DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

September 19, 2014

The Honorable Ernest J. Moniz
Secretary of Energy
U. S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-1000

Dear Secretary Moniz:

The Defense Nuclear Facilities Safety Board (Board) is pleased to enclose a copy of its Report to Congress on the Status of Significant Unresolved Issues with the Department of Energy's Design and Construction Projects (dated September 19, 2014). In the Conference Report accompanying the Fiscal Year 2007 National Defense Authorization Act, the conferees directed the Board to provide quarterly reports until the Department of Energy (DOE) and the Board submit a joint report "on their efforts to improve the timeliness of issue resolution, including recommendations, if any, for legislation that would strengthen and improve technical oversight of the Department's nuclear design and operational activities." The joint report was submitted to the congressional defense committees on July 19, 2007. While the conferees did not require the Board to continue providing reports, the Board will continue issuing these reports to Congress and DOE on a semiannual basis.

Sincerely,

Peter S. Winokur, Ph.D.
Chairman

Enclosure

c: Mr. Joe Olencz

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

September 19, 2014

To the Congress of the United States:

The Defense Nuclear Facilities Safety Board (Board) provides periodic reports to Congress and the Department of Energy (DOE) to present the status of significant unresolved safety issues concerning the design and construction of DOE's defense nuclear facilities. This periodic report builds on the Board's May 16, 2014, report and earlier reports to summarize the status of significant unresolved safety issues through July 31, 2014. The status of many issues has not changed significantly during this reporting period. However, the fact that an issue has not been resolved does not necessarily imply a lack of progress.

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

The Board may identify additional issues during future design reviews. For this reporting period, one unresolved issue was expanded to capture new concerns. Enclosure 1 of this report identifies significant unresolved safety issues for current design and construction projects. Enclosure 2 of this report summarizes significant unresolved safety issues that have been resolved by DOE on current design and construction projects.

PROJECTS WITH THE MOST SIGNIFICANT UNRESOLVED SAFETY ISSUES

The following projects have the most significant unresolved safety issues:

- Los Alamos National Laboratory's (LANL) Plutonium Facility (PF-4) seismic evaluation and upgrades.

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

Los Alamos National Laboratory, PF-4 Seismic Safety. Since October 2009, the Board has worked with DOE on several seismic safety issues that challenge whether adequate protection is being provided for the public and workers at PF-4. DOE and the National Nuclear Security Administration (NNSA) made progress in addressing a number of these safety issues, but the Board remains concerned that PF-4 is vulnerable to seismic collapse. The large

plutonium inventory at PF-4, coupled with the facility's proximity to the public, creates the potential for high off-site radiological consequences. DOE is pursuing actions to address the collapse vulnerability, but maintains that PF-4 is safe to operate in the interim and complies with DOE standards for seismic performance. The Board communicated to DOE, in a letter dated July 17, 2013, that it does not agree with the basis for this conclusion as expressed by the former Secretary of Energy in his March 27, 2013, letter to the Board. The Board also advised that completion of a new seismic analysis by NNSA is necessary to fully evaluate the vulnerability of PF-4 to collapse following a design basis earthquake. During this reporting period, LANL personnel continued preparations to strengthen 27 interior roof girder shear spans in support of a March 2016 completion deadline. NNSA's contractor completed Phase I of the PF-4 alternate seismic analysis. NNSA paused Phase II of the analysis (i.e., fragility analysis and performance evaluation) and tasked its independent peer reviewers to study the differences between the two seismic analyses and to provide a recommended course of action for seismic rehabilitation of PF-4.

Inadequate Seismic Safety Posture—On October 26, 2009, the Board issued Recommendation 2009-2, *Los Alamos National Laboratory Plutonium Facility Seismic Safety*, identifying the need for DOE to reduce the potential for high radiological consequences to the public from a seismically-induced fire at PF-4. This scenario, as analyzed in the facility's 2008 safety basis, assumed that the PF-4 structure remained intact. LANL undertook a series of actions to improve the safety posture of PF-4 in response to the seismic threat beginning in 2009. These actions included efforts to reduce the likelihood and severity of a post-seismic fire and upgrades to improve the seismic performance of the glovebox, fire suppression, and active confinement ventilation systems. LANL also initiated a revision of the PF-4 safety basis to refine the dose consequences associated with a post-seismic fire, again assuming that the structure remained intact. After conducting a review of the revised safety basis, the Board communicated deficiencies in the revised PF-4 documented safety analysis (DSA) in a June 18, 2012, letter to NNSA. On September 30, 2013, LANL submitted the 2013 annual update of the PF-4 DSA to NNSA, which was intended, in part, to address the safety basis issues raised by the Board. The revised PF-4 DSA was approved on April 28, 2014, and is expected to be implemented by February 17, 2015. The outcome of the alternate seismic analysis may result in the need for further changes to the PF-4 safety basis. The Board plans to review subsequent revisions of the safety basis after evaluating the adequacy and completeness of the alternate seismic analysis.

