DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Washington, DC 20004-2901

July 15, 2013

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 December 24, 2012, and earlier reports to summarize the status of significant unresolved safety issues through April 30, 2013, and identifies new issues associated with the relevant projects. 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.

In this periodic report, the phrase "unresolved safety issue" does not necessarily imply that the Board disagrees with DOE or believes DOE's path forward to resolution is inappropriate. Some of the issues noted in these reports simply 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 the Board believes 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 its continuing design reviews. For this reporting period, no new issues were identified, and two issues were resolved. Enclosure 1 of this periodic report identifies the significant unresolved safety issues for current design and construction projects. Enclosure 2 of this periodic report summarizes significant unresolved safety issues that have been resolved by DOE on current and past design and construction projects. Past projects include those completed, delayed, or abandoned by DOE.

PROJECTS WITH THE MOST SIGNIFICANT UNRESOLVED SAFETY ISSUES

The following projects have the most significant unresolved safety issues: (1) the seismic evaluation and upgrade of Los Alamos National Laboratory's (LANL) Plutonium Facility (PF-4), (2) the Hanford Site's Waste Treatment and Immobilization Plant (WTP), and (3) the Uranium Processing Facility (UPF) at the Y-12 National Security Complex.

Los Alamos National Laboratory, Plutonium Facility Seismic Safety. Since October 2009, the Board has worked with DOE on several seismic safety issues that challenge whether DOE is providing adequate protection of the public and workers at PF-4. DOE and the National Nuclear Security Administration (NNSA) have made progress in addressing a number of these safety issues, but the Board remains concerned that PF-4 is vulnerable to seismic collapse for the seismic hazard at LANL. During this reporting period, the Board continued to communicate to DOE that weaknesses in the seismic safety posture at PF-4 present a significant risk to the public. DOE continued to make incremental progress to reduce risk and plan for facility upgrades.

Inadequate Seismic Safety Posture

The Board last reported in the December 2012 periodic report that it continued working with NNSA to resolve potential seismic vulnerabilities that could compromise the safety function of the PF-4 structure. 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 radiological consequences to the public from a seismic event at PF-4. In 2011, the Board's concerns were amplified by LANL's discovery that the increase in the postulated seismic ground motion for the site could lead to facility collapse. The December 2012 report noted that NNSA had completed some structural upgrades to address known vulnerabilities, but that additional structural analysis completed by NNSA in September 2012 led NNSA to conclude that the facility remained vulnerable to seismic collapse. The December 2012 report also identified that the Board communicated its concern in a July 18, 2012, letter to DOE that NNSA's structural analysis was being performed without adequate definition and technical justification.

During this reporting period, NNSA began a new seismic analysis of PF-4 to address the inadequacies in the September 2012 analysis. This new seismic analysis is necessary to understand the facility's seismic vulnerabilities and to identify necessary upgrades to preclude a seismic collapse and ultimately provide adequate protection of the public and workers. NNSA expects to complete the new analysis in December 2013.

On January 3, 2013, the Board issued a letter to the Secretary of Energy urging DOE to implement additional near-term measures to protect the public from the potential effects of seismic collapse while it pursued longer-term resolution of the concern. Such risk reduction measures could include 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. On March 27, 2013, the Secretary of Energy responded with additional near-term measures being taken. The Secretary further asserted that nothwithstanding its vulnerabilities, the facility is safe because it meets DOE's seismic standard for providing a confinement safety function. The Secretary also concluded that the risk from this accident is well within DOE's quantitative safety objectives defined in DOE Policy 420.1, *Department of Energy Nuclear Safety Policy*. The Board is evaluating the Secretary's response.

Also on March 27, 2013, NNSA approved an addendum to the PF-4 safety analysis. The addendum describes the basis for DOE's near-term measures to reduce risk at PF-4. The addendum also identifies the structural modifications needed to resolve the collapse mechanisms identified in the seismic analysis completed in September 2012. On April 9, 2013, NNSA issued a memorandum directing the laboratory to (1) complete the compensatory actions by October 1, 2013, (2) complete modifications to girders and basement columns by March 1, 2016, and (3) complete a report by May 2013 on the Fiscal Year 2013 objectives to accelerate disposal and robust packaging of excess nuclear material. The laboratory completed the requested report and commited to robustly package or dispose of additional plutonium this fiscal year. The Board is reviewing the addendum and NNSA's plans for further reducing the inventory of plutonium in PF-4.

