A.J. Eggenberger, Chairman
John E. Mansfield, Vice Chairman
Joseph F. Bader
Larry W. Brown
Peter S. Winokur

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

625 Indiana Avenue, NW, Suite 700 Washington, D.C. 20004-2901
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October 17, 2007

Mr. Mark B. Whitaker, Jr.
Departmental Representative to the DNFSB
U. S. Department of Energy
1000 Independence Avenue, SW
Forrestal Building, Room 6H-025
Washington, DC 20585-1000

Dear Mr. Whitaker:

The Defense Nuclear Facilities Safety Board (Board) is pleased to enclose a copy of our Third Quarterly Report to Congress on the Status of Significant Unresolved Issues with the Department of Energy's Design and Construction Projects. Congress mandated that the Board write this report in the House Conference Report 109-702 (Section 3201), on the National Defense Authorization Act for Fiscal Year 2007 (H.R. 5122).

Sincerely,

A. J. Eggenberger
Chairman

Enclosure: as stated

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To the Congress of the United States:

On September 29, 2006, House Conference Report 109-702 on the National Defense Authorization Act for Fiscal Year 2007 (H.R. 5122) was released and approved by both houses of Congress. The Conference Report, Section 3201, directed the Defense Nuclear Facilities Safety Board (Board) to provide quarterly reports on the status of significant unresolved technical differences between the Board and the Department of Energy (DOE) concerning design and construction of DOE's defense nuclear facilities.

This is the third such quarterly report. The report reflects the status of issues generally through the end of July 2007. It builds on the first two reports to briefly summarize the status of issues previously raised and to identify new issues with these projects. The status of many issues did not change significantly in the 3-month reporting period, which is short compared to the typical schedules associated with the design process for complex, high-hazard facilities. The fact that an issue has not been resolved does not imply a lack of progress.

For each facility, the following information was provided in the first quarterly report: (1) a short description of the facility project, (2) the status of the facility, and (3) the status of significant issues identified by the Board. As used here, the term "unresolved issues" does not necessarily imply that the Board has a disagreement with DOE or believes DOE's path forward is inappropriate. Some of the issues noted in these quarterly reports simply await final resolution through further development of the facility design. All of the significant unresolved issues discussed here have been communicated to DOE personnel. Minor issues that the Board believes can be easily resolved and have an agreed-upon path forward are not included; such issues will be followed as part of the Board's normal design review process. It is important to note that additional issues may be identified as the Board conducts its continuing design reviews. Issues newly identified since the previous report are noted below, as well as those issues the Board believes have been resolved. For this reporting period, three new issues were identified, and two issues were resolved. Finally, this report addresses "new" design and construction projects at DOE's defense nuclear facilities that were introduced this quarter and are subject to the Board's review.

PROJECTS WITH THE MOST SIGNIFICANT UNRESOLVED ISSUES

A brief discussion of projects of greatest concern to the Board is provided below. These projects have unresolved issues or conditions for which there is no clear, agreed-upon path to resolution between DOE and the Board. The Board believes these issues and conditions have the

potential to result in significant nuclear safety, cost, or schedule impacts, and need to be addressed so that an agreed-upon path forward can be determined as soon as possible.

- ***Los Alamos National Laboratory, Chemistry and Metallurgy Research Replacement Project.*** Early in this project, the Board noted its concerns regarding the need to establish conservative design criteria for several safety-related systems—structure, ventilation, fire suppression, and nuclear material container design. Los Alamos National Laboratory recently identified significant deficiencies in the draft Preliminary Documented Safety Analysis (PDSA), which are discussed in the next section of this report. Given these deficiencies, the Board cannot assess the overall approach for selecting safety-related systems and the establishment of conservative design criteria for those systems. Additionally, Los Alamos National Laboratory finalized its update of the site seismic hazard in May 2007 and, as anticipated, this update included an increase in the seismic design ground motion criteria by about 50 percent. To allow design work to proceed, the project has been using a conservative seismic design ground motion criterion that bounds this increase. The project needs to establish the final seismic design ground motion criteria for the design of its safety-related systems. At the end of preliminary design, the Board will undertake a detailed review of the overall safety strategy, as well as assess the adequacy of the design criteria and the design of the safety-related systems.