In 2011, LANL discovered that the increase in the seismic ground motion postulated in the updated probabilistic seismic hazard analysis for the site could lead to collapse of PF-4, amplifying the Board's concerns regarding a seismic event at PF-4. DOE's initial attempts to model the seismic response of PF-4 identified structural vulnerabilities that could fail during a seismic event and result in loss of confinement capability or collapse. Subsequently, LANL initiated upgrades to address the vulnerabilities. The Board, in a July 18, 2012, letter, expressed concern that the seismic analysis that LANL, under NNSA direction, was then in the process of conducting was proceeding without adequate definition and technical justification. Subsequently, the Deputy Secretary of Energy, in his September 28, 2012, response to the Board,

directed NNSA to initiate action to conduct an alternate seismic analysis for PF-4 using a second modeling approach.

The Secretary of Energy transmitted a letter to the Board on March 27, 2013, stating that PF-4 was safe for continued operation based on the current structural analysis. The Board replied in a July 17, 2013, letter to the Secretary of Energy, stating that it did not agree with the LANL contractor's methodology upon which the Secretary of Energy based his conclusions. The Board also stated that it did not agree with NNSA's conclusion that the modeling results demonstrate compliance with DOE standards for confinement integrity following a design basis earthquake. However, the letter affirmed that the Board was encouraged by DOE's decision to conduct the alternate analysis using a second modeling approach that the Board believes is essential to ensure that all seismic vulnerabilities and necessary structural upgrades are identified to prevent the collapse of PF-4. The Deputy Secretary of Energy responded to the Board in a September 3, 2013, letter that provided the schedule for the alternate analysis and identified a completion date in December 2013. NNSA's contractor issued its draft report marking the completion of Phase I of the PF-4 alternate seismic analysis on June 26, 2014. NNSA paused the analysis and has asked its independent peer reviewers to study the differences between the two seismic analyses and to provide a recommended course of action for seismic rehabilitation of PF-4.

Hanford Site, Waste Treatment and Immobilization Plant. During this reporting period, DOE continued development of new safety strategies and paths forward for resolution of open safety issues with the WTP design. However, a considerable amount of work remains to close these safety issues. Many of the unresolved safety issues apply to multiple facilities at the 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 (EPC) work at the PT and HLW facilities due to unresolved safety issues and misalignment of the design and nuclear safety basis. DOE directed the WTP contractor to address open safety issues prior to resumption of full EPC work at the PT and HLW facilities.

To mitigate the impact of the delay in resolving these and other technical issues, DOE began pursuing major changes to its strategy for treating tank waste at Hanford as described in the September 2013 Hanford Tank Waste Retrieval, Treatment, and Disposition Framework (Framework). In the Framework, DOE proposed two new capabilities to support start-up of WTP's Low-Activity Waste (LAW) facility and, potentially, the HLW facility sooner than would be achievable with the current approach. The capabilities include the LAW Pretreatment System (LAWPS) and Tank Waste Characterization and Staging (TWCS). On March 17, 2014, DOE approved Critical Decision–0 for the LAWPS capability, formally establishing its mission need. DOE may also need to address the Board's open safety issues in the design of the newly proposed capabilities.

In a January 28, 2014, letter to the Secretary of Energy, the Board closed Recommendation 2010-2, *Pulse Jet Mixing at the Waste Treatment and Immobilization Plant,* and expressed concern that the underlying safety-related pulse jet mixing issues remain unresolved. DOE acknowledged that mixing issues require resolution prior to resumption of

EPC work at the PT and HLW facilities. The following is a listing of the status of the Board's unresolved safety issues related to the inadequate performance of mixing systems.