The Board remains concerned with the adequacy of the PF-4 safety analysis. The large radiological consequence to the public postulated in the PF-4 safety analysis resulted in the Board's Recommendation 2009-2. In response to this Recommendation, NNSA approved a revised safety

analysis that asserted that once the probability of collapse is remediated, the radiological consequences of postulated accident scenarios would be below the threshold requiring protection measures for the public. In a June 18, 2012, letter to NNSA, the Board identified technical deficiencies with the revised PF-4 safety analysis that challenged NNSA's conclusion. NNSA transmitted its response to the Board on November 5, 2012, acknowledging the need to improve the safety analysis. NNSA has established a due date of July 2013 for LANL to revise the safety analysis and resolve the Board's concerns. The Board is awaiting this revision.

Hanford Site, Waste Treatment and Immobilization Plant. During this reporting period, DOE resolved one issue concerning the validation of a computer model for mixing radioactive waste at WTP, but otherwise made little progress in addressing safety issues with the WTP design.

The Board last reported in December 2012 that DOE was slowing the construction of two key WTP facilities to resolve safety-related issues and re-evaluate the project's design. A number of technical issues remained unresolved, and DOE's progress in resolving the Board's open safety issues continued to be slow. For the current reporting period, nine significant safety issues are unresolved. Many of these issues have been unresolved for years. The Board believes that DOE must resolve these concerns expeditiously to allow for a transition from a design-construction phase to a construction-operation phase. Resolution of these significant unresolved safety issues is complicated by the partial construction of the facility and the use of a "black-cell" design concept in certain areas that may not allow for maintenance during the 40-year life of the plant.

Mixing in Process Vessels

One of the nine significant unresolved issues involves pulse jet mixing. On December 17, 2010, the Board transmitted Recommendation 2010-2, *Pulse Jet Mixing at the Waste Treatment and Immobilization Plant*, calling on the Secretary of Energy to address the inadequate performance of mixing systems at WTP which could lead to nuclear criticality accidents, explosions of flammable gases, and mechanical failures of process vessel components. The Recommendation consists of several sub-recommendations focused on (1) completing a large-scale test program to inform the design and resolve technical issues related to pulse jet mixing, (2) establishing the WTP Waste Acceptance Criteria (WAC) to support the test results, (3) demonstrating the ability to obtain representative samples from WTP vessels and the Waste Feed Delivery System to support safe plant operation and compliance with the WAC, and (4) developing a path forward for unresolved technical issues after completing the test program.

In the Board's last periodic report, the Board noted that DOE had been unable to validate a key technical assumption dealing with the treatment of non-Newtonian waste. The assumption had formed the basis for DOE's Implementation Plan for the Recommendation. Accordingly, DOE notified the Board that several deliverables could not be completed, and a revision to the Implementation Plan was required. Also, former Secretary of Energy Chu had undertaken a review of the WTP design. This review was ongoing at the time of the last periodic report.

During this reporting period, the former Secretary of Energy informed the Board that DOE will revise its Implementation Plan addressing the Board's Recommendation. Specifically, DOE will replace the current strategy, which had relied on computational fluid dynamics models and small-scale testing of pulse jet mixed vessels, with a full-scale testing program. The Board had an ongoing issue

with the validation of the computational fluid dynamics model of pulse jet mixing in WTP. Additional discussion of this issue is in the next section of this periodic report.

The following is a listing of the status of the Board's remaining unresolved issues on 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. DOE has approved a strategy that allows for hydrogen explosions in piping under certain conditions. This strategy relies on a quantitative risk analysis and other complex models to predict the magnitude of the explosion and the response of the piping system. The Board is concerned that DOE has not established how the quantitative risk analysis will be implemented.

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 Pretreatment and High-Level Waste Facilities of WTP. DOE subsequently completed a spray leak-testing program at Pacific Northwest National Laboratory. This program concluded that the spray leak model is non-conservative. DOE is planning additional testing to resolve this issue.

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 Pretreatment Facility process vessels at WTP. DOE revised the heat transfer calculations and, based upon these results, plans to revise the hydrogen generation calculations to establish post-accident hydrogen mixing requirements.

Instrumentation and control system design—In a May 5, 2011, letter to DOE, the Board identified certain instances where credited independent protection layers were not independent of the initiating event for certain hazards. In these cases, the credited protection layer would fail in a manner that rendered it ineffective and caused the hazard it was designed to prevent. In addition, the project has identified credited protection layers that are not designated as safety-related. These protection layers are relied upon for the design of other safety-related instrumentation and control systems. These credited control systems are not specified or maintained in the safety basis such that their operation is assured under all operating conditions. DOE has developed a plan that will address the issues raised by the Board. The Board will monitor the implementation of DOE's plan to resolve this safety 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. DOE stated that the project team would perform three new hazard analyses to address the Board's concerns. The Board is awaiting DOE's completion of these hazard analyses.

