SRS (continued)	H-Canyon	1955	TBD	<p>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.</p> <p>The concrete process air exhaust tunnel is more than 60 years old, and recent inspections have revealed that it has significantly degraded.</p>	<p>DOE continues to evaluate and address age-related issues including evaluation of the ventilation system.</p> <p>DOE completed a robotic crawler inspection of the process air exhaust tunnel to support an improved assessment of the tunnel structural integrity.</p>	DOE plans to further 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 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.	<p>DOE is pursuing actions to upgrade the fire pumps and water supply in A-Area.</p> <p>DOE is developing design specifications for replacement pumps and water supply.</p>	DOE continues to pursue a project to replace the fire water supply in A-Area.

ENVIRONMENTAL MANAGEMENT SITES						
SITE	FACILITY	BEGAN SERVICE	REMAINING SERVICE	IDENTIFIED CONCERN OR SAFETY ISSUES	ASSOCIATED DOE ACTIONS	DOE ACTIONS SINCE LAST REPORT
<b>Waste Isolation Pilot Plant (WIPP)</b>	WIPP Surface Structures, Shafts, and Underground Structures	1999 (Constructed 1981-1983)	Waste disposal operations will 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 were not operated, maintained, and protected consistent with current functions 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 includes upgrades to key SSCs and targets resumption of waste emplacement activities by the end of calendar year 2016.	DOE has commenced design of a new underground ventilation system and is reviewing interim controls developed by the WIPP contractor.

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