Criticality in Process Vessels—Inadequate pulse jet mixing could lead to accumulation of fissile material at the bottom of WTP process vessels, potentially leading to criticality. Particles of fissile material could separate from neutron absorbers and reach a critical mass in WTP process vessels. The WTP contractor proposed a two phased approach to resolve criticality concerns and has initiated Phase I. Phase I includes engineering studies and hazards assessments to evaluate criticality safety hazards and potential controls for the HLW facility and the high-solids-containing vessels in the PT facility. Phase II involves evaluation of criticality safety hazards and controls for the remainder of the PT facility vessels and equipment and the development of a formal Criticality Safety Evaluation Reports for DOE approval.

Generation and Accumulation of Hydrogen in Process Vessels—Inadequate pulse jet mixing can lead to the accumulation of solids in process vessels, resulting in generation and accumulation of hydrogen and potentially leading to explosions. DOE previously developed a technically defensible control strategy for hydrogen in process vessels. However, challenges with meeting the associated mixing requirements led DOE to pursue alternate control strategies. DOE is developing a new hydrogen control strategy and associated mixing requirements. Additionally, DOE is developing a new standard vessel design that will be used for all high-solids-containing vessels in the PT facility. DOE plans to test the mixing performance of this new vessel design.

Pulse Jet Mixer Control—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 plans to address this issue by conducting tests with prototypic pulse jet mixers to confirm the control system design and ensure the control system can adequately meet the safety functions.

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 is testing the proposed sampling system to evaluate the ability to obtain representative samples. The WTP project plans to rely on the TWCS capability to process and sample the waste to ensure that waste fed to WTP meets the WAC.

The following is a listing of the status of the Board's remaining unresolved safety issues with WTP.

Hydrogen Gas Control—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. The WTP project refers to this hazard as hydrogen in pipes and

ancillary vessels (HPAV). In February 2010, DOE approved a strategy that allows for hydrogen explosions in piping under certain conditions. This strategy relies on an application of Probabilistic Risk Assessment (PRA) and other complex models to predict the magnitude of the explosion and the response of the piping system. In February 2014, DOE requested the WTP contractor to prepare and submit for approval a plan for conducting PRA analyses that address HPAV issues. Also, DOE identified this concern as requiring resolution before proceeding with EPC work at the PT facility. The WTP contractor is developing the PRA plan and the path forward for resolution of HPAV issues.

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 of WTP. DOE completed a two-phase spray leak testing program at Pacific Northwest National Laboratory and is currently incorporating the test results into accident analyses at 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 with wastes that develop distinct sludge and supernatant layers if not agitated. DOE revised the heat transfer calculations to address the Board's issue. Based upon the results, DOE planned to revise the hydrogen generation calculations to establish post-accident hydrogen mixing requirements. However, because of challenges associated with pulse jet mixing, DOE is developing a new standard vessel design that will be used for all high-solids-containing vessels in the PT facility. Also, DOE is developing a new hydrogen control strategy and associated mixing requirements. Resolution of the heat transfer safety issue is dependent on the completion of the standard vessel design and the new hydrogen control strategy. Upon completion of these efforts, the Board plans to review any updates to the post-accident hydrogen mixing requirements.

Instrumentation and Control (I&C) System Design—In a May 5, 2011, letter to DOE, the Board identified certain instances where independent protection layers (IPLs) could fail in a manner that causes the very hazards the protection layers were designed to prevent. In addition, the Board identified IPLs that are not designated as safety-related, but are relied upon when deriving the design requirements for other safety-related instrumentation and control systems. The non-safety IPLs are not specified or maintained in the safety basis such that their operation is assured under expected operating conditions. DOE developed an action plan to resolve the issues raised by the Board. The DOE contractor plans to reconstitute the I&C design and is considering implementing DOE-STD-1195-2011, *Design of Safety Significant Safety Instrumented Systems Used at DOE Non-Reactor Nuclear Facilities*, which, if properly implemented, would resolve this issue.

Ammonia Controls—In a September 13, 2011, letter to DOE, the Board communicated its concern that the design and safety-related controls for potential releases of large quantities of ammonia at the WTP site did not adequately protect workers and facilities. In its response, DOE stated that the project team would perform three new hazard analyses to address the Board's

concerns. DOE is currently developing a new approach for addressing this issue in the WTP hazard analyses. The Board plans to review DOE's efforts to resolve safety issues associated with a large ammonia release at all WTP facilities.