Erosion and corrosion—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 is developing a plan to address the Board's erosion and corrosion issues.

Design and construction of 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 will monitor 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 current design of the WTP slurry pipeline system is susceptible to frequent formation of sliding beds of solids on the bottom of the piping. Sliding beds can increase wear from erosion and corrosion and can increase the likelihood of pipeline plugging. Also, prolonged operation of a centrifugal pump with a plugged process line could cause the pump to fail catastrophically. This failure would result in the loss of primary confinement of radioactive waste and damage adjacent structures, systems, and components. The Board also observed that DOE has not incorporated new information on waste properties into the design of the slurry transport system. DOE is currently preparing a response to the Board's letter.

Y-12 National Security Complex, Uranium Processing Facility. During this reporting period, DOE continued to make progress in addressing issues related to the integration of safety into the UPF design and the validation of modeling assumptions supporting the UPF structural analysis.

Integration of Safety into the Design

In an April 2, 2012, letter to NNSA, the Board communicated its concern that the UPF project team had not adequately integrated safety into the preliminary design, thereby making the design inconsistent with the expectations and requirements in DOE directives. Inconsistencies included (1) the Preliminary Safety Design Report (PSDR) for the project was not based on a complete and bounding unmitigated evaluation of hazards in the facility, (2) the accident analyses inadequately identified and analyzed representative and bounding accidents, and (3) the seismic design requirements for key safety controls were inadequate to ensure protection of the public and workers during postulated seismic events. DOE independently identified many similar issues during its review of the PSDR. The Board's letter also reiterated a long-standing concern with effective federal oversight of the project.

The Board's last periodic report discussed NNSA's response to the April 2, 2012, letter. By letter dated June 27, 2012, NNSA committed to upgrading certain seismic design requirements to prevent criticality accidents after a seismic event and to systematically reviewing and correcting the hazard and accident analyses. The Board also reported that its staff was reviewing a major revision of the UPF PSDR.

During this reporting period, the Board's staff completed reviewing the revisions to the PSDR and its supporting hazard and accident analyses. The revisions resolve many of the issues identified in the April 2012 letter that led the Board to conclude that the hazard and accident analyses were incomplete and not bounding. The Board will complete its review of the revised PSDR in July 2013.

Validation of Local Analysis/Design Modeling Assumptions

In a September 6, 2012, letter to NNSA, the Board identified that the UPF project team had not validated a number of modeling assumptions in the structural analyses and design which could impact the behavior of local areas of the structure under design loads and lead to failure of safety-related systems and components attached to the structure. By letter dated November 5, 2012, NNSA provided a reasonable plan for validating modeling assumptions and design techniques.

During this reporting period, DOE made progress in executing this plan. For example, NNSA identified and initiated a series of studies to validate important assumptions applicable to the UPF redesign. The Board is monitoring the development of these studies.

SAFETY ISSUES RESOLVED DURING THE PERIOD

1. Project: Hanford Site, Waste Treatment and Immobilization Plant

Issue—Selection of Validation Set for Computational Fluid Dynamics Model. On April 3, 2012, the Board issued a letter to DOE regarding the planned validation of a computer model of pulse jet mixing in WTP. The WTP contractor planned to use the Fluent computational fluid dynamics model to confirm that the performance of the WTP mixing systems will meet safety requirements. The Board was concerned that experimental data obtained from planned small-scale tests would not be adequate to validate the Fluent model over the range of mixing conditions expected at WTP.

Resolution—The Secretary of Energy's November 8, 2012, letter to the Board stated that "DOE envisions that a full-scale test program will replace the current design verification strategy that relies on the use of computational fluid dynamics and scaling for the vessels subject to PJM [pulse jet mixing]." Since DOE will no longer rely on computational fluid dynamics modeling to confirm the performance of WTP pulse jet mixing systems, the Board considers this issue closed.