- ***Hanford Site, K-Basin Closure Sludge Treatment Project.*** In its previous quarterly reports, the Board highlighted its concern that the PDSA for this project was not based on the final design, and that safety-related systems, structures, and components were still being designed and required further analysis to determine whether they could adequately perform their safety functions. Subsequently, DOE halted procurement activities and terminated its review of the PDSA to ensure that the design was complete and that the PDSA reflected the completed design. While evaluating the maturity of the design, the contractor identified design problems that could jeopardize the project's successful completion. The contractor and DOE decided to reestablish the project at the conceptual design phase and will implement formal project management in accordance with DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets*. The Board's concern about the PDSA was resolved by this decision. However, this is the latest in a series of redesign efforts to remove and process sludge from the K-Basins that have already delayed the completion of this project by 3 years. Sludge containing up to 300,000 curies of actinides and fission products continues to be stored in temporary containers in a storage basin that has exceeded its design life. Reestablishing the project at the conceptual design stage will likely result in several more years of delay.

NEW ISSUES IDENTIFIED DURING THE PERIOD

1. Project: Chemistry and Metallurgy Research Replacement Project

New Issue—Deficiencies in the Draft Preliminary Documented Safety Analysis. As noted above, Los Alamos National Laboratory recently identified significant deficiencies in the draft Preliminary Documented Safety Analysis. The draft does not establish an adequate facility safety strategy for the Chemistry and Metallurgy Research Replacement Project and, as a result, the Board cannot assess the overall approach for selecting safety-related systems and the establishment of conservative design criteria for these systems. In the analysis, there is an over reliance on the passive confinement of the structure that credits extremely low leakage from the facility to the environment during an accident, which in turn results in potentially inadequate identification of safety-related accident mitigation controls. Several accident scenarios have significant offsite consequences (about 16 rem) that have not been identified for designation of safety-class controls. Several other events, such as seismically induced fires, are not adequately analyzed to ensure that the identified safety controls would effectively prevent or mitigate the consequences. The chemical and toxicological hazards are not analyzed to ensure the identification of proper controls. The consequences of the design basis accidents are not quantitatively evaluated to ensure adequate protection of onsite workers.

2. Project: Highly Enriched Uranium Materials Facility

New Issue—Water Supply for the Fire Protection System. In a letter dated March 25, 2002, the Board identified weaknesses in the Technical Basis Document for the Highly Enriched Uranium Materials Facility project regarding identification of the boundaries of safety-related systems. Without clear identification of such boundaries, the safety classification of some systems, including support systems and components, could be missed. In response, the project revised its design basis requirements to specify that "support SSC [structure, systems, and components] to safety-significant SSCs that mitigate or prevent accidents should be classified as safety-significant if their failures prevent a safety-significant SSC from performing it safety function." This requirement is consistent with guidance in DOE Guide 420.1-1, *Nonreactor Nuclear Safety Design Criteria and Explosives Safety Criteria Guide for Use with DOE O 420.1, Facility Safety.* The site's potable water system will be used to supply water to the safety-significant fire protection system of the Highly Enriched Uranium Materials Facility. As a result, the potable water system is a support system needed to ensure that the fire protection system for the Highly Enriched Uranium Materials Facility will operate as designed. However, the portion of the potable water system that supplies the Highly Enriched Uranium Materials Facility is not currently classified as safety-significant consistent with the design basis requirements. A safety-significant classification would help ensure that the

potable water system will be reliable through more rigorous design, construction, maintenance, and configuration control of the system.

3. Project: K-Basin Closure Sludge Treatment Project

New Issue—Project Management and Engineering Adequacy. For the past several years, the effort to remove sludge from the K-Basins has repeatedly encountered problems requiring a shift in the project's technical approach. DOE has developed multiple conceptual design approaches, each of which has had funding problems or has failed to meet the design requirements and safety functions for the system, thus requiring a new start. As noted above, DOE has again re-established this project at the conceptual design stage and is considering new alternatives (Critical Decision-1), while sludge containing up to 300,000 curies of actinides and fission products continues to be stored in temporary containers in a storage basin that has exceeded its design life. The project is now expected to fully implement DOE Order 413.3A to provide a formal and robust project management approach. Project engineering needs to ensure that safety is adequately incorporated in the design at the earliest stages of the project and that the selected alternative can achieve the needed processing capability.

4. Project: Technical Area (TA)-55 Reinvestment Project

New Issue—Safety System Adequacy. The scope and timing of the TA-55 Reinvestment Project warrants reconsideration to ensure that the project addresses deficiencies in safety systems identified during the safety basis upgrade and during other reviews conducted within the last few years. In addition, the baseline assumptions on the programmatic mission for TA-55 have changed substantially, further suggesting a need to realign the scope of the sub-projects and their timing with safety upgrades. Safety systems must reliably perform their safety functions and proper investment is necessary to maintain adequate reliability. However, safety infrastructure investments at TA-55, including the Reinvestment Project, have largely relied upon qualitative judgements and anecdotal evidence to inform decision-making. As a result, it is difficult to assess whether the selected scope satisfies the most pressing infrastructure needs. A defensible basis for safety system upgrades included under the TA-55 Reinvestment Project needs to be developed. The basis should include considerations of the deficiencies in safety systems identified during the safety basis upgrade and timing of proposed increases in the mission. To the extent feasible, the basis should also incorporate results of recent safety system assessments, including results garnered from implementation of a formal condition assessment system.