Erosion and Corrosion of Piping, Vessels, and Pulse Jet Mixer Nozzles—In a January 20, 2012, letter to DOE, the Board communicated its 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. DOE identified these issues as requiring resolution to enable resumption of EPC work at the PT and HLW facilities. Currently, the WTP contractor is performing erosion testing and is analyzing localized corrosion limits.

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. DOE's response to the letter included a plan to address these issues, but the schedule to implement the plan will take several years to complete. The Board is monitoring DOE's implementation of the plan.

Formation of Sliding Beds in Process Piping—In an August 8, 2012, letter to DOE, the Board communicated its 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. Also, 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 adjacent structures, systems, and components. DOE identified these issues as requiring resolution to enable resumption of EPC work at the PT and HLW facilities. The Board received DOE's response to the letter on April 28, 2014. DOE plans to address this issue through systematic evaluation of hazards, reassessing the pipeline design strategy, performing additional erosion testing, and establishing an acceptable WAC. The Board plans to evaluate DOE's efforts to resolve these issues.

NEW ISSUES IDENTIFIED DURING THE PERIOD

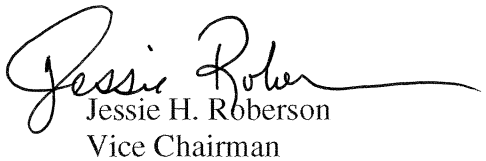
1. Project: Los Alamos National Laboratory—Transuranic Waste Facility

In a letter to NNSA dated June 11, 2012, the Board identified a number of issues with the Preliminary Safety Design Report for the Transuranic Waste Facility (TWF) project that could impact the identification, design, and functional classification of the facility's safety-related controls. NNSA responded to the Board in a letter, received on October 9, 2012, in which NNSA committed to a number of deliverables aimed at addressing the Board's issues during the development of the project's Preliminary Documented Safety Analysis (PDSA). Through its development, NNSA has addressed a number of the Board's issues; however, there are open, as well as new, concerns that need to be addressed as the project proceeds to construction. For the purposes of this report, the Deficiencies in the Preliminary Safety Design Report issue is considered subsumed by the following new issue.

New Issue—Deficiencies in the PDSA. During this reporting period, the Board completed its review of the facility's PDSA. The Board concluded that while NNSA made progress in resolving the safety issues identified in the June 11, 2012, letter, there continue to be concerns with the effectiveness of TWF safety controls. Additional action by NNSA is required to ensure adequate integration of safety into the TWF design. In an August 7, 2014, letter to NNSA, the Board identified a number of deficiencies with the TWF PDSA regarding the adequacy of TWF safety controls. In the letter, the Board identified five safety issues that require additional action from NNSA as the project proceeds to construction. These issues are: (1) inadequate analysis of sealed sources, (2) insufficient justification for inputs to accident analysis calculations, (3) inadequate controls to prevent freezing of the fire protection system, (4) inadequate facility worker safety analysis, and (5) inadequate analysis of wildland fires. The Board requested a response from NNSA within 60 days and will review the project's proposed path forward.