2. Project: Savannah River Site, Salt Waste Processing Facility

Issue—Flammable Gas Control. In a letter to DOE dated February 10, 2009, the Board identified several concerns associated with the control of flammable gas in Salt Waste Processing Facility (SWPF) vessels and piping systems. Both the vessels and piping systems contain radioactive waste; the process vessels contain air pulse agitators to mix the waste. DOE calculations of process vessel temperature following a loss of vessel cooling did not account for heat input from the air pulse agitators. Since flammable gas generation increases with temperature, neglecting the heat input from air pulse agitators could lead to inadequately designed flammable gas controls. Additionally, DOE's structural analysis of process piping considered potential explosions due to flammable gas accumulation. However, this analysis did not include several key considerations, such as deflagration-to-detonation transitions and reflections due to piping configuration or obstructions. The process piping structural analysis also failed to provide a sufficient technical basis for allowing plastic deformation of the piping in the event of an explosion.

Resolution—DOE revised calculations of waste temperature after a loss of vessel cooling to include heat addition from air pulse agitators and recirculation pumps. DOE used the

calculation results to design defensible temperature controls. The temperature controls will shut down recirculation pumps to limit heat addition to the process vessels when temperature limits are reached. These temperature controls will ensure flammable gas generation does not exceed process vessel safety system design limits. Additionally, DOE revised its structural analysis of process piping systems from flammable gas hazards. The revised calculations include assumptions such as deflagration-to-detonation transitions and prohibit plastic deformation. DOE also developed screening criteria for evaluating process piping systems for flammable gas buildup. The screening criteria assign remedial actions such as flushing or draining of piping when deemed necessary to control flammable gas buildup. DOE will track remedial actions and include them in SWPF operating procedures. The overall flammable gas control strategy in process vessels and piping systems sufficiently protects the primary confinement boundary and facility workers in accordance with applicable DOE requirements. The Board considers this issue closed.

CHANGE IN PROJECT STATUS

1. Project: Savannah River Site, Waste Solidification Building

In December 2012, DOE approved a Baseline Change Proposal for the Waste Solidification Building (WSB) due to construction delays. The Baseline Change Proposal deferred the date for Critical Decision-4 until August 2015. The Board will follow the final construction and start-up activities for the WSB project as the revised schedule is implemented.

2. Project: Los Alamos National Laboratory, Upgrades to Pit Manufacturing Capability at the Plutonium Facility (Technical Area-55)

NNSA is developing a new plutonium strategy for pit production. A mature pit manufacturing upgrade plan for PF-4 does not exist; therefore the Board is removing Upgrades to Pit Manufacturing Capability at the Plutonium Facility from the listing of projects in Enclosure 1 of this report. The Board will continue to follow the development of NNSA's plutonium strategy.

To the extent that this strategy initiates new design and construction projects in the future, the Board will track their progress and significant unresolved safety issues in this report.

Respectfully submitted,

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Enclosure

ENCLOSURE 1

JULY 2013 REPORT SUMMARY OF SIGNIFICANT UNRESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES						
SITE	**FACILITY**	**TOTAL PROJECT COST ($M)**	**STATUS**			**ISSUES[b]**
			Critical Decision (CD) Approved	**Design Completion[a]**	**Construction Completion**	
Hanford Site	**Waste Treatment and Immobilization Plant (WTP)**	12,263			*(Operational 2019)*	
	a. WTP Pretreatment (PT) Facility		CD-3	85% Final Design	43%	5. Hydrogen gas control—***(Jun 09)*** 7. Inadequate mixing—***(Apr 10)*** 9. Inadequacies in the spray leak methodology—***(Jun 11)*** 11. Heat transfer analysis for process vessels—***(Sep 11)*** 12. Erosion and corrosion—***(Jun 12)*** 14. Design and construction of electrical distribution system—***(Jun 12)*** 15. Formation of sliding beds in process piping—***(Dec 12)***
	b. WTP High-Level Waste (HLW) Facility		CD-3	89% Final Design	43%	5. Hydrogen gas control—***(Jun 09)*** 7. Inadequate mixing*—***(Dec 10)*** 9. Inadequacies in the spray leak methodology—***(Jun 11)*** 10. Erosion and corrosion—***(Jun 12)*** 12. Design and construction of electrical distribution system—***(Jun 12)*** * Recommendation 2010-2 extended the PT Facility pulse jet mixing issue identified in the April 2010 report to pulse jet mixing systems in the HLW Facility.

[a] The percent of design completion is an estimate for the particular stage of design, conceptual, preliminary, or final.
[b] 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.