ISSUES RESOLVED DURING THE PERIOD

1. Project: Hanford Waste Treatment Plant Pretreatment Facility

Issue—The Board was concerned about hydrogen accumulation in plant equipment. Some of the equipment is in black cells that are not intended to be accessible for the life of Waste Treatment Plant operations. Hydrogen explosions could damage safety-class and safety-significant systems or components that protect the public and workers from radioactive exposure. Additionally, repair following an explosion would result in increased exposure to workers, and interrupting Pretreatment Facility operations would impact overall risk reduction efforts for the site by delaying the treatment of high-level waste stored in the tank farms.

Resolution—DOE has developed a conservative design criterion that will mitigate concern about potential hydrogen accumulation in plant equipment. DOE briefed the Board on May 23, 2007, and has prepared white papers addressing the design approach to be used for pipe supports to withstand the effects of hydrogen explosions. The Board believes the design criterion is adequate for its intended purpose, and this issue is considered resolved.

2. Project: Hanford Tank Retrieval and Waste Feed Delivery System

Issue—The Board found that the analysis performed to determine the minimum design pressure rating of the waste feed delivery transfer system was not technically defensible due to numerous uncertainties in the assumptions made. DOE formed an expert panel that concluded these uncertainties are accommodated by using conservative values for density and particle size of the waste. However, the panel noted the need for an improved understanding of process variations, additional testing, and model revisions.

Resolution—DOE provided the Board with results of additional analyses performed to determine the minimum design pressure rating of the waste feed delivery transfer system. Based on these results, the Board believes DOE has now conducted sufficient testing and modeling of the wastes to accurately determine the minimum design pressure and has adequately dispositioned all the issues raised by the expert panel.

NEWLY LISTED PROJECT

1. Project: Savannah River Waste Solidification Building

Description: The Waste Solidification Building will treat low-level and transuranic waste streams from the Pit Disassembly and Conversion Facility and the Mixed Oxide

Fuel Fabrication Facility, which are facilities being planned for construction at the Savannah River Site. The low-level wastes will be solidified for onsite disposal, and the transuranic waste will be solidified for disposal at the Waste Isolation Pilot Plant.

***Status of Facility*:** This facility was initially a subproject of the Pit Disassembly and Conversion Project. DOE subsequently decided to make the Waste Solidification Building a stand-alone facility separate from the Pit Disassembly and Conversion Project. DOE believes that the Critical Decision for the Pit Disassembly and Conversion Project encompassed the approved Critical Decision-0 and Critical Decision-1 for the Waste Solidification Building. Critical Decision-2 approval is expected in late fiscal year 2008. The facility needs to be operational to support the Mixed Oxide Fuel Fabrication Facility in 2016.

***Status of Significant Issues*:** The design of the Waste Solidification Building was suspended in 2004. The design effort recommenced in late 2006. This facility should be a relatively simple design with a total project cost of approximately $250 million. The Board has reinitiated its review of this project and has identified no outstanding issues at this time.

As directed by Congress, the Board will continue to exercise its existing statutory authority.

Respectfully submitted,

A. J. Eggenberger
Chairman

John E. Mansfield
Vice Chairman

Joseph F. Bader
Member

Larry W. Brown
Member

Peter S. Winokur
Member

Enclosure

ENCLOSURE

THIRD QUARTERLY REPORT
SUMMARY OF SIGNIFICANT UNRESOLVED ISSUES
WITH NEW DEFENSE NUCLEAR FACILITIES

SITE	FACILITY	TOTAL PROJECT COST ($M)	STATUS			ISSUES
			Critical Decision Approved	Design Completion	Construction Completion	
Hanford Site	**Waste Treatment Plant**	12,200			(***Operational 2019***)	
	a. Pretreatment Facility		CD-3	66%	25%	1. Seismic ground motion 2. Structural engineering 3. ~~Chemical process safety~~—***resolved*** **(3)***
	b. High Level Waste Treatment Facility		CD-3	80%	21%	1. Seismic ground motion 2. Structural engineering 3. Fire protection
	c. Low Activity Waste Facility		CD-3	93%	50%	1. Fire protection
	d. Analytical Laboratory Facility		CD-3	86%	43%	1. Fire protection
	Demonstration Bulk Vitrification System Project	224	CD-1	95%	Some site and foundation work (***Operational FY 2011***)	1. Confinement strategy
	K-Basin Closure Sludge Treatment Project	100 Being evaluated	Being evaluated; rebaselined to CD-0	Being evaluated	Starting (***Operational to be determined***)	1. ~~Completeness of Preliminary Documented Safety Analysis~~—***resolved*** **(3)** 2. Project management and engineering adequacy—***new issue*** **(3)**
	Tank Retrieval and Waste Feed Delivery System	1,140	One subproject is not using the formal Critical Decision process	Various degrees of completion	Various degrees of completion and operations	1. ~~Design pressure rating of waste transfer system~~—***resolved*** **(3)** No issues
	Immobilized High-Level Waste Interim Storage Facility	100	CD-3	90%	Deferred (***Operational to be determined***)	No issues