Respectfully submitted,

Peter S. Winokur, Ph.D.
Chairman



Jessie H. Roberson
Vice Chairman

Sean Sullivan
Member

Enclosures

ENCLOSURE 1

SEPTEMBER 2014 REPORT SUMMARY OF SIGNIFICANT UNRESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES			
SITE	**FACILITY**	**Critical Decision (CD) Approved**	**ISSUES[a]**
Hanford Site	**Waste Treatment and Immobilization Plant (WTP)**	--	--
	a. WTP Pretreatment Facility	CD-3	1. Hydrogen gas control—***(Jun 09)*** 2. Criticality in Process Vessels—***(Apr 10)*** 3. Generation and Accumulation of Hydrogen in Process Vessels—***(Apr 10)*** 4. Pulse Jet Mixer Control—***(Apr 10)*** 5. Ability to Obtain Representative Samples—***(Apr 10)*** 6. Inadequacies in the spray leak methodology—***(Jun 11)*** 7. Heat transfer analysis for process vessels—***(Sep 11)*** 8. Instrumentation and control system design—***(Sep 11)*** 9. Ammonia controls—***(Mar 12)*** 10. Erosion and corrosion—***(Jun 12)*** 11. Design and construction of electrical distribution system—***(Jun 12)*** 12. Formation of sliding beds in process piping—***(Dec 12)***
	b. WTP High-Level Waste Facility	CD-3	1. Hydrogen gas control—***(Jun 09)*** 2. Pulse Jet Mixer Control—***(Apr 10)*** 3. Inadequacies in the spray leak methodology—***(Jun 11)*** 4. Instrumentation and control system design—***(Sep 11)*** 5. Ammonia controls—***(Mar 12)*** 6. Erosion and corrosion—***(Jun 12)*** 7. Design and construction of electrical distribution system—***(Jun 12)*** 8. Formation of sliding beds in process piping—***(Dec 12)***
	c. WTP Low-Activity Waste Facility	CD-3	1. Instrumentation and control system design—***(Sep 11)*** 2. Ammonia controls—***(Mar 12)*** 3. Erosion and corrosion—***(Jun 12)*** 4. Design and construction of electrical distribution system—***(Jun 12)***
	d. WTP Analytical Laboratory	CD-3	1. Instrumentation and control system design—***(Sep 11)*** 2. Ammonia controls—***(Mar 12)*** 3. Design and construction of electrical distribution system—***(Jun 12)***
	e. WTP Balance of Facilities	CD-3	1. Instrumentation and control system design—***(Sep 11)*** 2. Ammonia controls—***(Mar 12)*** 3. Design and construction of electrical distribution system—***(Jun 12)***

[a] Dates in parentheses indicate the periodic 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 2.

SEPTEMBER 2014 REPORT SUMMARY OF SIGNIFICANT UNRESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES			
SITE	**FACILITY**	**Critical Decision (CD) Approved**	**ISSUES[a]**
Hanford Site (continued)	**K-Basin Closure Sludge Treatment Project**	Phase 1: CD-3 Phase 2: CD-0	No open issues remain.
	Waste Feed Delivery System	Not formally implementing CD process	No open issues remain.
	Low Activity Waste Pretreatment System	CD-0	No issues identified.
Idaho National Laboratory	**Integrated Waste Treatment Unit**	CD-4	No open issues remain.
	Calcine Disposition Project	CD-0	No issues identified.
Los Alamos National Laboratory	**Plutonium Facility (PF-4) Seismic Upgrades**	Not formally implementing CD process	1. Inadequate seismic safety posture—***(Jun 12)***
	Radioactive Liquid Waste Treatment Facility Upgrade Project—Transuranic Liquid Waste Facility	CD-1	No open issues remain.
	Transuranic Waste Facility	Phase A: CD-4 Phase B: CD-2	1. Deficiencies in the Preliminary Documented Safety Analysis—***(Dec 12)***
Oak Ridge National Laboratory	**Transuranic Waste Processing Center Sludge Project**	CD-1	No issues identified.
Savannah River Site	**Salt Waste Processing Facility**	CD-3	No open issues remain.
	Waste Solidification Building	CD-2/3	No open issues remain.
Y-12 National Security Complex	**Uranium Processing Facility**	CD-1	No open issues remain.
Multiple Sites	**Multiple Sites**	N/A	1. Deficiencies with the System for the Analysis of Soil-Structure Interaction (SASSI) computer software—***(Jun 11)***