JULY 2013 REPORT SUMMARY OF SIGNIFICANT UNRESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES						
SITE	**FACILITY**	**TOTAL PROJECT COST ($M)**	**STATUS**			**ISSUES[b]**
			Critical Decision (CD) Approved	**Design Completion[a]**	**Construction Completion**	
Hanford Site (continued)	**c. WTP Low-Activity Waste Facility**		CD-3	77% Final Design	64%	3. Instrumentation and control system design—***(Sep 11)*** 4. Erosion and corrosion—***(Jun 12)*** 5. Design and construction of electrical distribution system—***(Jun 12)***
	d. WTP Analytical Laboratory		CD-3	75% Final Design	81%	2. Design and construction of electrical distribution system—***(Jun 12)***
	e. WTP Balance of Facilities		CD-3	77% Final Design	72%	1. Ammonia controls—***(Mar 12)*** 2. Design and construction of electrical distribution system—***(Jun 12)***
	K-Basin Closure Sludge Treatment Project	280	Phase 1: CD-1 Phase 2: CD-0	Phase 1: 95% Final Design Phase 2: 33% Conceptual Design	Phase 1: 15% ***(Operational 2015)*** Phase 2: ***(Operational to be determined)***	5. Non-bounding spray leak consequence analyses—***(Dec 12)*** 6. Safety instrumented systems—***(Dec 12)***
	Waste Feed Delivery System	660	Not formally implementing CD process	Various degrees of completion	Various degrees of completion and operations	No open issues remain.
	Tank Waste Supplemental Treatment Project	110–310	Not formally implementing CD process	100% Conceptual Design	***(Operational 2018)***	No issues identified.
Idaho National Laboratory	**Integrated Waste Treatment Unit (IWTU)**	570.9	CD-4	100% Final Design	100% ***(Operational 2013)***	No open issues remain.
	Calcine Disposition Project	900–2,000	CD-0	< 30% Conceptual Design	Will utilize portions of the IWTU ***(Operational 2022)***	No issues identified.

JULY 2013 REPORT
SUMMARY OF SIGNIFICANT UNRESOLVED ISSUES
WITH NEW DEFENSE NUCLEAR FACILITIES

SITE	FACILITY	TOTAL PROJECT COST ($M)	STATUS			ISSUES[b]
			Critical Decision (CD) Approved	Design Completion[a]	Construction Completion	
Los Alamos National Laboratory	**Chemistry and Metallurgy Research Replacement Project—Nuclear Facility**	3,710–5,860 Undergoing DOE review	CD-1	70% Final Design	Some ground work *(Operational to be determined)*	No open issues remain.
	Plutonium Facility (PF-4) Seismic Upgrades	Building structure: 15–20 Fire suppression system: 6 Active confinement ventilation system: 60–145	Not formally implementing CD process	Various degrees of completion	Various degrees of completion	2. Inadequate seismic safety posture— *(Jun 12)*
	Radioactive Liquid Waste Treatment Facility Upgrade Project— Transuranic Waste Processing Facility	202–270	CD-1	0% Preliminary Design	*(Operational 2020)*	No open issues remain.
	Transuranic Waste Facility	71–124	Phase A: CD-3 Phase B: CD-2	Phase A: 100% Final Design Phase B: 90% Final Design	Phase A: 100% Phase B: *(Operational 2015–2018)*	2. Deficiencies in the Preliminary Safety Design Report— *(Dec 12)*
Oak Ridge National Laboratory	**Transuranic Waste Processing Center Sludge Project**	>100	CD-1	17% Final Design	*(Operational 2019)*	No issues identified.
Savannah River Site	**Salt Waste Processing Facility**	1,340	CD-3	99% Final Design	71% *(Operational 2015)*	No open issues remain.
	Waste Solidification Building	414.1	CD-2/3	100% Final Design	83% *(Operational 2015)*	No open issues remain.

JULY 2013 REPORT SUMMARY OF SIGNIFICANT UNRESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES						
SITE	FACILITY	TOTAL PROJECT COST ($M)	STATUS			ISSUES[b]
			Critical Decision (CD) Approved	Design Completion[a]	Construction Completion	
Y-12 National Security Complex	**Uranium Processing Facility**	4,200–6,500	CD-1	66% Final Design	(*Operational 2025*)	4. Inadequacies in the integration of safety into the design—*(Jun 12)* 5. Validation of local analysis/design modeling assumptions—*(Dec 12)*
Multiple Sites	**Multiple Sites**	N/A	N/A	N/A	N/A	1. Deficiencies with the System for the Analysis of Soil-Structure Interaction (SASSI) computer software—*(Jun 11)*

ENCLOSURE 2

JULY 2013 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. 6. 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. 8. 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. 10. 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. 13. 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. 6. Structural steel analysis and design—***resolved Dec 10.*** See Item 6 for the Pretreatment Facility. 8. Deposition velocity—***resolved Mar 12.*** See Item 8 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.