SITE	FACILITY	TOTAL PROJECT COST ($M)	STATUS			ISSUES
			Critical Decision Approved	Design Completion	Construction Completion	
Idaho National Laboratory	**Integrated Waste Treatment Unit project**	462	CD-2/3B	90%	Some ground work (***Operational 2009***)	1. Pilot plant testing 2. Waste characterization 3. Distributed control system design
Los Alamos National Laboratory	**Chemistry and Metallurgy Research Replacement Project**	725–975 Being reevaluated	CD-1	80%	Some ground work (***Operational 2014***)	1. ~~Design-build acquisition strategy—~~***resolved*** **(2)** 2. Site characterization and seismic design 3. Safety-significant active ventilation system—~~resolved (2)~~ **reopened because of issue 6 (3)** 4. Safety-class fire suppression system 5. Safety-class and safety-significant container design 6. Draft Preliminary Documented Safety Analysis deficiencies—***new issue*** **(3)**
	Technical Area-55 Reinvestment Project	72	Phase A: CD-2 Phase B: CD-0	60%	(***Complete 2010***) (***Complete 2014***)	1. Safety system adequacy—**new issue (3)**
	Upgrades to Pit Manufacturing Capability at Technical Area-55	Annual funding	Not formally implementing Critical Decision process		Work ongoing	1. Lack of adherence to DOE Order 413.3A
	Radioactive Liquid Waste Treatment Facility Upgrade Project	96	CD-1		(***Operational 2011***)	No detailed review completed
	New Solid Transuranic Waste Facility Project	40	CD-0	60%	(***Operational 2011***)	No detailed review completed
	Nuclear Material Safeguards and Security Upgrades Project, Phase 2	240	CD-1	30%	(***Operational 2013***)	No detailed review completed
	Technical Area-55 Radiography Project	38	CD-0	90% on hold	(***Operational 2010***)	No detailed review completed

SITE	FACILITY	TOTAL PROJECT COST ($M)	STATUS			ISSUES
			Critical Decision Approved	Design Completion	Construction Completion	
Nevada Test Site	**Device Assembly Facility—Criticality Experiments Facility**	150	CD-2	90%	(***Operational 2011***)	1. Structural cracks
Oak Ridge National Laboratory	**Building 3019—Uranium-233 Downblending and Disposition Project**	371	CD-2/3A	90%	(***Operational 2012***)	1. Preliminary Documented Safety Analysis
Pantex Plant	**Component Evaluation Facility**	112	CD-0	Project is on hold	***(Operational on hold)***	No detailed review completed
Savannah River Site	**Pit Disassembly and Conversion Facility**	2,450	CD-1	50%	(***Operational on hold***)	1. Assumption on combustible loading for seismically induced fire
	Salt Waste Processing Facility	900	CD-1	35%	(***Operational 2013***)	1. Geotechnical investigation 2. Structural evaluation 3. ~~Quality assurance~~—***resolved*** **(2)**
	Container Surveillance and Storage Capability Project	79—97	CD-1	30%	Building preparations started (***Operational 2010***)	1. Fire protection strategy 2. Preliminary hazards analysis 3. Criticality safety 4. ~~Design process control~~—***resolved*** **(2)**
	Plutonium Disposition Project	500 Being reevaluated	CD-0	10%	Not started (***Operational 2013***)	No issues identified
	Waste Solidification Building	244	CD-1		Not started (***Operational 2016***)	No issues identified
Y-12 National Security Complex	**Highly Enriched Uranium Materials Facility**	549	CD-3	100%	60% (***Operational 2009***)	1. Fire protection system water supply—***new issue*** **(3)**
	Uranium Processing Facility	1,400—3,500	CD-0 (CD-1 informally approved)	10%	(***Operational 2017***)	1. ~~Preliminary hazards analysis development~~—**resolved (2)** 2. Nonconservative airborne release fraction and respirable release fraction values

* Numbers in parentheses indicate the Quarterly Report in which an issue was considered resolved or a new issue was identified.