ENCLOSURE 2

SEPTEMBER 2014 REPORT SUMMARY OF RESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES		
SITE	**FACILITY**	**RESOLVED ISSUES**[a]
Hanford Site	**a. Waste Treatment and Immobilization Plant (WTP) Pretreatment Facility**	1. Seismic ground motion—***resolved Feb 08.*** The initial ground motion for the design basis earthquake was not technically defensible. Geologic work was completed in early 2007. The resulting data were used to develop final seismic ground motion criteria. 2. Structural engineering—***resolved Dec 09.*** The Board found weaknesses in the structural design, including the modeling, the lack of a clear load transfer capability in the structure, and an inadequate finite element analysis. DOE revised the analyses and prepared summary structural reports showing that the reinforced concrete sections of the facility met structural design requirements. 3. Chemical process safety—***resolved Oct 07.*** The Board was concerned about hydrogen accumulation in plant equipment. In response, DOE developed a conservative design criterion. This issue was reopened in the June 22, 2009, periodic report to Congress as "hydrogen gas control" when DOE changed the design approach. 4. Fire safety design for ventilation systems—***resolved Dec 09.*** The Board was concerned about the means of protecting the final exhaust high-efficiency particulate air (HEPA) filters of the confinement ventilation system from fires. DOE developed and approved design changes to provide adequate protection of the filters from fires. 5. Structural steel analysis and design—***resolved Dec 10.*** The Board identified issues related to the adequacy of the structural steel design. The project team subsequently incorporated more realistic composite construction modeling and demonstrated that the design margin was adequate to compensate for the inadequacies of the finite-element model. 6. Deposition velocity—***resolved Mar 12.*** The Board was concerned that a decision by the WTP project team to change the value for deposition velocity from 0 cm/sec to 1 cm/sec was not technically justified. The project team subsequently changed the deposition velocity to an acceptable value. 7. Use of Low-Order Accumulation Model—***resolved Mar 12.*** The Board was concerned about DOE's use of the Low-Order Accumulation Model for design work on the WTP project because the model under-predicted solids accumulation and had no physical basis. DOE subsequently abandoned use of the model for design work on the project. 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	1. Seismic ground motion—***resolved Feb 08***. See Item 1 for the Pretreatment Facility. 2. Structural engineering—***resolved Dec 09.*** See Item 2 for the Pretreatment Facility. 3. Fire protection—***resolved Jun 09.*** The Board was concerned that DOE lacked an adequate technical basis for not providing fireproof coatings on structural steel members. The project developed a new fire protection strategy. The Board reviewed this strategy and found it to be acceptable. 4. Fire safety design for ventilation systems—***resolved Dec 09.*** See Item 4 for the Pretreatment Facility. 5. Structural steel analysis and design—***resolved Dec 10.*** See Item 5 for the Pretreatment Facility.

[a] 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.

SEPTEMBER 2014 REPORT SUMMARY OF RESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES		
SITE	**FACILITY**	**RESOLVED ISSUES**[a]
Hanford Site (continued)	**b. WTP High-Level Waste Facility (continued)**	6. Deposition velocity—***resolved Mar 12.*** See Item 6 for the Pretreatment Facility. 7. Selection of validation set for computational fluid dynamics model—***resolved July 13.*** See Item 8 for the Pretreatment Facility.
	c. WTP Low-Activity Waste Facility	1. Fire protection—***resolved Jun 09.*** See Item 3 for the High-Level Waste Facility. 2. Structural steel analysis and design—***resolved Dec 10.*** See Item 5 for the Pretreatment Facility.
	d. WTP Analytical Laboratory	1. Fire protection—***resolved Jun 09.*** See Item 3 for the High-Level Waste Facility.
	K-Basin Closure Sludge Treatment Project	1. Completeness of Preliminary Documented Safety Analysis—***resolved Oct 07.*** The Preliminary Documented Safety Analysis was not based on the project design. DOE subsequently re-established the project at the conceptual design stage, with plans to develop a new safety analysis. This action eliminated the issue. 2. Adequacy of project management and engineering—***resolved Sep 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. 3. Inadequacies in integration of safety into the design—***resolved Jun 12.*** Design documentation did not contain sufficient information with which to verify the ability of safety systems to perform their safety functions. Through application of a tailoring strategy for project acquisition, the project team had eliminated key safety-in-design deliverables. DOE and the project team subsequently developed the appropriate safety-in-design documents and provided sufficient design detail to verify the adequacy of safety systems. 4. Inadequacies in safety basis development—***resolved Jun 12***. Safety basis information lacked adequate rigor and conservatism to ensure that DOE had selected the appropriate type and level of controls to protect the public, workers, and the environment from potential hazards. DOE subsequently revised the safety basis using more defensible parameters and identified additional safety controls in the design and operation of the facility to provide the required protection. 5. Non-bounding spray leak consequence analyses—***resolved Nov 13***. The unmitigated spray leak accident analysis lacked conservatism and improperly relied on active engineered controls and operator actions. The project subsequently revised the accident analysis to produce bounding spray leak accident consequences and no longer credits active engineered controls or operator actions in the unmitigated analysis. 6. Safety instrumented systems—***resolved Apr 14.*** The safety basis for the preliminary design credited instrumented systems with performing safety-significant safety functions but did not include design requirements or performance criteria for certain key attributes of safety instrumented systems. DOE approved a revised safety basis and final design, which included design criteria for all key attributes of safety instrumented systems.
	Waste Feed Delivery System	1. Design pressure rating of waste transfer system—***resolved Oct 07.*** The analysis performed to determine the pressure rating of the waste transfer system was inadequate. DOE performed additional analyses and conducted sufficient testing and modeling to determine the minimum design pressure accurately.