JULY 2013 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)**	11. Selection of validation set for computational fluid dynamics model—***resolved July 13.*** See Item 13 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 6 for the Pretreatment Facility.
	d. WTP Analytical Laboratory	1. Fire protection—***resolved Jun 09.*** See Item 3 for the High-Level Waste Facility.
	Demonstration Bulk Vitrification System Project	1. Confinement strategy—***resolved May 08.*** The early design of the facility had a number of major vulnerabilities with regard to the confinement of hazardous wastes. DOE developed a confinement strategy that led to improvements in the confinement design. This project was removed from this periodic report as of September 2010. This removal occurred after DOE placed Critical Decision-2 in abeyance until it had completed additional studies and made a decision regarding the preferred strategy for pretreating and immobilizing the low-activity waste.
	Interim Pretreatment System	This project was removed from this periodic report as of September 2010 because DOE withdrew funding for the project after establishing the mission need. No detailed reviews were completed.
	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.
	Large Package and Remote Handled Waste Packaging Facility	This project was removed from this periodic report as of June 2011. This removal occurred after DOE placed conceptual design activities in abeyance. No detailed reviews were completed.

JULY 2013 REPORT SUMMARY OF RESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES		
SITE	**FACILITY**	**RESOLVED ISSUES**[a]
Hanford Site (continued)	**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.
	Immobilized High-Level Waste Interim Storage Facility	This project was removed from this periodic report as of September 2010. This removal occurred after DOE abandoned it. DOE plans to initiate a new capability to fulfill the mission at a later date. No detailed reviews were completed.
	Interim Hanford High-Level Waste Storage Project	This was project was removed from this periodic report as of December 2012. This removal occurred after DOE issued a notification of suspension for the project. The notification indicates that design activities may restart in fiscal year 2014. No detailed reviews were completed.
Idaho National Laboratory	**Integrated Waste Treatment Unit (IWTU) 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	**Chemistry and Metallurgy Research Replacement (CMRR) Project—Nuclear Facility**	1. Design-build acquisition strategy—***resolved Jun 07.*** NNSA's acquisition strategy combined Critical Decision-2 (approval of performance baseline) and Critical Decision-3 (approval to start construction), which essentially eliminated formal review of the final design prior to construction. NNSA directed the project team to revise its acquisition strategy to reflect a more traditional approach. 2. Site characterization and seismic design—***resolved Dec 09.*** A technically defensible seismic design for the facility was needed to ensure that safety-related structures, systems, and components could perform their intended safety functions when subjected to the ground motion of the design basis earthquake. See comment below. 3. Safety-significant active ventilation system—***resolved Dec 09.*** The safety-significant active ventilation system needed to remain operable and perform its intended safety functions following design basis accidents. See comment below. 4. Safety-class fire suppression system—***resolved Dec 09.*** This facility has the first safety-class fire suppression system in a new facility in the DOE complex. The fire suppression system needed to remain operable and perform its intended safety functions following design basis accidents. See comment below. 5. Safety-class and safety-significant container design—***resolved Dec 09.*** The safety strategy for the facility relied on containers to prevent the release of large fractions of material. See comment below. 6. Deficiencies in Draft Preliminary Documented Safety Analysis—***resolved Dec 09.*** Safety requirements from the safety analysis did not flow adequately into the system design descriptions to ensure that the requirements were incorporated into the design. See comment below. The Board submitted its Certification Review Report, *Chemistry and Metallurgy Research*

JULY 2013 REPORT SUMMARY OF RESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES		
SITE	**FACILITY**	**RESOLVED ISSUES**[a]
Los Alamos National Laboratory (continued)	**Chemistry and Metallurgy Research Replacement Project—Nuclear Facility (continued)**	*Replacement Facility Project Los Alamos National Laboratory*, to the congressional defense committees on September 4, 2009. In this report, the Board concluded that its concerns regarding the design of CMRR up to that point had been resolved, and this was the basis for closing issues 2-6 above.
	Technical Area-55 Reinvestment Project	1. Adequacy of safety systems—***resolved Sep 08.*** The scope and timing of this project warranted reconsideration to ensure that the project would address deficiencies with safety systems. NNSA subsequently developed and executed an Integrated Priority List to manage the safety system upgrades within the scope of the Technical Area-55 Reinvestment Project, as well as safety system upgrades managed through other means. The Board therefore closed this issue for the Reinvestment Project and committed to reevaluating issues with respect to the Integrated Priority List process. The Board subsequently raised an issue, "Inadequate approach to ensure timely improvements to the safety posture" concerning the Integrated Priority List process in its February 2009 periodic report to Congress. 2. Inadequate approach to ensure timely improvements to the safety basis—***removed Jun 12***. The Board lacked confidence that safety system vulnerabilities at Technical Area-55 identified during efforts to upgrade the safety basis would be eliminated in a timely manner. DOE successfully improved its processes for identifying and prioritizing safety system upgrades. The Board, however, remained concerned about the timely completion of upgrades necessary to improve the seismic performance of PF-4, particularly upgrades associated with the building structure and the fire suppression and active confinement ventilation systems. Therefore, the Board's generic issue concerning the adequacy of the approach to ensuring timely improvements to the safety posture at Technical Area-55 was removed from this report. The Board's remaining concerns were incorporated into an issue concerning the seismic safety posture of PF-4. In the June 2012 periodic report, the Board replaced the entry for Technical Area-55 Reinvestment Project with an entry dedicated to seismic upgrades at PF-4 titled, Plutonium Facility (PF-4) Seismic Upgrades, because not all of the seismic upgrades of concern to the Board were captured under the Technical Area-55 Reinvestment Project.
	Upgrades to Pit Manufacturing Capability at the Plutonium Facility (Technical Area-55)	1. Lack of adherence to DOE Order 413.3A—***resolved Sep 08.*** The project had not demonstrated formal mechanisms for ensuring that design requirements and interfaces would be appropriately managed and controlled. NNSA committed to managing the upgrades using a tailored approach to the Order and to developing an Integrated Nuclear Planning process to improve coordination among the projects. The Board decided to decouple this issue from the project and track it through the course of its normal oversight of the Integrated Nuclear Planning process. As a result of changes to NNSA's plutonium strategy, including NNSA's planned 5-year deferral of the CMRR Project, NNSA's plans to increase pit manufacturing are no longer valid. This project was removed from this report as of July 2013.

JULY 2013 REPORT SUMMARY OF RESOLVED ISSUES WITH NEW DEFENSE NUCLEAR FACILITIES		
SITE	**FACILITY**	**RESOLVED ISSUES**[a]
Los Alamos National Laboratory (continued)	**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.
	Nuclear Material Safeguards and Security Upgrades Project, Phase 2	This project was removed from this periodic report as of September 2010. The Board's interest in this project stemmed from the potential for upgrades that would impact safety-related aspects of PF-4 operations. The Board's review revealed no adverse safety impacts.
	Technical Area-55 Radiography Project	This project was removed from this periodic report as of September 2010. The removal occurred after DOE placed the conceptual design on hold. An interim radiography capability in Technical Area-55 is fulfilling the current requirements. No detailed reviews were completed.
Nevada National Security Site (formerly Nevada Test Site)	**Device Assembly Facility—Criticality Experiments Facility**	1. Structural cracks—***resolved Feb 09.*** The structure has numerous cracks in the concrete that are abnormal for a nuclear facility. Such cracking could indicate improper curing during construction that degrades the strength of the concrete. NNSA performed a comparative evaluation of uncracked and cracked portions of the facility. This evaluation revealed that the cracked and uncracked concrete had comparable strength. 2. Deficiencies in fire protection system water supply—***resolved Sep 11.*** Safety issues were associated with the fire protection water supply to the facility, including susceptibility to single-point failure, use of unlisted components, and deterioration of the lead-in supply lines. NNSA completed an evaluation for the water supply system and developed recommendations for correcting these deficiencies. This assessment and proposed improvements were acceptable. NNSA authorized startup of the Criticality Experiments Facility on May 9, 2011. The Board will continue to report on the deficiencies of the fire protection water supply in its periodic *Report to Congress: Summary of Significant Safety-Related Infrastructure Issues at Operating Defense Nuclear Facilities.*
Oak Ridge National Laboratory	**Building 3019—Uranium-233 Downblending and Disposition Project**	1. Deficiencies in Preliminary Documented Safety Analysis—***resolved Sep 11.*** The Preliminary Documented Safety Analysis was based on incomplete information and lacked detail on safety-related controls necessary to ensure that safety systems would be adequate to protect workers. DOE changed the scope of the project such that the Board no longer considered this issue to be relevant. As a result of changes in scope, this project was removed from this periodic report as of March 2012.
Pantex Plant	**Component Evaluation Facility**	This project was removed from this periodic report as of September 2010. The removal occurred because DOE had made minimal progress beyond the initial mission need approval and has no plans to move forward with the project. No detailed reviews were completed.