SEPTEMBER 2014 REPORT SUMMARY OF RESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES		
SITE	**FACILITY**	**RESOLVED ISSUES**[a]
Idaho National Laboratory	**Integrated Waste Treatment Unit Project**	1. Pilot plant testing—***resolved Feb 09.*** During pilot plant testing, an over-temperature condition developed in the charcoal adsorber bed. DOE investigated the cause of the over-temperature condition and proposed adequate controls to prevent/mitigate such an occurrence in the full-scale facility. 2. Waste characterization—***resolved Feb 09.*** Characterization of the waste to be processed was necessary to ensure that the process would be operated within the bounds of its safety basis. Additional sampling data were compiled and analyzed to show that the control strategy for the facility was adequate. 3. Distributed Control System design—***resolved Feb 09.*** DOE had not demonstrated that the safety-related Distributed Control System was capable of placing the process in a safe configuration, if necessary. DOE changed the design of the control system and added new design requirements to ensure the operational reliability of the safety-related control system.
Los Alamos National Laboratory	**Radioactive Liquid Waste Treatment Facility Upgrade Project**	1. Weak project management and federal project oversight—***resolved Sep 10.*** The federal Integrated Project Team was not well established or providing effective oversight of the design process. NNSA assigned additional personnel to the team and increased the team's involvement in project oversight. 2. Weak integration of safety into the design process—***resolved Sep 10.*** The integration of the safety and design processes for the project was weak. The project team subsequently developed and implemented appropriate tools for tracking and managing key assumptions and design requirements, developed an adequate technical basis for material selection, identified appropriate seismic criteria, and implemented appropriate hazard analysis techniques.
	Transuranic Waste Facility	1. Inadequate integration of safety into the design process—***resolved Sep 10***. The project team had not developed adequate information and design specificity for its safety systems to demonstrate the integration of safety into the design. NNSA changed the scope of the project such that the Board no longer considered this issue relevant.
Savannah River Site	**Salt Waste Processing Facility (SWPF)**	1. Geotechnical investigation—***resolved Feb 08.*** The geotechnical reports required to support the design of the project were incomplete, precluding the ability to make a final determination of the design basis earthquake and design settlement. The project team completed the reports and finalized the design basis earthquake and design settlement. 2. Structural evaluation—***resolved Dec 09.*** Initial reviews of the structural design documentation for the main processing facility revealed several significant errors and deficiencies in the structural analysis. DOE brought appropriate structural design expertise and oversight to bear on the project, and issued summary structural reports showing that the facility meets the structural design requirements. 3. Quality assurance—***resolved Jun 07.*** Quality assurance requirements were not implemented, as evidenced by inadequate calculations and the project team's failure to report unrealistic predictions by software and use of unapproved software. DOE completed a corrective action program to address these quality assurance issues. 4. Hydrogen generation rate—***resolved Jun 09.*** The SWPF project team failed to adequately consider or quantify in the project safety control strategy the hydrogen generation rate from thermolysis, which can occur when organic solvent material is heated in the presence of radiation. Idaho National Laboratory performed testing that demonstrated the adequacy of the hydrogen generation rate used in the design. 5. Flammable gas control—***resolved July 13.*** The SWPF project team did not have a defensible strategy for controlling flammable gases generated in piping and vessels. The SWPF strategy was inadequate because it (1) failed to consider heat input from air pulse