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SITE	**FACILITY**	**RESOLVED ISSUES**[a]
Savannah River Site	**Pit Disassembly and Conversion Facility**	1. Assumption on combustible loading for seismically induced fire—***resolved Apr 10.*** The project team had not validated assumptions in the safety basis regarding combustible loading to support the facility's safety control strategy for a seismically induced facility fire. NNSA changed the scope of the project such that this issue was no longer relevant.
	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 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.

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SITE	**FACILITY**	**RESOLVED ISSUES**[a]
Savannah River Site (continued)	**Container Surveillance and Storage Capability (CSSC) Project**	1. Fire protection strategy—***resolved Jun 08***. The project's fire protection strategy, including the design of the safety-class fire detection and gaseous suppression system, was not sufficiently mature to demonstrate that containers of radioactive material would be protected during postulated fire events. This issue was removed from this periodic report when the project was subsumed by the Plutonium Preparation Project. 2. Preliminary hazards analysis—***resolved Jun 08***. The Board identified several deficiencies with the preliminary hazards analysis, including the project team's failure to address all hazards (e.g., loss of rack storage cooling, toxicological hazards from process gasses) and failure to incorporate DOE guidance on preliminary consequence calculations supporting the early identification of safety systems. This issue was removed from this periodic report when the project was subsumed by the Plutonium Preparation Project. 3. Criticality safety—***resolved Feb 08***. The project team intended to rely on administrative controls to justify excluding nuclear incident monitors from the facility's design. This approach was inconsistent with industry criticality standards. DOE subsequently decided to include nuclear incident monitors in the design. 4. Design process controls—***resolved Jun 07.*** The project team lacked an appropriate system for tracking design inputs and assumptions to ensure that safety-related structures, systems, and components would be designed and fabricated to meet requirements. The project team committed to maintaining inputs and assumptions, documenting their origin, and tracking them through completion of the design. On June 27, 2008, DOE approved a revised alternative for the Plutonium Preparation Project that subsumed the CSSC Project and revised the scope of the Plutonium Disposition Project. The CSSC Project was removed from this periodic report as of September 2008.
	Tank 48 Treatment Process Project	1. Project delays—***resolved Jun 11.*** DOE's delay in recovering Tank 48 and returning it to service had the potential to impact high-level waste cleanup at the site and posed a safety risk to workers and the environment. DOE revised its Implementation Plan for the Board's Recommendation 2001-1, *High-Level Waste Management at the Savannah River Site*. DOE also took actions to mitigate many of the risks associated with Tank 48 project delays, such as committing to making Tank 50 available for high-level waste service. DOE suspended this project in July 2011 because of budget constraints, identification of a promising new technology for treating the waste, and an improved projection of the volume of available high-level waste tank space resulting from enhancements at the Defense Waste Processing Facility. This project was removed from this periodic report as of September 2011.
	Plutonium Preparation Project (formerly the Plutonium Disposition Project)	On November 22, 2009, DOE approved combining the Pit Disassembly and Conversion Facility Project and the Plutonium Preparation Project into a new project called the Pit Disassembly and Conversion Project. The Plutonium Preparation Project was removed from this periodic report as of April 2010.

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SITE	**FACILITY**	**RESOLVED ISSUES**[a]
Savannah River Site (continued)	**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.
	Pit Disassembly and Conversion Project (in existing K-Area facilities)	NNSA closed the Pit Disassembly and Conversion Project on September 30, 2012, and the Board has discontinued its oversight. The Pit Disassembly and Conversion Project was removed from this report as of December 2012.
Y-12 National Security Complex	**Highly Enriched Uranium Materials Facility (HEUMF)**	1. Water supply for fire protection system—***resolved Sep 08.*** The water supply for the safety-significant fire suppression system was not classified as safety-significant in accordance with the design basis requirements. NNSA committed to connecting the system to the safety-significant water supply planned for the Uranium Processing Facility (UPF), to providing a safety-significant water supply pressure monitor, and to incorporating safety-related configuration controls to ensure the availability of a single dedicated flow path in the system. HEUMF began operation in January 2010.
	Uranium Processing Facility	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.