SEPTEMBER 2014 REPORT SUMMARY OF RESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES		
SITE	**FACILITY**	**RESOLVED ISSUES**[a]
Savannah River Site (continued)	**SWPF (continued)**	agitators in determining flammable gas generation rates, (2) failed to include deflagration-to-detonation transitions and reflections due to piping configuration and obstructions when modeling explosions, and (3) allowed plastic deformation of piping in the event of explosions. In response to these issues, DOE (1) accounted for air pulse agitator heat input in determining flammable gas generation rates, (2) included deflagration-to-detonation transition and reflection in the evaluation of flammable gas hazards, and (3) prohibited plastic deformation of piping in the event of an explosion. 6. Fire protection for final HEPA filters—***resolved Sep 10.*** The design of the confinement ventilation system failed to implement all features required by DOE directives to protect the final HEPA filter stage from potential fires or to demonstrate the equivalency of the design to the requirements in DOE directives. The project team implemented design changes and documented the equivalency of the design to the requirements in DOE directives. 7. Operator actions following a seismic event—***resolved Jun 12.*** The design of the facility failed to ensure that all operator actions required to prevent explosions following a seismic event could be accomplished. DOE performed an additional analysis and implemented a number of design changes to ensure that the required actions could be completed. Examples included incorporating seismically qualified interlocks and switches for process pumps into the design and adding a seismically qualified connection for a portable air compressor to the air dilution and ventilation systems to maintain operability after a seismic event. 8. Mixing system controls and operational parameters—***resolved Dec 12.*** The SWPF project team's selection of controls and operational parameters for the air pulse agitators did not account for the limitations of mixing tests and modeling. DOE performed additional tests to demonstrate acceptable mixing performance and committed to implementing appropriate process controls during facility operations.
	Waste Solidification Building	1. Structural design—***resolved Jun 09.*** The analysis for the structural design of the roof and the design of the facility with respect to withstanding potential settlement was inadequate. NNSA directed the project team to alter the design of the roof and correct the settlement analysis. The revised settlement analysis identified the need for design changes to structural members; these changes were subsequently incorporated into the facility design. 2. Deficiencies in Preliminary Documented Safety Analysis—***resolved Feb 09.*** The Preliminary Documented Safety Analysis did not include an appropriate analysis of hydrogen explosion scenarios to ensure confinement of material, nor did it include an adequate demonstration of compliance with DOE Standard 1189 with respect to chemical hazards. NNSA directed the project team to revise its hydrogen explosion calculations to ensure confinement and to demonstrate compliance with the standard for chemical hazards.

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SITE	**FACILITY**	**RESOLVED ISSUES**[a]
Y-12 National Security Complex	**Uranium Processing Facility (UPF)**	1. Preliminary hazards analysis development—***resolved Jun 07.*** The draft preliminary hazards analysis was insufficient to support the development of the design by ensuring the integration of safety and the appropriate specification of safety controls. NNSA subsequently developed a safety evaluation report that contained an appropriate hazards evaluation and adequate safety controls. 2. Non-conservative values for airborne release fraction and respirable release fraction—***resolved Sep 08.*** The project team used an airborne release fraction and respirable fraction for its preliminary hazards analysis that were not based on values in the DOE handbook. NNSA subsequently agreed to use the appropriate bounding values from the DOE handbook. 3. Structural and geotechnical engineering—***resolved Dec 12.*** NNSA had not demonstrated that the following had been properly considered in the design of the UPF structure: (1) the effects of the weathered shale on the building's response; (2) the spacing between the UPF structure and adjacent buildings to accommodate the predicted horizontal seismic motion; (3) the finite element modeling requirements; (4) the sizing of structural members; and (5) controls for internal blasts. NNSA subsequently took appropriate actions to demonstrate that: (1) the weathered shale will not significantly affect the response of the building; (2) sufficient spacing exists between the UPF structure and adjacent buildings; (3) the finite element modeling requirements are appropriate; (4) the main building is adequately designed for seismic and other anticipated loads; and (5) internal blasts will be prevented by process controls. 4. Validation of local analysis/design modeling assumptions—***resolved Apr 14.*** The UPF project lacked a rigorous approach for identifying and technically justifying structural modeling and analysis assumptions. NNSA provided the Board with an acceptable plan for validating the UPF structural modeling assumptions and design techniques. Through implementation of the plan, the UPF project team prepared a comprehensive list of modeling assumptions and developed technically defensible studies for those needing additional justification. 5. Integration of safety into the design— ***resolved Apr 14.*** The Board identified a number of deficiencies with the UPF Preliminary Safety Design Report (PSDR) and design requirements that led the Board to conclude that the UPF project team had not adequately integrated safety into the preliminary design. The UPF project team revised the PSDR and supporting hazard and accident analyses to address these issues. In the spring of 2013, new safety issues concerning the effectiveness of UPF's safety controls required additional action by NNSA to ensure the integration of safety into the UPF design. NNSA laid out a path forward that would lead to adequate resolution of the Board's concerns. Subsequent to the Board identifying this issue, NNSA began pursuing alternatives to the UPF design. Until the design of the UPF alternative matures, it is unclear to what extent the Board's concerns with the integration of safety into the UPF design remain applicable. The Board will reassess this issue as the design of the alternative progresses.